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- Center for Photonics and Nanoelectronics
- Developing Urban Educational Leaders (CDUEL) (The Center for)
- Emulsion Polymers Institute
- Energy Research Center
- Enterprise Systems Center (ESC)
- Global Islamic Studies, Center for
- Goodman Center for Real Estate
- Humanities Center
- Institute for Interactivist Studies
- International Materials Institute for New Functionality in Glass
- Lawrence Henry Gipson Institute for Eighteenth-Century Studies
- Loewy Institute
- Martindale Center for the Study of Private Enterprise
- Philip and Muriel Berman Center for Jewish Studies
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Strong programs in business, the humanities, education, arts and sciences, and human services compliment our well-known strength in engineering. Lehigh students can choose from an array of courses and enjoy the resources and facilities of a major research university and the atmosphere and personal attention of a small college.

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Mission, Vision and Values

Lehigh's Mission statement
To advance learning through the integration of teaching, research, and service to others.
(Adopted 1992)

Lehigh's Core Values
Essential and enduring tenets -- a small set of timeless guiding principles that require no external justification; they have intrinsic value and importance.

- Integrity and honesty
- Equitable community
- Academic freedom
- Intellectual curiosity
- Collaboration
- Commitment to excellence
- Leadership
(Adopted 2007)

The Principles of our Equitable Community
Lehigh University is first and foremost an educational institution, committed to developing the future leaders of our changing global society. Every member of our community has a personal responsibility to acknowledge and practice the following basic principles:

- We affirm the inherent dignity in all of us, and we maintain an inclusive and equitable community.
- We recognize and celebrate the richness contributed to our lives by our diverse community.
- We promote mutual understanding among the members of our community.
- We confront and reject discrimination in all its forms, including that based on age, color, disability, gender identity, genetic information, marital status, national or ethnic origin, political beliefs, race, religion, sex, sexual orientation, socio-economics, veteran status, or any differences that have been excuses for misunderstanding, dissension, or hatred.
- We affirm academic freedom within our community and uphold our commitment to the highest standards of respect, civility, courtesy, and sensitivity toward every individual.
- We recognize each person’s right to think and speak as dictated by personal belief and to respectfully disagree with or counter another’s point of view.
- We promote open expression of our individuality and our differences within the bounds of University policies.
- We acknowledge each person’s obligation to the community of which we have chosen to be a part.
- We take pride in building and maintaining a culture that is founded on these principles of unity and respect.
(Adopted 2011)

Lehigh's Vision Statement
Lehigh University prepares graduates to engage with the world and lead lives of meaning. We commit to:

- National and international research prominence
- Learning experiences grounded in fundamental, transferable skills across all disciplines and in real world challenges
- Strategic risk-taking in the presence of opportunity and adversity
- Social, environmental and economic sustainability
- Meaningful connection and partnership with alumni, supporters and citizens around the globe
- A robust return on the investment in a Lehigh education
- A diverse, inclusive and financially accessible environment
Lehigh University defines a semester as 14 weeks and 70 individual days of instruction to be followed by 2 days of a reading-consultation and study period in preparation of 9 consecutive calendar days of final examinations with four periods per day of 3 hour exam blocks. The summer term is 12 weeks with measured sessions. The academic year consists of one summer and two regular terms. Please note the academic calendar is subject to change without notice.

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<td>August 20                    Tuesday                      Graduate Student General Orientation</td>
<td>January 19                    Sunday                      Degree awarding date</td>
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<tr>
<td>August 22                    Thursday                           First Year Student Check In</td>
<td>January 20                    Monday                           First day of class</td>
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<tr>
<td>August 25                    Sunday                           Degree Awarding Date</td>
<td>January 26                    Sunday                           Last day Web registration</td>
</tr>
<tr>
<td>August 26                    Monday                           First Day of Class/Registration day</td>
<td>January 26                    Sunday                           Last day to add courses without instructor’s permission</td>
</tr>
<tr>
<td>September 1                  Sunday                           Last day for Web registration</td>
<td>January 31                    Friday                           Last day to add/drop without a “W”</td>
</tr>
<tr>
<td>September 6                  Friday                           Last day of registration</td>
<td>February 1                    Thursday                         Deadline to file applications for May graduation</td>
</tr>
<tr>
<td>September 6                  Friday                           Last day to add or drop a course without a “W”</td>
<td>February 7                    Friday                           Last day to select OR cancel pass/fail grading</td>
</tr>
<tr>
<td>September 13                 Friday                           Last day to select OR cancel pass/fail grading</td>
<td>February 17                    Monday                         Common Hour exam Day 1</td>
</tr>
<tr>
<td>September 23                 Monday                           Common Hour exam Day 1</td>
<td>February 19                    Wednesday                        Common Hour exam Day 2</td>
</tr>
<tr>
<td>September 25                 Wednesday                        Common Hour exam Day 2</td>
<td>February 25                    Tuesday                         Common Hour exam Day 3</td>
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<tr>
<td>October 1                    Tuesday                          Common Hour exam Day 3</td>
<td>February 27                    Thursday                        Common Hour exam Day 4</td>
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<td>October 1                    Sunday                           Applications for January degree due</td>
<td>March 6                      Friday                           Mid-term grades due</td>
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<td>October 3                    Thursday                         Common Hour exam Day 4</td>
<td>March 9-13                     Monday-Friday                    Spring Break</td>
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<td>October 11                   Friday                           Mid-term grades due</td>
<td>March 16                      Monday                           Classes resume</td>
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<td>October 14-15                 Monday-Tuesday                   Pacing Break - no classes</td>
<td>March 30                      Monday                           Common Hour exam Day 1</td>
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<td>October 28                    Monday                           Common Hour exam Day 1</td>
<td>April 1                        Wednesday                        Common Hour exam Day 2</td>
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<td>October 30                    Wednesday                        Common Hour exam Day 2</td>
<td>April 7                        Tuesday                         Common Hour exam Day 3</td>
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<td>November 5                    Tuesday                          Common Hour exam Day 3</td>
<td>April 9                        Thursday                        Common Hour exam Day 4</td>
</tr>
<tr>
<td>November 7                    Thursday                         Common Hour exam Day 4</td>
<td>April 10                       Friday                           Last day for May doctoral candidates to deliver dissertation drafts to dean</td>
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<tr>
<td>November 11-15                Monday-Friday                     Reserved registration period for Spring. Specific dates to be determined.</td>
<td>April 10                       Friday                           Last day to drop a class with a &quot;W&quot;</td>
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<td>November 12                   Tuesday                          Last day to withdraw from a course with a “W”</td>
<td>April 13-17                    Monday-Friday                    Reserved registration period for Fall and Summer. Specific dates to be determined.</td>
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<td>April 24                      Friday                           Last day for in-class hourly exams</td>
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<td>November 27-29                Wednesday-Friday                   Thanksgiving Break</td>
<td>May 1                         Friday                           Last day of class</td>
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<td>November 26                   Tuesday                          Last day for in-class hourly exams</td>
<td>May 1                         Friday                           Last day for May master’s candidates to electronically upload thesis and deliver final paperwork to Registration &amp; Academic Services</td>
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<td>December 6                   Friday                           Last day of classes</td>
<td>May 2                         Saturday                        Review-consultation-study period for Tuesday classes</td>
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<tr>
<td>December 6                   Friday                           Last day for January master’s degree candidates to electronically upload thesis and deliver final paperwork to Registration &amp; Academic Services</td>
<td>May 4                         Monday                           Review-consultation-study period for Monday classes</td>
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<td>December 7                   Saturday                        Review-consultation-study period for Tuesday classes</td>
<td>May 5                         Tuesday                           Final exams begin</td>
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<td>May 16                        Saturday                        Grades Due</td>
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<td>December 21                  Saturday                          Final Grades Due</td>
<td>July 1                        Monday                           Deadline to apply for September degree</td>
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Academic programs:

www.lehigh.edu/lufacts

www.lehigh.edu

Main web address:

LEHIGH ON THE WEB

membership.

national origin, age, handicap, sex, sexual orientation or union

without discrimination because of race, color, religious creed, ancestry,

Lehigh University provides equal opportunity on the basis of merit

POLICY OF EQUALITY

The bachelor of science degree in chemistry is certified by the American

of theatre.

by the U.S. Department of Education as the accrediting body for the field

Schools of Theatre, Commission on Accreditation, which is recognized

The department of theatre is accredited by the National Association of

Psychological Association, Commission on Accreditation. The APA-CoA

is a specialized accrediting agency recognized by the U.S. Secretary

Education and the Council for Higher Education Accreditation. The

doctoral program and the educational specialist program in school

psychology are approved by the National Association of School

Psychologists. NASP is one of the specialized professional associations

(SPAs) of the Council for Accreditation of Educator Preparation

(CAEP), which is recognized by the Council for Higher Education

Accreditation. The master's program in counseling and human services

is accredited by the Masters in Psychology and Counseling Accreditation

Council. MPCAC is a member of the Association of Specialized and

Professional Accreditors, which is recognized by the Council for Higher

Education Accreditation.

The computer science and business program is accredited by both

the Computing Accreditation Commission of ABET and AACSB

International.

The department of theatre is accredited by the National Association of

Schools of Theatre, Commission on Accreditation, which is recognized

by the U.S. Department of Education as the accrediting body for the field

of theatre.

The bachelor of science degree in chemistry is certified by the American

Chemical Society.

POLICY OF EQUALITY

Lehigh University provides equal opportunity on the basis of merit

without discrimination because of race, color, religious creed, ancestry,

national origin, age, handicap, sex, sexual orientation or union

membership.

LEHIGH ON THE WEB

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Lehigh at a glance:

www.lehigh.edu/lufacts

Academic programs:

www.lehigh.edu/programs

Catalog:

www.lehigh.edu/catalog

Higher Education Opportunity Act disclosures:

http://www.lehigh.edu/~inprv/heoa/index.html

Parents & family:

www.lehigh.edu/parents

Admissions information:

www.lehigh.edu/admissions

Campus visits, interviews and open houses:

www.lehigh.edu/visitinglehigh

Maps and Directions:

www.lehigh.edu/maps

Entrance Examinations

SAT/ACT: Each candidate for admission to the first-year class is

required to take either the SAT or the ACT. Students are not required to

sit for the writing component of either exam. Official test results should

be sent directly to Lehigh through the College Board (CEEB code 2365)

or ACT (ACT code 3612). In special circumstances, where the cost of

sending test scores presents a financial hardship to the student or their

family, students can self-report scores on the Common Application or

have their counselor submit unofficial scores. However, ultimately if

a student is admitted to Lehigh official scores must be sent from the

testing agency prior to matriculation.

For applicants whose first language is not English, Lehigh additionally

requires the results of the TOEFL iBT (Test of English as a Foreign

Language Internet-Based exam) or the IELTS (International English

Language Testing System). This requirement is waived for applicants

whose two most recent years of full-time instruction (high school or

college) have been in English. The minimum acceptable score is 90

on the TOEFL iBT or 7.0 on the IELTS. Students whose scores are

lower than Lehigh’s minimums are still considered for admission but

may be required to take additional English courses during their first-year

and/or during the summer semester prior to fall matriculation. Official

score reports should be sent to Lehigh by the testing agency. The most

up-to-date information on requirements for non-US citizens can be

found on the Lehigh Admissions website: www1.lehigh.edu/admissions/undergrad/intl

Recommendations

The Office of Admissions requires, as part of a candidate’s file, a letter of

recommendation from the school counselor, principal, or headmaster

from the candidate’s school. One teacher recommendation is also

required. In addition to academic qualifications, recommendations

should address the candidate’s personal qualifications such as

character, intellectual motivation, participation in school activities,

and established habits of industry and dependability. Electronic

submission through the Common Application website (http://

www.commononapp.org) is encouraged.

Admission and Deposit

Lehigh University accepts the Common Application, so please

follow the procedures on the Common Application Website (https://

www.commononapp.org) to complete your application. To see all of our

requirements and forms, visit the Application Requirements page (http://

www1.lehigh.edu/admissions/undergrad/apply/requirements). Any

additional or missing documents should be submitted through the LU


you experience any issues or have questions please check our FAQs

(https://www1.lehigh.edu/admissions/undergrad/apply) first; if you

still have questions please reach out to the Office of Admissions at

admissions@lehigh.edu or 610-758-3100.
Once your application is submitted, a confirmation email will be sent to the email address you designated on your Common Application within one week. If it has been more than seven business days since you submitted your application and you have not received a confirmation email, please contact the Office of Admissions at admissions@lehigh.edu or (610) 758-3100. In your email, please include your full name, address, and date of birth you provided in your application.

SUBJECT MATTER REQUIREMENTS
The course work or units required for admission represent the equivalent of the usual four-year college preparatory curriculum. Minimum course work requirements can be misleading since most students who gain admission to Lehigh University exceed the minimum requirements. Below you will find the minimum requirements as well as recommended course work.

Minimum Requirements
- English: 4
- Foreign Languages: 1, 2
- Social Science: 2
- Laboratory Science: 2
- College Preparatory Mathematics: 2, 3

Recommended Course work
- English: 4
- Foreign Languages: 1, 2
- Social Science: 3
- Laboratory Science: 3
- College Preparatory Mathematics: 2, 4

1 Only in exceptional cases, and for otherwise well-qualified candidates, will the Committee on Admissions waive the Foreign Language requirement for admission to any one of the three undergraduate colleges.

2 We recommend candidates for the P.C. Rossin College of Engineering and Applied Science and College of Business pursue a math curriculum that includes calculus.

While there are many elements that go into Lehigh’s holistic application review, the Committee on Admissions will be aware of things such as (in no particular order):
- The difficulty of courses taken with special attention given to courses recognized as accelerated by national academic organizations
- Rank or relative rank in class
- The student’s grades within the context of the school environment
- Evidence of improvement or deterioration in grades during the secondary school career with particular attention paid to performance in senior year courses
- The quality of performance in courses that relate to the student’s anticipated area of study
- Comments and recommendations from the principal, headmaster, guidance counselor, teachers, or other professional educators within the school system
- Extra-curricular/work experience with particular emphasis placed on demonstrated leadership
- Demonstrated interest in Lehigh University

Admissions decisions are final and will be posted online via the Applicant Student Portal for each student. An admitted student in the Regular Decision round may secure a place in the entering class by notifying the university that he or she intends to enroll at Lehigh and by submitting the appropriate non-refundable enrollment deposit via the Admitted Student Portal or postmarked through the US Postal Service by May 1. A student admitted through the Early Decision rounds must send notification and deposit by the date indicated in his or her acceptance letter. This fee is applicable towards the fall-term bill. Students who do not attend will forfeit their deposit.

Transfer Students
Each August, students who have attended another college or university are admitted with advanced standing. Candidates for transfer admission must meet the high school subject matter requirements prescribed for incoming first-year students, and are required to have at least one year of full-time study (a minimum of 24 credits completed prior to time of enrollment at Lehigh) at another institution. Exceptions to fulfilling high school requirements will be granted following the review of a college level transcript. The academic performance at the college level is the primary focus when giving consideration to admission.

Candidates who have been dropped for poor scholarship, who are not in good standing, or who have been released for disciplinary reasons are not eligible for admission.

Each candidate must submit an official transcript and course descriptions from each institution attended. An admissions decision cannot be made without this information. Information regarding transfer applications, including application deadlines, may be found at www.lehigh.edu/tapply. Each application must be accompanied by an application fee of $70.

Students are encouraged to take an active role in seeing that the various components of their admission application have arrived at the university. Students will be notified by Registration & Academic Services as to the total transfer credits Lehigh will grant to the student.

HOUSING
Every effort is made to accommodate transfer student housing needs. All students are required to live on-campus through the end of the sophomore year. Contact the Office of Residential Services, Rathbone Hall, Lehigh University, 63 University Drive, Bethlehem, PA 18015 or call (610) 758-3500. This office also can provide information about off-campus housing. Fraternities and sororities often have room for members or boarders. Information on this option may be obtained through the Assistant Dean for Fraternity and Sorority Affairs (http://studentaffairs.lehigh.edu/ofsa/contact).

Advanced Placement
The university offers capable students who have superior preparation an opportunity for advanced placement and/or college credit. Many secondary schools, in association with the College Board, offer college-level work. Students participating in these courses should sit for the Advanced Placement Tests offered by the College Board. Entering first-year students that request the College Board to send their Advanced Placement Test scores to Lehigh are considered for advanced placement.

Some departments noted below offer examinations during Freshman Orientation to students who studied college-level subjects in secondary school but did not sit for the Advanced Placement Tests. Entering first-year students wishing to sit for an examination in any Lehigh course should notify the Office of the First-Year Experience via email at fye@lehigh.edu by the date given on the First-Year Student Portal. The student should specify the number and title of the course. Students who receive credit on the basis of Advanced Placement Test grades need not sit for the Lehigh tests to confirm the credit granted.

Current practice at Lehigh is as follows:

Art, Architecture and Design
Eight credit hours for ART 001 and ART 002 are granted to students who earn a grade of 5. Three credit hours for Art Elective in Art History are granted for those students who earn a grade of 4. Those students who earn grades of 5 on the Advanced Placement Studio Art Examination receive four credit hours for ART 003.

Biology
Four credit hours for BIOS 001 Biology For Non-Majors, given to those who earn grades of 4 or 5.

Chemistry
Four credit hours for CHM 030 are granted to students who earn a grade of 5 on the Advanced Chemistry Placement test.

Computer Science
Students who receive a grade of 4 or 5 on the AP Computer Science A exam will receive two credits for CSE 001 and two credits for CSE 002. Students who receive a grade of 4 or 5 on the AP Computer Science Principles will receive three credits of CSE 012.

Economics
Students will receive two credit hours of Economics Elective for a score of 4 or 5 on the microeconomics or macroeconomics exam. Students receiving a score of 4 or 5 on both the microeconomics and macroeconomics exams will receive four credits for ECO 001 and two credits of Economics Elective and satisfy the College of Business degree requirements.

English

For Students Entering Fall 2019

Students who earn a score of 4 on either of the English AP exams or a score of 700-749 on the SAT Evidence Based Reading and Writing test, or a score of 32-34 on the ACT English test, or a score no lower than a 6 on all of the three parts of the optional SAT essay exam, or a score of 10 on the ACT Optional Writing Test, you will receive three credits for ENGL 001. If you earn a score of 5 or higher on the IB test, you will receive three credits for ENGL 001. You will complete the six-hour University English requirement by taking an English course suggested by the department, typically ENGL 011. Students will complete the six-hour University English requirement by taking an English course suggested by the department, typically ENGL 011.

Students who earn a score of 5 on either of the English AP exams, or a score of 750 or higher in the SAT Evidence Based Reading and Writing test, or a score of 35-36 on the ACT English test, or a score of no lower than a 7 on all of the three parts of the optional SAT essay exam, or a score of 11 or 12 on the ACT Optional Writing Test, will receive six credits for ENGL 001 and ENGL 002. Students receiving six hours of this English requirement are exempt from English.

For Students Entering Fall 2020

College of Business:

All First-Year students in the College of Business must take English 1 to fulfill the First-Year Writing Requirement.

Those students who demonstrate proficiency in writing by taking an achievement test (see below) will get credit for English 1 (3 credits). They will be eligible to take English 11. Those students who do not demonstrate proficiency as measured by achievement tests will take English 1 to fulfill their writing requirement.

College of Arts and Sciences (CAS) and Rossin College of Engineering and Applied Science (RCEAS):

All First-Year students in CAS and RCEAS must take two courses in First-Year Writing: one of these course requirements can be fulfilled by demonstrating proficiency on the basis of achievement test scores.

Those students who demonstrate proficiency (see below) will get credit for English 1 (3 credits) and will have fulfilled the first of the two required First-Year Writing courses. Those students will take English 11 to fulfill the second course requirement.

Those students who do not demonstrate proficiency on the basis of achievement test scores will take the sequence English 1 and English 2 to fulfill the two-course writing requirement.

Achievement Test Scores:

To receive credit for English 1 (3 credits), students must achieve one of the following:

- a score of 4 or higher on either of the English AP exams,
- a score of 6 or higher on all three parts of the optional SAT essay exam,
- a score of 10 or higher on the ACT Optional Writing Test,
- a score of 5 or higher on the IB test.

Exceptions and special cases:

- Students in the Eckardt Scholar Program are exempt from all CAS requirements, including FY Writing.
- Students in the IDEAS program fulfill the writing requirement by taking writing-intensive seminars in their program.
- Multi-lingual students are assessed for proficiency by the International Center for Academic and Professional English. Those who are deemed sufficiently proficient are placed in English 1 and 2; others are advised to take English 3 and 5.

Environmental Science

Students scoring a 4 or 5 on the environmental science exam will receive three credits for EES 002 and one credit for EES 022.

Government and Politics

Four credits for POLS 001 are awarded to those students that score a 4 or 5 on the American Government test, and four credits for POLS 003 are awarded to those that score a 4 or 5 on the Comparative Politics exam.

History

Students earning a grade of 5 in the American History Advanced Placement examination will receive four credits of History elective for use as Social Science credit. Students earning a grade of 5 in the European History and the World History exam will receive four credits of History elective for use as Social Science credit.

Latin

Students receive four semester hours of credit for a grade of 4 or 5 in the Virgil examination; those who successfully write in more than one area (e.g. Virgil and lyric poetry) receive eight hours of credit. Credit will be awarded for LAT 099 Latin Elective. Students receiving credit for Latin and who wish to continue their study of Latin must consult with the Director for proper placement.

Mathematics

Four semester hours of credit for MATH 021, Calculus I, are granted to those who earn grades of 4 or higher on the Calculus AB examination. To those who earn a grade of 4 or higher on the Calculus BC examination, eight hours of credit are granted for MATH 021 and MATH 022, Calculus I and II. Credit for MATH 021 and MATH 022 or both may also be earned by passing the examination offered by the Mathematics Department during First-Year Orientation. Students regardless of whether they have taken the advanced placement examination may take this examination or not.

Modern Languages and Literature

Students receive four semester hours of credit at the intermediate level I for grades of 4, and eight hours of credit at the intermediate level I & II for grades of 5 on the advanced placement tests. Those who write the SAT II subject tests and score 600 to 699 receive four hours of credit; 700 and above receive eight hours of credit. The maximum number of credits given is eight. Those students receiving grades of 4 or higher on the Spanish literature examination will receive four credits for SPAN 151.

Music

Two credit hours of Music elective are given to those students who earn a grade of 5 on the Advanced Placement test in Music, Listening/Literature of Music: Theory. Students wishing to pursue theory at Lehigh must still take a placement exam.

Physics

Five hours of credit are given for PHY 011, PHY 012, for a score of 5 on the "Physics 1: Algebra-Based" examination (or, "Physics B" examination, for those who took the exam prior to 2015) or a score of 4 or higher on the "Physics C: Mechanics" examination. If a student receives this advanced placement credit for PHY 011, five hours of credit will additionally be given for PHY 021, PHY 022, for a score of 4 or higher on the "Physics C: Electricity and Magnetism" examination. PLEASE NOTE: Credit will only be awarded for PHY 021 & 022 if AP credit was awarded for PHY 011 & 012; credit for the "Physics C: Electricity and Magnetism" examination cannot be awarded after taking PHY 011 & 012 at Lehigh. Alternatively, Anticipatory Exams for PHY 011 and PHY 021 are offered to incoming students during Freshman Orientation.

Psychology

Four credit hours of PSYC 001 are granted to students who earn a grade 4 or 5.

Statistics

Four credit hours of PSYC 001 are granted to students who earn a grade 4 or 5.
International Baccalaureate
Students who earn International Baccalaureate credit may be granted transfer credit for high-level or advanced subjects with scores of 5 or higher. All students will have their credentials evaluated on an individual basis for specific course equivalency once official International Baccalaureate scores have been received.

Please note decisions to award credit are reviewed annually and are subject to change.

Estimate of Expense for Undergraduates

Principally three areas of income support the operating expense of Lehigh University: tuition and fees, endowment earnings, and gifts and grants. The university is conscious that educational costs are significant and it strives to maintain a program of high quality instruction while recognizing that there are limitations on what families can afford to pay. Costs will vary somewhat from student to student depending upon the various options chosen.

TUITION, ROOM, AND BOARD
There are three major plans that cover the major expense associated with university attendance. These are as follows:

The Tuition Plan
The university provides comprehensive academic and student services under its tuition plan. The tuition sum is inclusive of most athletic events, basic treatments in the Health Center, libraries, and laboratory services. A technology fee of $450 is charged to all full-time students. An additional $730 fee is charged to all students enrolled in the College of Engineering and Applied Science or with a declared major in natural science. The full-time tuition rate is charged to students enrolled in twelve or more credit hours per semester. For students enrolled in less than twelve credit hours, tuition is charged on a per-credit-hour basis.

University Housing Plan
A variety of living arrangements are available. The university provides housing for approximately 2,500 students on campus in a wide selection of residence facilities and approximately 900 students in fraternity and sorority housing. The housing arrangements are grouped within four basic categories, with rates associated with the category level. First and second year students are required to reside in university housing. Second year students may choose residence hall or Greek housing options.

University Meal Plan
Ten meal plans are available. First year residents are required to participate in the Category IA Meal Plan or one of the Category I Meal Plans. Upper-class students living in a traditional or suite-style residence hall are required to participate in the Category IA Meal Plan or one of the Category I or II Meal Plans. Students residing in a fraternity or sorority are expected to participate in their house meal plan but also have the option to choose any of the university plans offered. Students residing in campus apartments or any off-campus facilities are not required to participate in a meal plan but have the option to choose any of the plans offered.

Each meal plan includes Dining Dollars. This pre-paid declining balance account was designed for maximum flexibility and convenience and can be used at most dining locations on campus to further increase your purchasing options.

Cost of Attendance

Tuition, Room, and Board charges are listed for the academic year (fall and spring semesters) with one-half charged for each semester. Other Fees are typically charged per occurrence.

<table>
<thead>
<tr>
<th>Tuition, 2019-2020</th>
<th>$54,790</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology Fee</td>
<td>$450</td>
</tr>
<tr>
<td>Student Activity Fee</td>
<td>$250</td>
</tr>
<tr>
<td>University Housing</td>
<td></td>
</tr>
<tr>
<td>Category I (Dravo, Drinker, Centennial I &amp; II, McClinticMarshall, Richards, Taylor)</td>
<td>$8,290</td>
</tr>
<tr>
<td>Category II (All Greek Houses, Houses 85, 87, 89, 93, UMOJA, Warren Square)</td>
<td>$8,890</td>
</tr>
<tr>
<td>Category III (Brodhead House, Trembley Park Suite Singles)</td>
<td>$9,230</td>
</tr>
<tr>
<td>Category IV (Farrington Square, Sayre Park Village, Trembley Park Apartments)</td>
<td>$9,650</td>
</tr>
</tbody>
</table>

NOTE: The above University Housing rates are based on multiple occupancy.

MEAL PLANS
The number of meals specified is per week.

| Category IA (Carte Blanche including $200 Dining Dollars) | $6,460 |
| Category I (19 meals including $100 Dining Dollars) | $5,870 |
| 225 Block Plan any 225 meals per semester including $100 Dining Dollars | $5,870 |
| 200 Block Plan any 200 meals per semester including $300 Dining Dollars | $5,870 |
| Category II (150 Block Plan any $150 meals per semester including $300 Dining Dollars) | $5,160 |
| 125 Block Plan any 125 meals per semester including $500 Dining Dollars | $5,160 |
| Category III (75 meals per semester including $500 Dining Dollars) | $3,140 |
| Category IV (50 meals per semester including $500 Dining Dollars) | $2,450 |
| Category VI (The Dining Dollars $700 Dining Dollars) | $700 |

Based upon the above charges, most first-year students are normally billed the tuition rate, technology fee and student activity fee along with the Category I or II room fee and a Category I meal plan. The total cost for the four areas would be $69,650 to $70,250 for the 2019-20 academic year.

OTHER FEES

| Tuition charge per credit for part-time status or audit | $2,285 |
| Engineering and Science Fee per year (for specified students) | $730 |
| Application fee (for undergraduate admission consideration) | $70 |
| Late preregistration (assigned to all fulltime students who do not select their full class load during the designated period each term) | $100 |
| Late registration | $100 |
| Late application for degree | $50 |
| Examination makeup (after first scheduled makeup) | $25 |
| Late payment (after announced date) | $200 |
| Returned check fine | $35 |
| Key/lock change (lost or non-return), room door, residence halls/sorority | $50 |
| Identification card (replacement) | $30 |

The university reserves the right at any time to amend or add charges and fees, as appropriate, to meet current requirements.

OTHER EXPENSES
A student should plan to meet various other expenses. These expenses include the purchase of books and supplies from the Lehigh University Bookstore located in Farrington Square. Necessary purchases supporting one’s academic program should average approximately $1,400 per year. The Bookstore carries basic goods for students' needs. A student should also plan an allowance to handle personal and travel expenses.

Billing and Payments

Billing statements are available online for both the student and any person the student authorizes. Semester billing statements are available approximately six weeks prior to the start of each semester. Payments are due as follows: Fall semester by the first business day of August, Spring semester by the first business day of January, and all Summer Sessions five days prior to the start of classes. If registration occurs
Refunds of Charges

TUITION AND ACADEMIC FEES
An undergraduate student in good standing who formally withdraws or reduces his or her course enrollment below twelve credit hours before 60% of the semester has been completed during the fall and spring semesters will be eligible for a tuition refund. An undergraduate student in good standing who formally withdraws or reduces his or her course enrollment before 60% of a session has been completed during the summer sessions will be eligible for a tuition refund. A graduate student in good standing who formally withdraws or reduces his or her course enrollment before 60% of the semester has been completed during any semester will be eligible for a tuition refund. The tuition refund for a student who withdraws or drops a course(s) is calculated on a daily basis. No refunds for tuition can be made for courses or workshops with five class sessions or less after the first day of class. Additional penalties may apply to withdraw from special programs or courses held at off-campus locations, such as Study Abroad or Geology Field Camp.

The date used to calculate refunds is based on when a properly authorized withdrawal or drop/add is received by Registration & Academic Services. Academic fees (such as Technology Fee, Engineering and Science Fee, course associated fees, etc.) are generally non-refundable after the first day of classes. In the event of a medical withdrawal or death of a student, certified by the Dean of Students, tuition will be refunded in proportion to the semester remaining.

Tuition Credit/Refund for a Disciplinary Suspension or Expulsion
A student who is suspended from the University during the semester in which the incident occurred is eligible for a tuition credit that will be applied to the semester immediately following the period of suspension. The amount of tuition credited will be based upon the tuition refund schedule for a voluntary withdrawal and the tuition rate in effect during the semester in which the incident occurred less any required financial aid adjustments and any outstanding balance on the student’s account. The date used to calculate the tuition credit will be the date that the disciplinary process (including any appeals) is finalized and communicated in writing to the student. For cases in which a student is placed on interim suspension and prohibited from being on campus or attending classes, the tuition credit will be calculated using the interim suspension date. Tuition credit not utilized in the semester immediately following the period of suspension is forfeited.

A student who is expelled from the University forfeits all payments for tuition and fees incurred for the semester the incident occurred. If the decision to suspend or expel a student is made in a semester subsequent to the semester in which the incident occurred, the student is eligible to receive a 100% tuition refund less any required financial aid adjustments and less any other outstanding balance on the students' account for any courses that the student is unable to complete as a result of the suspension/expulsion. Refunds will not be distributed until all disciplinary procedures including the appeals process are complete.

The University may, in its sole discretion, place a hold on the student's academic records at the time of the incident, which will limit access to transcripts and other educational records until the disciplinary process is complete.

Please note that financial aid is not guaranteed for students who exceed 8 semesters of enrollment because of a disciplinary suspension.

REFUND SPECIFICS
Credit balances resulting from an overpayment with a bank card are eligible to be refunded as a credit transaction to the bank card by contacting the Bursar’s Office. Credit balances resulting from an overpayment with a check drawn on a domestic bank require a minimum two week waiting period before a refund check will be issued. Credit balances resulting from loans, grants, scholarships, and other forms of financial aid are eligible for refund after the 10th day of class. All refund checks will be payable to the student unless:
1. the student has authorized in writing a parent or guardian listed in the Banner Student System to receive the refund, or
2. the check payment on the account was clear that the payment was from an unrelated organization or institution, such as a sponsoring corporation.

Refund checks are mailed to the student’s university post office address or, if none, to the student’s “home address” listed in the Banner Student System. Any exception to this policy must be authorized in writing by the student. Students receiving financial aid that drop below full time status must have their financial aid package re-evaluated by the Office of Financial Aid prior to the issuance of any refund check.

RESIDENCE HALL/HOUSING REFUNDS
Residence hall rooms are rented on an annual basis only. A student who signs a housing contract is expected to reside in and be financially responsible for residence hall housing for both the fall and spring semesters of the specific academic year for which the contract was signed. A student who forfeits a housing reservation and who returns to the university at any time during the contracted academic year is still obligated for housing charges if vacancy in the residence hall facilities exists and without regard to location. Prior to registration, housing rental refunds are made in full in the event a student does not register because of illness or injury; is dropped from the university due to academic reasons; attends a university-approved study abroad or co-op program; graduates; or voluntarily withdraws from the university. After registration, prorated housing rental refunds are granted for the same reasons. Prorated refunds are based upon the date the room has been vacated, belongings are removed, and the room key is returned to the Office of Housing Services. Any student suspended or expelled from housing or the university will not be granted any housing rental refund.

UNIVERSITY MEAL PLAN REFUNDS
Meal plan refunds are made in full in the event a student does not register and has not purchased any meals from the plan. After registration, a student who purchases meals on the plan but withdraws from the university will receive a pro-rata meal plan refund based on the date of the last use or number of meals remaining depending on the meal plan chosen. The Dining Dollar portion is non-refundable.

Any student suspended or expelled from housing or the university will not be granted a meal plan refund. Meal plans may be changed within the requirements of the living area up to the tenth day of class each semester on line with charges assessed per an established proration schedule. After the tenth day of class, a student who wishes to change a meal plan must petition and receive approval from the Office of Student Auxiliary Services. If the change is approved, an adjustment will be processed on a pro-rata basis to the meal portion of the plan charge as of the week following the last meal purchased.
ADJUSTMENTS TO FINANCIAL AID

The Office of Financial Aid is responsible for determining the appropriate redistribution of charges and refunds when students receive any financial assistance. These decisions are made on the basis of federal, state and institutional policies. Any refunds due to the Title IV programs will be refunded in the following order:

- Federal Direct Unsubsidized Stafford Loan
- Federal Direct Subsidized Stafford Loan
- Federal Perkins Loan
- Direct PLUS Loan
- Federal Pell Grant
- Federal SEOG
- Any other Title IV program

Financial Aid

The mission of the Office of Financial Aid is to reduce the financial barriers to a Lehigh education for those families whose resources alone would make it impossible to meet the cost of attendance. We are committed to meeting 100% of demonstrated need for all admitted undergraduate students and strongly believe that this commitment, along with a cooperative and willing family partnership, can make a Lehigh University education an attainable goal.

Our aid program is designed to measure the difference between our costs and the amount of money your family can be expected to contribute towards those costs. That difference is called “financial need” and represents financial aid eligibility. The majority of Lehigh’s funds are awarded on the basis of financial need. Students must file on time and meet academic progress requirements to be eligible for consideration.

The basic components of financial aid consist of gift aid (grants and scholarships) and self help (employment and loan assistance). Gift aid is generally not repayable. The majority are awarded on the basis of “need” and are renewable on the basis of continuing “need”, satisfactory academic progress criteria and on time filing. Employment provides money for books and personal expenses, and is paid through biweekly payroll checks based on hours worked. Loans are repayable funds from one or more sources, repayable after the student ceases to be enrolled on at least a half-time basis.

Additional sources of aid include, but are not limited to: state agencies, employers, and various clubs, churches, religious and fraternal organizations, and foundations. High school guidance counselors are able to provide information about local aid programs.

For more detailed information, please visit the financial aid office website at www.lehigh.edu/financialaid.

Application Procedures

APPLICATION PROCEDURES FOR 2019-2020

Students who are applying for institutional need-based aid are required to submit the Free Application for Federal Student Aid (www.fafsa.ed.gov (http://www.fafsa.ed.gov)), the College Scholarship Service CSS Profile (www.collegeboard.com (http://www.collegeboard.com)), Federal tax forms (student, parent and business tax returns if applicable) and non-custodial parent application (CSS Profile and Federal tax forms), if applicable. For more detailed information such as deadlines and links to forms, please visit the financial aid website at www.lehigh.edu/financialaid.

INTERNATIONAL CANDIDATES

International students may be eligible for university-funded financial aid. Opportunities are limited. Two forms are required: the International Student Financial Aid Application and the Certificate of Finances. The forms can be found on the Admissions website under “Applying to Lehigh.” Students who do not receive financial aid as a first year student are not eligible for aid in future semesters.

RENEWAL OF AID

Financial need is reviewed annually to ensure aid eligibility as determined by the Office of Financial Aid. In conjunction with federal, state and university guidelines, reflects current financial and household information. In order to maintain federal and institutional grant eligibility from one academic year to the next, students must continue to demonstrate financial need. Changes in circumstances such as sibling(s) enrollment in undergraduate college, changes in household size or changes in income may result in a change in financial aid eligibility. For more detailed information such as deadlines and links to forms, please visit the financial aid website at www.lehigh.edu/financialaid.

All students receiving financial aid must maintain satisfactory academic progress. Satisfactory academic progress for Federal financial aid eligibility differs from the academic progress policy for institutional aid. To maintain eligibility for Federal aid, students are expected to maintain satisfactory academic progress based on both qualitative (cumulative GPA) and quantitative (pace of progression). Students must achieve a minimum cumulative GPA of a 1.70 after their freshman year (earning between 0 and 22 credits) and a minimum cumulative GPA of 2.0 for all other grade levels (23 credits and above). Per Federal Guidelines, students have a maximum of 12 semesters of Federal Aid to complete their graduate requirements (aggregate loan limits apply as well). Students must successfully complete a minimum of 67% of their attempted coursework.

In order to maintain eligibility for Institutional financial aid, students must 1.) Earn 12 new credits each semester, 2.) Earn a minimum grade point average of 2.0 for each semester, and 3.) Maintain a minimum cumulative grade point average of 2.0. Eligibility for institutional aid at Lehigh University is limited to Undergraduate enrollment in 8 consecutive semesters (unless you are enrolled in IBE, IDEAS or Art Engineering). NOTE: Institutional aid is provided to assist students in obtaining a bachelor’s degree. Additional aid will not be available to students who choose to enhance their bachelor’s degree with additional credentials (ie. second major/minor) and are unable to do so during the 8 consecutive semesters.

For both Federal and Institutional aid purposes, academic progress will be checked annually, at the end of each payment period, unless a student is on Financial Aid Probation, in which case SAP will be checked at the end of each semester.

Sources of University Aid

Several forms of university-funded aid, based on need and merit, are available.

LEHIGH UNIVERSITY GRANTS [ENDOWED AND SPONSORED SCHOLARSHIPS]

Lehigh Grants are need-based awards funded through university funds and endowments established by generous alumni and friends of the university. The general Lehigh Grant fund is originally awarded to act as a “placeholder” until we are notified of the amounts we are able to award for each of the named scholarship funds. The general Lehigh Grant may be swapped with an endowed or sponsored Lehigh scholarship, established by a donor.

LEHIGH UNIVERSITY MERIT SCHOLARSHIPS

Merit-based awards are gift aid awarded to students solely on a merit basis. When awarding merit aid, we take a holistic approach, looking beyond the numbers related to academic talent alone and reviewing what a student contributes outside the classroom as well as considering recommendations and personal essays. Selection for Lehigh merit-scholarship recipients is made by the Admissions Office -- all students are considered for these awards during review of admission applications. Merit awards can be given in the amounts of full-tuition (Founders Scholarship), half-tuition (Trustees Scholarship) and $12,000 (Deans Scholarship). Awards are renewable for four years of undergraduate study and require a 3.0 average and satisfactory progress toward a Lehigh degree.

CUTLER-SAMETZ CHORAL ARTS SCHOLARSHIPS

Several merit scholarships of $5,000 are available for gifted students in the Choral Arts who maintain at least a 2.8 grade point average. Talented singers are eligible for these scholarships, renewable for four years, and recipients also receive free vocal lessons. Scholars are expected to join the University Choir. A separate application from the music department is required.

SNYDER FAMILY MARCHING SCHOLARSHIPS

Established by alumnus Joseph Snyder and family, these scholarships are for students who demonstrate musical talent and leadership.
Regarding the need-based financial aid process, the financial aid process is designed to help families across many factors, such as your family’s income, assets, size and unusual expenses, and our program is designed to help families across the economic spectrum. Please note the following important items.

**PERFORMING ARTS SCHOLARSHIPS**

Open to students in any academic major or program, these scholarships recognize students with exceptional musical and theatrical (including performance, design, technical, and playwriting) talent. These scholarships are valued at $3,000 and $5,000 and are renewable for four years. Recipients must maintain at least a 2.8 grade point average and remain active in the performing arts at Lehigh. A separate application is required.

**ARMY ROTC LEADERSHIP AWARDS**

In certain instances, the university may supplement an Army ROTC scholarship with a leadership award that is equal to the cost of room and board. These are highly competitive and require a 2.5 average for renewal.

**NATIONAL MERIT SCHOLARSHIP CORPORATION AWARDS**

Lehigh is a collegiate sponsor of the National Merit Scholarship program. Scholarships ranging from $1,000 to $2,000 per year may be awarded to Merit finalists selecting Lehigh as their first choice college, and who are not also receiving another form of National Merit scholarship.

**ATHLETIC AWARDS**

Athletics scholarships are available for students with exceptional athletic ability.

### Availability of Jobs

Work-study jobs are available throughout the university and are funded through federal and university sources. If you are offered work-study as part of your aid package, the Office of Financial Aid maintains a listing of available on-campus jobs. Pay rates range from the federal minimum wage to $10.00 per hour. You are paid on a bi-weekly basis, as you work and submit timesheets. Your work-study earnings are not deducted from your billed expenses.

The Job Locator Development Program is designed to assist you if you do not qualify under the Federal Work-Study program to find employment off-campus or with a number of incubator companies located on the Mountaintop Campus. This program is coordinated through the Office of Career Services.

### Aid from the Government

Lehigh University is an eligible participant in federally funded student aid programs. Campus-based programs, where the university makes the awards based on the dollars available, include:

- Federal Supplemental Educational Opportunity Grants
- Federal Work Study
- Direct entitlement programs (where the government directly, or through commercial lenders for loan programs, provides the necessary funds) include:
  - Federal Pell Grants
  - Federal Direct Subsidized Loans
  - Federal Direct Unsubsidized Loans
  - Direct Parent Loan for Undergraduate Students (PLUS)

Please visit our website at [www.lehigh.edu/financialaid](http://www.lehigh.edu/financialaid) for more detailed information on any of these programs.

### Information for All Financial Aid Applicants

The Office of Financial Aid determines your financial aid award based solely on your family’s demonstrated financial need. We consider many factors, such as your family’s income, assets, size and unusual expenses, and our program is designed to help families across the economic spectrum. Please note the following important items regarding the need-based financial aid process:

- **Family Responsibility**: Lehigh’s philosophy behind financial aid eligibility is that a student and his or her parents are first and foremost responsible for the expenses related to obtaining an undergraduate degree. Furthermore, our expectation is that both parents, regardless of marital status, have a responsibility to participate in the financial aid process.

- **Expected Family Contribution**: Lehigh financial aid counselors carefully review the information your family provides in the financial aid application, including any additional circumstances brought to our attention, in order to determine the Expected Family Contribution ([http://www1.lehigh.edu/financialaid/glossary](http://www1.lehigh.edu/financialaid/glossary)), also known as the “EFC.” It is important to understand that the Expected Family Contribution is not what we think a family has “left over” after other expenses have been covered, and we do not necessarily expect that the parent contribution will be paid from current income. Rather, the level of contribution reflects our analysis of what parents can afford to absorb in education costs over time. Parents may choose to provide their contribution from savings, current income, future income (through borrowing), or some combination.

- **Determining Need-Based Financial Aid Eligibility**: Need-based eligibility is calculated per academic year and is determined using the following formula:

  \[
  \text{Cost of attendance for one academic year} - \text{calculated EFC} = \text{financial need} 
  \]

- **Merit-Based Financial Aid**: All students are considered for merit aid at the time of admission. Students who are selected to receive a merit-based scholarship will be notified when they are admitted to the University. The Office of Financial Aid does not determine eligibility for merit scholarships (academic, athletic or otherwise), and the application process described on our website is not related to these resources. View more information on Lehigh merit scholarships > ([http://www1.lehigh.edu/admissions/undergrad/tuition](http://www1.lehigh.edu/admissions/undergrad/tuition)).

If a student has demonstrated financial need ([http://www1.lehigh.edu/financialaid/glossary](http://www1.lehigh.edu/financialaid/glossary)), this financial need will be covered with a combination of grant-aid ([http://www1.lehigh.edu/financialaid/glossary](http://www1.lehigh.edu/financialaid/glossary)) and self-help ([http://www1.lehigh.edu/financialaid/glossary](http://www1.lehigh.edu/financialaid/glossary)).

### Student Rights and Responsibilities

**STUDENT RIGHTS**

Students have the right to know:

- the cost of attendance;
- the refund policy for students who withdraw;
- the financial assistance available from federal, state and institutional sources;
- procedures and deadlines for submitting applications for financial aid;
- how financial aid recipients are selected;
- how eligibility was determined, including all resources the aid office considered available to the student;
- how and when funds will be disbursed;
- an explanation of each type of award received:
  - for any student loan received: the interest rate, total amount to be repaid, when repayment begins, the length of the repayment period, and the cancellation or deferment provisions of the loan;
  - for any Federal Work-Study or university-funded job: a description of the job, the hours to be worked, the rate of pay, and how and when the student will be paid;
- the criteria used to determine satisfactory academic progress for financial aid purposes; and
- how to appeal a decision by the Office of Financial Aid concerning any aid award.

**STUDENT RESPONSIBILITIES**

It is the student’s responsibility to:

- read directions thoroughly, complete all application forms accurately, and to comply with any deadlines;
- provide any supplemental information or documentation required by the Office of Financial Aid or other agency if applicable;
- read, understand, and keep copies of any forms the student is required to sign;
- repay any student loans received;
• attend an entrance interview and an exit interview if federal, state or university loans are received while in attendance at Lehigh;
• notify the Office of Financial Aid of any change in enrollment status or financial status (including any scholarships or grants received from outside sources); changes of address and enrollment status must also be reported to lender(s) for any loan(s);
• satisfactorily perform the work agreed upon in a Federal Work-Study or university-funded work program; and
• know and comply with all requirements for continuation of financial aid, including satisfactory academic progress requirements.

For additional information write to the Office of Financial Aid, Lehigh University, 27 Memorial Drive W, Bethlehem, PA 18015; telephone (610) 758-3181; FAX (610) 758-6211, email financialaid@lehigh.edu or visit our website www.lehigh.edu/financialaid.

Lehigh University Theatre

In Spring, 1997, the department of theatre moved to the Zoellner Arts Center, Lehigh’s impressive performing arts facility. Three theaters, scene and costume shops, a dance studio, music practice rooms, classrooms and more enhance the department’s curricular activities. The department of theatre’s annual production program includes four productions in the three hundred-seat Diamond Theater and multiple lab productions in the one-hundred seat Black Box Theater. The plays range from classics to world premieres and recent mainstage seasons have included: Smart People, The Broken Machine, Blithe Spirit and Godspell.

Shows directed and produced by students as class projects or independent work occur regularly in the Fowler Black Box Theater. Recent lab theatre productions have included: Poof!, The Moon Please and Panopticon. Many events are sponsored by the Mustard and Cheese Drama Society, the country’s second oldest collegiate drama club.

Auditions and production crews are open to all members of the university community. Production opportunities exist in performance, choreography, set and costume construction, properties management, lighting, sound, house management and publicity. Advanced students have opportunities to direct or design, under faculty supervision.

Outstanding work in the Diamond or black box theaters may be recognized with Williams Prizes and theatre department prizes in acting, directing, design, playwriting and technical production.

Professional guest artists - directors, playwrights, designers, and actors - frequently visit the Lehigh campus to work on productions, teach classes, and conduct seminars and workshops for all interested students. The department also sponsors artists-in-residence, guest lecturers, workshops, and touring performances.

Musical Organizations

The music department offers students an array of ensembles in which to perform and develop leadership skills. The choirs, bands, orchestra, and ensembles are conducted by members of the faculty and managed by elected student leaders. Nearly all performances except Christmas Vespers are held in Baker Hall in the Zoellner Arts Center.

Students earn one credit per semester for each ensemble or lesson course in which they are registered, but they may register for zero credit to avoid overloading.

LEHIGH UNIVERSITY PHILHARMONIC ORCHESTRA

The Lehigh University Philharmonic Orchestra, directed by Eugene Albugelscu, is a body of 60-70 players from diverse backgrounds. Though primarily a student orchestra, faculty and community members also participate, creating an ensemble that contains unique intersections between students of all majors and professionals, campus and community. Students bring the great works of orchestra repertoire to life in four pairs of concerts a year in Baker Hall, Zoellner Arts Center. Membership is by audition.

JAZZ ENSEMBLES

The Jazz program, directed by Bill Warfield, consists of a number of groups large and small, including the Jazz Ensemble, the LU Jazz Repertory Orchestra, the LU Funk Band, and a number of combos. The ensembles perform contemporary literature as well as the music of the more traditional bands such as Basie, Ellington, Goodman and Herman. A distinguished faculty of jazz musicians teaches private lessons and coaches the combos. Membership is by audition.

MARCHING 97

The Marching 97, under the direction of David Diggs, meets during the fall semester and plays at each Lehigh home game, as well as several away games. Made up of students from all of the colleges at Lehigh, the band is a student-run organization dedicated to building a positive Lehigh spirit at games and off the field. Band camp is held three days during the week prior to the start of classes. No audition is required.

SYMPHONIC BAND

The Symphonic Band, under the direction of David Diggs, meets and performs only in the spring semester of each year. The ensemble consists of students, faculty and staff who are interested in playing music. No audition is necessary.

WIND ENSEMBLE

The Wind Ensemble, under the direction of David B. Diggs, is a select group of students dedicated to performing music for woodwinds, brass and percussion. These students represent many diverse majors. In 1999 the Wind Ensemble was honored by Downbeat Magazine, receiving the award for the most outstanding college classical symphonic band.

LEHIGH UNIVERSITY CHORAL ARTS

The Lehigh University Choral Arts, directed by Steven Sametz, and Sun Min Lee is the umbrella organization for a number of vocal ensembles:

LEHIGH UNIVERSITY CHOIR

The Choir is an active force in campus life. The 60 mixed voices of the Choir, drawn from all majors of the University, are auditioned at the beginning of the academic year. They give four major concerts on campus and tour internationally. The Choir frequently performs with orchestra and regularly performs new music, including many works written especially for them. They have been heard five times on National Public Radio. The Choir has toured to Austria, China, France, Germany, Korea, Portugal, Russia, Thailand, Taiwan, and has performed in Carnegie Hall and Avery Fisher Hall at New York’s Lincoln Center.

LEHIGH UNIVERSITY CHORAL UNION

The Lehigh University Choral Union, composed of students, faculty, staff, and Lehigh Valley community members performs three times a year with internationally known soloists and a full symphony orchestra. The 200 singers of the Choral Union bring major works such as Beethoven’s Ninth Symphony, Mahler’s Second Symphony, and the Brahms Requiem to a broad audience. No audition is required.

LEHIGH UNIVERSITY GLEE CLUB

The recently revived Glee Club sings traditional and new music for male voices under the direction of Steven Sametz. Enthusiastically welcomed by alumni and the university community, the Glee Club has thrilled audiences on campus, on tour in China, and at Lincoln Center, where they performed with the University Choir.

DOLCE

Dolce – Lehigh University’s Women’s Ensemble under the direction of Sun Min Lee begins a new tradition of women’s music on campus. They perform on campus and in the community. This group sings a variety of music written especially for female voices as well as music adapted for the group. Members of Dolce also sing with the University Choir.

Club Sports

A Club Sport is formed when a group of students voluntarily organize in the aim of seeking structured and most often competitive sport opportunities in an area of common interest. Club sports are structured and guided by the principles and obligations of other student organizations, and are not formally recognized until they are fully compliant and meet required expectations. The initiative, organizational commitment and personal investment required for club sports participation fosters an extraordinary learning and leadership experience.

Competition levels can range from Div I club Men’s Ice Hockey and Men’s Rowing to sports such as Cycling, Equestrian, Men’s and Women’s Rugby, Ultimate Frisbee, Water Polo or non competitive sports.
that includes Fencing and Gymnastics just to name a few. In total, there are 32 recognized club sports that are active.

Intramural Sports

Intramural sports are organized, structured, and competitive activities that are played within the University. At Lehigh, members form teams from IFC, Pan-Hellenic, off campus houses and dorms. These teams and individuals accumulate trophy points in sporting contests for an overall All University Champion in one of four divisions: Upper-class Greek, Upper-class Independent, Women and Freshmen. Intramural sports, which varies from 11 to 15 activities, offers our students a high degree of physical fitness, helps establish habits of regular and healthful exercise, fosters the development of self confidence, good sportsmanship, and a spirit of cooperation.

Fitness

The Fitness Programming initiatives at Lehigh exist to promote the development of a physically educated person. Opportunities are provided for all members of the Lehigh community to learn skills necessary to perform a variety of physical activities and acknowledge the implications of and the benefits from involvement in physical activities. We teach the value of physical activity and its contribution to a healthful lifestyle. Our programs focus on activities in which a person can participate over the course of a lifetime, and contribute to the development of health-related components of physical fitness through sport.

Recreation

The entire Lehigh community is invited to participate in the annual Turkey Trot, compete in organized leagues such as summer softball and others during the academic year or informal activities such as lap swimming in our pool, playing pickup basketball, refining your dance moves in the Dance Studio which are all located in Taylor Gym. The Goodman Campus provides a vast green space, to throw a Frisbee, kick a soccer ball or play a friendly game of touch football. You can run on our nationally known cross country course, hit a tennis ball at the Lewis Tennis Center or drive a bucket of golf balls at the Mulvihill Golf Learning Center. The opportunities are endless!

Student Code of Conduct

Intellectual honesty and mutual respect are not accidental values in a university. They are, for students and professors alike, a presupposition of the pursuit of truth, which brings universities into existence. It is essential that an academic community uphold these values. The student code of conduct and the student conduct system are mechanisms by which the university endeavors to develop in all students a sense of responsibility to the Lehigh University community.

The Lehigh University Student handbook (http://studentaffairs.lehigh.edu/handbook) contains information relevant for the student members of our community. All students have an obligation to read and be familiar with the Student Handbook, the Code of Conduct, and the other policies contained therein.

In Bethlehem, An Educational Tradition

Lehigh University shares in the historical heritage of Bethlehem, even though, having been founded in 1865, it is a relative newcomer. The fact that Lehigh was established in Bethlehem reflects the tradition of education established by the community’s first settlers thirty years before the founding of the nation.

The first Moravians were among the many German religious sects that came to the New World, and especially to Pennsylvania, during the early 1700s. But unlike William Penn, who established his sylvania as a new land where he might hold his Quaker beliefs away from England’s oppression, the Moravians came as missionaries with the intent of converting the Indians to Christianity. For this purpose they settled the Lehigh Valley.

The early Moravians were industrious. Their first building, the Gemein Haus (community house) was completed in 1741. This building stands today, one of thirty-nine remarkably preserved pre-Revolutionary War buildings constructed by the Moravian settlers and in continuous use ever since by the Moravian community. Many of these buildings are located on Church St., west of the City Center; industrial buildings are located in the 18th Century Industrial Area in the Monocacy creek valley west of the business district.

The leader of the Moravians was Count Nicholas von Zinzendorf of Dresden. He arrived in the settlement in time for their observance of Christmas Eve in 1741 and gave the settlement the name Bethlehem—“house of bread”.

The settlers built high-quality structures of stone, demonstrating principles of engineering that were not generally used elsewhere. They were interested in music, and established the first symphony orchestra in America. In 1748, the settlement had a fourteen-man orchestra. The community’s first organ was built in 1757 by John Gottlob Klemm. The musical tradition, including the trombone choir, continues today, perhaps most visibly in the Bach Choir of Bethlehem, whose yearly Bach Festival is held in the university’s Packer Memorial Church. In 1985, the 300th anniversary of the birth of Johann Sebastian Bach was observed.

Zinzendorf envisioned Bethlehem as the center for manufacturing; outlying Moravian settlements, such as Nazareth, Pa., would be primarily devoted to agriculture. On October 15, 1742, a large barn was “raised” with the help of most of the residents. Three months later a grist mill at the community spring produced the first flour. In 1758, the Sun Inn was built along Main St., a haven for travelers. Reconstruction of the picturesque inn was completed in 1982, and it now operates as a community center and restaurant.

Zinzendorf’s determination that Bethlehem would be a major industrial center was assisted by the completion in 1755 of the water works, the first public utility in the New World.

The Moravian dedication to education was an extension of the philosophy of John Amos Comenius, who had written, “Everyone ought to receive a universal education.” The Moravian educational institutions that continue today, including Moravian Academy and Moravian College, stem from this tradition.

The Moravians, although avowedly opposed to war, found their community pressed into service as a hospital when Washington’s troops bivouacked at Valley Forge during the winter of 1777-78. Washington came to the community once, and many other Continental Army officers were visitors.

The Sun Inn was also used as a hospital during the war; among its patients was an aristocratic renegade from France, Marie Joseph Paul Ives Gilbert Motier, the Marquis de la Fayette. Lafayette had come to assist the Continental Army aboard his own ship, the “Victory.” Fifty years later a college in Easton was named in his honor and it became Lehigh’s traditional football rival.

The first bridge across the Lehigh River was built in 1794. It was replaced in 1816, but the latter was destroyed by a flood in 1841. In 1759, the turnpike (toll road) over South Mountain, generally along the route of the present Wyandotte St. hill, was opened. The present Hill-to-Hill Bridge was built some fifty years ago.

“Black gold.” During the late 18th century, anthracite was found in the mountains north of the Lehigh Valley. In 1818, the Lehigh Coal Co. and the Lehigh Navigation Co. were formed, one to mine the anthracite on the upper Lehigh River, the other to transport it down river to metropolitan markets.

The Lehigh River was difficult to navigate. Consequently, in 1829 the Lehigh Canal was completed from Mauch Chunk (now Jim Thorpe), through Bethlehem to Easton, where it connected with the Delaware Canal. During the 1840s, iron mines were opened in the area, and several blast furnaces, fueled by coal, were in operation. Zinc ore, was found in neighboring Upper Saucon Township. In the 1850s Asa Packer built the Lehigh Valley Railroad. These origins eventually led to the heavy industry that continues in the Lehigh Valley today.

When Asa Packer founded Lehigh University in 1865, one of his objectives was to make possible broadly based education for young people of the region, combining the technical skills needed to run the flourishing industry of the Lehigh Valley with a liberal education.
In addition to its role as a steel-making center, Bethlehem today is a major tourist attraction. The Moravian community sets up an elaborate nativity scene and the entire city is decorated with lighting during the holiday period. The Moravian tradition of a single candle (now electric) in each window is widely observed.

Atop South Mountain is a steel tower known as the Star of Bethlehem. During the holiday period, the star’s hundreds of bulbs create a 95-foot-high star that can be seen for many miles. The star was the gift to the community of Marion Brown Grace, wife of Eugene Gifford Grace, the steel magnate and president of the university board of trustees.

The community of Bethlehem has a population of approximately 78,000 persons with segments from a variety of nations who retain traditions of their country of origin.

There are five principal independent colleges in the Lehigh Valley besides Lehigh. They are Lafayette, DeSales University, Moravian, Muhlenberg, and Cedar Crest. A cooperative program is maintained that allows cross-registration for courses as well as shared cultural events. There are also two community colleges in the area.

In August 1984, Bethlehem held its first Musikfest, a 10-day annual festival that features a variety of musical performances and ethnic foods. An instant success, Musikfest was the brainchild of Jeffrey A. Parks, a lawyer and 1970 Lehigh graduate.
University Resources
Lehigh University offers a variety of resources to support the campus community.

Library and Technology Services
The exponential growth and increasing sophistication of information technology offer new and exciting opportunities for enhanced teaching, learning, and research. At Lehigh University, one merged organization called Library and Technology Services (LTS) delivers communications, computing, distance education administration, enterprise systems implementation, faculty development, library, and media services to capitalize on these new opportunities. Additional information about Library and Technology Services can be found at lts.lehigh.edu.

Libraries
Lehigh University has two major library facilities, the Linderman Library and the Fairchild-Martindale Library.

The historic Linderman Library is a showcase for humanities programs and collections, as well as an intellectual center for the campus at large. Its 1878 high Victorian rotunda and 1929 grand reading room have been retained in all their magnificence. A 2005 renovation transformed the library to include seminar rooms, a computer classroom, exhibition space, group studies, a cafe, and wireless throughout.

Linderman houses books and journals in the humanities and Lehigh’s impressive collection of rare books, including Darwin’s Origin of Species and John James Audubon’s double elephant folio edition of Birds of America. The library has an extensive digitization program and supports an open access repository, readily available for the deposit of faculty and student research.

The Fairchild-Martindale Library offers a mix of immersive and collaborative learning spaces, experimental classrooms, areas for individual or group work or study, and a cafe. The library provides the campus with electronic and print books and journals in all branches of science, engineering, mathematics, and the social sciences, including business and education. The Center for Innovation in Teaching and Learning offers an extensive variety of programs and training opportunities for the campus community.

The Lehigh Libraries offer students, faculty, and staff a full range of electronic journals, full text and image databases easily accessible from on and off campus. Help Desk staff and subject librarians provide personalized service in person and online. Consortial partnerships allow the Libraries rapid and easy borrowing and document delivery from collections located in other libraries in the Lehigh Valley and Philadelphia, as well as nationally and internationally.

Computing
Providing technology and consulting services to support classroom teaching, laboratories, and other aspects of the academic and research programs is a strategic priority for Lehigh University. About 407 Windows and Macintosh personal computers are distributed across campus for convenient use by students at 31 computing sites. Students and faculty have access to site-licensed software applications and central and cloud-based file storage from on and off campus. LTS provides software at public computing sites for general word processing and spreadsheets, mathematical and statistical packages, and specialized applications for scientific and engineering work. Over 60 software titles are also available in a virtual environment through the LLapps service.

Lehigh provides access to a variety of computing systems suitable for large scale scientific computing and compute intensive applications. These systems contain 2884 computing cores, 126 GPU devices, with 407,808 CUDA cores and 13.75 terabytes of memory available to tackle the most complex and demanding research projects. For more information, see https://researchcomputing.lehigh.edu. University computing capacity and Internet bandwidth are continuously being increased to meet escalating demand.

The Center for Innovation in Teaching and Learning supports faculty innovation -- see the Faculty Development section of this catalog for details. Library and Technology Services provides technical support for the many computer classrooms, suitable for individual "hands-on" instruction. Most Lehigh University classrooms are equipped with permanently-installed computer projection systems. Equipment is available through the Digital Media Studio to enable faculty or students to give computer-based presentations in any space.

Media Services
Library and Technology Services offers an extensive media collection and streaming video services for courses. Videos and DVDs are available for viewing and for short-term loan at the Fairchild-Martindale Circulation Desk.

The Digital Scholarship Team is part of the Library & Technology Services Center for Innovation in Teaching and Learning. The team works with faculty and students in the use of digital tools and technologies that will enable them to develop and/or disseminate their course work and research. Examples of work include documentary audio and video, web publication, and spatial and data visualization.

In addition to the staff offices located in the 5th floor of Fairchild Martindale Library, team members also man and provide services in the Digital Media Studio, located in room 425 of the Library. The Studio houses resources for professional audio and video recording and a Mac computer lab equipped with basic and advanced video editing and design software. The lab also loans video, audio, and photography equipment.

Student Services
The library and most distributed computing facilities are open seven days per week and for evening hours during the fall and spring semesters. The computing center is open 24 hours during fall and spring. During final exams, the Fairchild-Martindale Library is open around the clock. For most of these hours, the LTS Help Desk provides library and technology assistance to the Lehigh community via walk-up, phone, email, and chat. The Help Desk is the starting point for requesting help with computing, networking, software, library research, and more.

The STARS Team (Student Technology and Repair Services) provides technical consulting for Lehigh students. The team staffs a service area known as the STARS Desk where students can drop off their computers to receive technical support, troubleshooting, and consultation services. The team includes a full-time staff member/manager and twenty student Technology Consultants who are trained to assist with a variety of technology-related problems. Types of assistance provided include: Virus/malware removal, hardware troubleshooting and repair, data recovery, network connection issues, and fixing operating system problems.

Library and Technology Services maintains a variety of facilities for printing, scanning, copying, and duplicating within the constraints of copyright and yearly paper consumption restrictions. In the Libraries are public scanners and microform printers. The Digital Media Studio assists with video and audio production. There are printers at most computing sites. Students are strongly encouraged to print responsibly by using the duplex feature, never printing multiple copies, and examining documents to eliminate unneeded sections before printing.

Each semester Library and Technology Services offers an extensive program of seminars and course-based instructional sessions for students. Attendees learn how to use software applications, library resources, and web-authoring tools. LTS professionals work closely with faculty to integrate library, computing, and media resources into the curriculum. They facilitate the use of course management software, online courses of various kinds, and course projects in a wide range of disciplines using interactive websites created by faculty and students.

Through seminars and policies on the use of print and electronic resources, students are also taught computer and information ethics and safe computing practices.
Student Employment

Student assistants are essential for the operation of most Library and Technology Services functions. Working for LTS, graduate and undergraduate students gain valuable skills and good work habits. At the job fair, held each fall, there are opportunities to learn in-depth about the jobs available.

Lehigh University Art Galleries – Museum Operation (LUAG)

Lehigh University Art Galleries Teaching Museum’s (LUAG) central educational resource is viewed as a multifaceted integrated classroom in which education is approached in the following ways: Museum and Curatorial Studies; Collections Care and Management; Exhibitions and Interpretation; and Partnership with the Community. Courses are taught across the Center for Innovation in Teaching and Learning’s (CITL) world-class teaching collection, which represents a diverse and broad cross-section of art and culture. Students and faculty are engaged in direct experiential learning within the Integrated Teaching Collection and Visual Laboratory. Exhibitions, lectures, panel discussions, and videos in eight campus locations are planned specifically to function as teaching tools for exploring diverse topics in visual literacy and the humanities.

Museum Education and Community Engagement

As a university teaching museum, LUAG is a well-established, evolutionary and progressive program within the broader institutional mandate of Lehigh University. Our educational and cultural mission is advanced through firsthand observation and hands-on training. Faculty from all disciplines is encouraged to seek opportunities for teaching through our Collection. Students develop skills to respond critically to a rapidly changing world through problem-based learning and collaboration, ultimately preparing them to become well-informed consumers of visual culture in the broadest sense. We create educational opportunities for the entire student body, and enrich the cultural life of the campus and the community at large. LUAG works in conjunction with Art, Architecture/Design, History, and Curatorial and Museum Studies, as well as other departments on campus to increase involvement in the arts and humanities.

During the past few years, we have expanded our Gallery activities to include more docent-guided tours, greater volunteer engagement, and special programs. One of our current initiatives is to create an atmosphere of “accessible art” for visitors with vision loss or limited vision. With the assistance of internal and external writers, we provide audio descriptions and tactile diagrams of select artwork in the Teaching Collection. The descriptions will enable visitors the ability to “see” with their mind’s eye, encouraging a more relaxed and accessible viewing of the collection for all visitors.

University teaching museums invite exploration and the traversing of boundaries, both between and within curricular disciplines and across cultures. LUAG has an established reputation for being a unique institution on the college campus, and are a vital resource within the liberal arts environment.

Faculty Development

The Center for Innovation in Teaching and Learning fosters excellence in teaching and learning by providing faculty with tools, development opportunities, workshops, and consultation services. Faculty looking for consultation or support in any of the following areas are encouraged to contact the CITL: course or curriculum design; active or collaborative learning pedagogies; instructional approaches in new course contexts; instructional media or technology; online or hybrid teaching; writing assignment design; digital scholarship for research or teaching; high-performance computing for research or teaching; peer-to-peer learning; instructor presentation skills; student communication skills; assessment of student learning.

Dr. Gregory Reihman, Associate Vice Provost and Director of the Center for Innovation in Teaching and Learning, may be contacted at 610-758-5045 or ilk204@lehigh.edu. The CITL website is http://citl.lehigh.edu. The Faculty Development website is http://fts.lehigh.edu/services/faculty-development. Writing Across the Curriculum website is http://trac-web.lehigh.edu

Lehigh University Press

Lehigh University Press represents a clear expression of faculty and institutional commitment to the advancement of scholarship. Press management rests with a Director, Katherine Crassons (English), and with an Editorial Board comprised of university faculty. The Press is interested in all fine scholarship and has five series: Critical Conversations in Horror Studies, Studies in Eighteenth-Century America and the Atlantic World; Studies in Christianity in China; Perspectives on Edgar Allan Poe; and Studies in Text and Print Culture. By linking the name of the university to a list of exemplary work by scholars across the nation, the Press reinforces the value of excellence in scholarship for faculty, graduate, and undergraduate students alike. Publications by the Press have won national awards, including Patricia D’Antonio, Founding Friends: Families, Staff, and Patients at the Friends Asylum in Early Nineteenth-Century Philadelphia (2006: The American Journal of Nursing’s Book of the Year) and Sarah Fatherly, Gentlewomen and Learned Ladies: Women and Elite Formation in Eighteenth-Century Philadelphia (2010: The Philip S. Klein Prize for the best book on a topic that illuminates the history of Pennsylvania).

For more information, contact:

Lehigh University Press
Lehigh University, B040 Christmas-Saucon Hall
14 East Packer Avenue
Bethlehem, PA 18015
Phone: 610-758-3933
Fax: 610-758-6331
Email: inlup@lehigh.edu
Website: https://lupress.cas2.lehigh.edu/

Resources for Students

The Student Affairs division is dedicated to fostering student success by providing a balanced, rich and integrated living and learning environment. Virtually every student enrolled is touched by Student Affairs, beginning with orientation through the Office of First-Year Experience, and continuing through programs devoted to leadership development, community service, residential life, activities, academic support, a vibrant campus life and diversity and inclusion programs. Students are supported through the Health and Wellness Center and Counseling and Psychological Services which collectively work to ensure a safe and healthy living environment. I encourage you to visit our departmental websites to learn more about each of these areas.

To learn more about all the resources for students Lehigh University please view the following:

Student Handbook Resources http://studentaffairs.lehigh.edu/content/university-resources
Student Affairs http://studentaffairs.lehigh.edu/
Dean of Students http://studentaffairs.lehigh.edu/dos
Counseling and Psychological Services http://studentaffairs.lehigh.edu/counseling
Health and Wellness Center http://studentaffairs.lehigh.edu/health
Lehigh University Police Department https://police.lehigh.edu/

DISABILITY SUPPORT SERVICES

Disability Support Services, in the Dean of Students Office, supports and enhances Lehigh University’s educational mission and its commitment to maintaining an inclusive and equitable community by providing equal access and reasonable accommodations to qualified students with disabilities in accordance with the Americans with Disabilities Act as amended (ADAAA) and Section 504 of the Rehabilitation Act of 1973.

Services for students with documented disabilities are coordinated by Disability Support Services (610-758-4152), often in conjunction with various other campus departments such as Residential Services, Facilities Services, and Transportation and Parking Services. Students may be contacted at 610-758-5045 or ilk204@lehigh.edu. The CITL website is http://citl.lehigh.edu. The Faculty Development website is http://fts.lehigh.edu/services/faculty-development. Writing Across the Curriculum website is http://trac-web.lehigh.edu

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Health and Wellness Center http://studentaffairs.lehigh.edu/health
Lehigh University Police Department https://police.lehigh.edu/

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Services for students with documented disabilities are coordinated by Disability Support Services (610-758-4152), often in conjunction with various other campus departments such as Residential Services, Facilities Services, and Transportation and Parking Services. Students
requesting accommodations must present the University with current and comprehensive documentation. For more information refer to our website at: http://studentaffairs.lehigh.edu/disabilities

HEALTH & WELLNESS CENTER
Lehigh University offers health services to all (matriculating) students at the Health & Wellness Center (HWC) located in Johnson Hall. Health care providers, including nurses, and nurse practitioners and physicians, see patients by appointment Monday to Friday from 8:15-4:45. Our providers are also available for phone consultation after hours and on weekends.

The providers at the HWC treat a variety of illnesses, injuries and medical conditions. Gynecologic care is available daily for both preventative care services and treatment. Allergy immunotherapy injections are also administered at the HWC. Many lab tests are run at the HWC and phlebotomy services are available on certain days. Students can be easily referred off campus for x-rays and consultations with medical and surgical specialists. More seriously ill students can be sent to either of our local hospital Emergency Departments.

Incoming students must comply with University immunization requirements. A university sponsored health insurance plan is available which complements the services of the HWC. Families are urged to review their existing insurance coverage and limitations and to consider purchasing the university sponsored plan. Students should carry their insurance cards with them at all times.

Most services performed at the HWC are without charge. For more detailed information about this and other things, please consult our web page at www.lehigh.edu/health.

Counseling and Psychological Service
The University Counseling and Psychological Service, at 610-758-3880, is located on the fourth floor of Johnson Hall. The office is open from 8:00 - 5:00, Monday through Friday with reception service available from 8:15am to 4:45pm. Most services are free of charge. Counselors are available for 24-hour emergency consultations (see Crisis Intervention below).

1. Philosophy & Mission
The University Counseling and Psychological Service (UCPS) is dedicated to the belief that a person’s college years are a time of challenge, inquiry, experimentation, productivity and change. Services are designed to help students not only manage crises, but to thrive in meaningful ways . . . to grow in self-understanding in order to make more satisfying and better use of their personal and interpersonal resources. Individual contacts, group therapy, faculty and staff consultation, and numerous outreach activities are some of the primary means by which the mission is accomplished. UCPS staff members are committed to providing assistance to all registered Lehigh students interested in personal, social, and academic growth and discovery, and to serving the larger campus community through consultation, teaching, research, and various other types of involvement.

2. Direct Services
To accomplish its mission, and while upholding the established state and APA (American Psychological Association) ethical principles and code of conduct for psychologists, the UCPS provides a variety of services to the Lehigh University community including:

- Crisis Intervention Services (On call 24/7 at 610 758 3880 and select #0)
- Group and Individual Psychotherapy
- Peak Performance
- Outreach Programming
- Assessment and Evaluation
- Consultation Services
- Training
- Advocacy

More information can be found at: http://studentaffairs.lehigh.edu/counseling

Career and Professional Development
One function of a college education is to foster the growth and development of the student to prepare for a meaningful and satisfying life after college. Lehigh provides career planning services for undergraduate and graduate students as an integral part of the career development process.

Career planning can best be described as an educational process through which students
1. identify and develop their abilities, aptitudes, and interests;
2. learn the relationship between their capabilities and interests, their university experiences, and professional opportunities outside the university; and
3. prepare for those opportunities.

The office is open throughout the year. The main phone number is (610)-758-3710 and the website is www.lehigh.edu/careersearchs.

OFFICE OF FELLOWSHIP ADVISING
The Office of Fellowship Advising (OFA) assists Lehigh students who are applying for competitive national fellowships and scholarships. It publicizes opportunities, oversees the selection of candidates for awards that require university nomination and, with the assistance of fellowship advisors, guides students through the frequently complicated application procedures.

The OFA web-site (https://ofa.lehigh.edu/) contains a searchable database of a wide variety of fellowships and scholarships for students research. The database includes links to the foundations’ official sites, deadlines, and a general descriptions. Other resources and information on the application process are provided on the website as well.

Students who are interested in applying for awards and faculty members working with motivated, well-qualified students are encouraged to email the Office of Fellowship Advising at ofa@lehigh.edu.

CENTER FOR COMMUNITY ENGAGEMENT
The Lehigh University Center for Community Engagement (CCE) (http://cce.lehigh.edu) assists Lehigh’s faculty, staff, and students who are involved with service-learning classes or community-based research projects. The center projects are community globally and locally. The HWC provides health care services, and mobilizes university-community partnerships to address societal challenges, promotes knowledge and research for the common good, and helps cultivate engaged citizens.

We are a centralized resource for all community members to support high-quality research, learning, and active citizenship.

The Center for Community Engagement offers a variety of resources from one-on-one consulting to workshops and courses to faculty development and evaluation/assessment support. A number of courses, such as SOAN/HMS 120: Values and Ethics of Community-Engaged Research (http://catalog.lehigh.edu/courselisting/soan), also offer formalized training in community-engaged research. Finally, the center can be a sounding board in the early stages of any project to ensure reciprocal, ethical, and meaningful experiences for our community and our institution. A yearly community-engaged learning and research symposium is held to highlight exceptional academic learning, community partnerships, and research collaborations.

The Center for Community Engagement is located in Williams Hall 020 and has space for meetings, informal discussion, and computer workstations for those working on community projects. Contact via email at inengage@lehigh.edu or via phone 610-758-1081. The website is accessible at: http://cce.lehigh.edu/.

Office of International Affairs

“Lehigh University prepares graduates to engage with the world and lead lives of meaning.”

—Lehigh University Vision Statement

The Office of International Affairs directs Lehigh’s plan for comprehensive internationalization, where an international or intercultural dimension is infused in all aspects of teaching, research, and service. Our area includes Fellowship Advising, the Global Citizenship Program, Global Partnerships and Strategic Initiatives, the Global Union, Iacocca Institute, Iacocca International Internship Program, the International Center for Academic and Professional English, the Office of International Students and Scholars, Study Abroad, and the United Nations Partnership.
Fellowship Advising

Bill Hunter, Director, Fellowship Advising
32 Sayre Drive, Coxe Hall, Room 202, Bethlehem, PA 18015-3123
(610) 758-4505
wdh3@lehigh.edu

Whitney Szmodis, Assistant Director, Fellowship Advising
32 Sayre Drive, Coxe Hall, Room 203, Bethlehem, PA 18015-3123
(610) 758-4716
wes307@lehigh.edu (wes307@lehigh.edu)

Coordinator
(610) 758-3193
ofa.lehigh.edu

https://global.lehigh.edu/fellowship-advising

The Office of Fellowship Advising assists Lehigh students who are applying for competitive national fellowships and scholarships. It publicizes opportunities, oversees the selection of candidates for awards that require university nomination and, with the assistance of fellowship advisors, guides students through the complex application procedures. Students who are interested in applying for awards, and faculty members working with motivated, well-qualified students, are encouraged to contact the office.

Global Union

Caroline Neal, Intercultural Programs Coordinator, Office of International Students & Scholars, Program Director Global Union
32 Sayre Drive, Coxe Hall, Room 107, Bethlehem, PA 18015-3123
(610) 758-6412
cbn219@lehigh.edu (wdh3@lehigh.edu)
global.lehigh.edu/globalunion

The Global Union, located in Coxe Hall Room 215, is a collaboration of more than 50 student clubs and organizations that promote global awareness and cultural understanding within the Lehigh community. Students involved in the Global Union hail from all corners of the globe, including nearly half from the United States.

The Global Union hosts panel discussions on world issues, a large International Education Week celebration, dinners and cultural festivals, and musical performances. All events at the Global Union are free and open to the Lehigh community.

The Global Union lounge is open from Monday-Thursday from 4-9 p.m. for student meetings and program presentations. To reserve the space, visit global.lehigh.edu/reserve-lounge.

For more information regarding the Global Union, see the website at global.lehigh.edu/globalunion.

Iacocca Institute

IACOCCA INSTITUTE®
111 Research Drive; 610-758-6723

Kira Mendez, Director, Iacocca Institute; Trisha Alexy, Curriculum Director, Iacocca Global Village; Mary Frances Schurtz-Leon, Candidate Manager, Iacocca Global Village; Diana Q. Shepherd, Director, Iacocca Global Entrepreneurship Intensive.

The Iacocca Institute creates transformative experiences that challenge, develop and empower the next generation of global leaders. Its programs are immersive, highly diverse, cross-cultural, and experiential. The Institute collaborates with others to bring the impact of these experiences to young leaders throughout the Lehigh community and across the globe. Over the years, the Institute has built an extensive global network of university and industry partners, and its alumni network spans more than 140 countries.

Current Iacocca Institute programs include:

Iacocca Global Village for Future Leaders® (GV)
The Iacocca Global Village engages advanced university students and young professionals from around the globe in an immersive intercultural learning experience that improves participants' leadership and entrepreneurship skills and demonstrates the positive impact of culture and diversity in an organizational setting and the power of international networks. During the five-week summer program, Villagers learn about ethical leadership and trends in business and industry. They live together, work together on consulting projects, and participate in leadership development and culture-sharing experiences. The program strives for extreme diversity—60 to 90 participants from 35-45 countries, including the U.S.—to maximize learning. Now in its 23rd year, the Global Village has more than 2100 alumni from 139 countries who represent a vibrant and connected network, and many GV alumni continue to serve the program as mentors, experts, and clients throughout their careers. Each year, the Institute is able to accept a modest number of highly qualified current Lehigh undergraduate and graduate students into the Global Village program. Lehigh University alumni are also encouraged to apply. The Iacocca Institute funds 50% of the program fees for all Lehigh students, faculty/staff, and alumni.

Iacocca Global Entrepreneurship Intensive (formerly PA School for Global Entrepreneurship)
Now in its 19th year, the Iacocca Global Entrepreneurship Intensive (IGEI) brings top U.S. and international high school students together for a four-week residential intensive global leadership and entrepreneurship learning experience. This summer program focuses on challenging students as they develop greater cultural awareness and leadership skills and learn business practices with other students, faculty, and entrepreneurs. To date, IGEI participants have included over 1225 students from 65 countries and 20 states. During summer 2019, in addition to the core four-week program on the Lehigh campus, the Institute is offering a two-week IGEI San Francisco-Silicon Valley for high school students at the Lehigh@NasdaqCenter, a unique setting resulting from a partnership between Lehigh University and the Nasdaq Entrepreneurial Center. This special IGEI program allows students to build entrepreneurship and leadership skills while experiencing the unique entrepreneurial culture of Silicon Valley.

Iacocca Global Village on the Move (GVOTM)
Created in collaboration with the Institute's network of global university and organizational partners, Global Village on the Move (GVOTM) programs are customized 7-10 day programs that provide immersive leadership and cultural experiences, tailored to regional themes, for local and global professionals, including Institute and Lehigh alumni. The Institute has worked with partners in Peru, Spain, Australia, United Arab Emirates, Malaysia, Italy, China, Russia, and India to deliver GVOTM programs in 10 cities on four continents over the past 18 years.

Additional custom programs and partnership opportunities
The Institute regularly develops customized experiences and hosts other intensive leadership programs that align with its mission. In summer 2019, the Institute will host 25 professionals from sub-Saharan Africa for a Mandela Washington Fellowship Institute, a program of the U.S. Department of State. In addition, the Institute will host a group of 25-30 high-school students from Osaka Japan for a one-week business and entrepreneurship intensive residential experience. The Institute regularly hosts student interns for academic year and summer projects and positions, and is always open to collaboration with other Lehigh departments and colleges on new projects and programs.

The Iacocca Institute was established in 1988 in partnership with Lehigh alumni and automotive icon Lee A. Iacocca ’45, former chairman and chief executive officer, Chrysler Corporation.

For more information, contact Kira Mendez, Director, Iacocca Institute®, Iacocca Hall, Lehigh University, 111 Research Drive, Bethlehem, PA 18015.

International Center for Academic and Professional English

Mark Ouellette, Ph.D.
Director
246 Maginnes Hall
9 W. Packer Ave.
Bethlehem, PA 18015
(610) 758-6099
inicape@lehigh.edu
https://global.lehigh.edu/cape

The International Center for Academic and Professional English (ICAPE) at Lehigh University offers a variety of year-round courses (https://global.lehigh.edu/cape/credit-courses), language/culture workshops (https://global.lehigh.edu/cape/workshops), language testing (https://global.lehigh.edu/cape/testing-services), and private tutoring (https://global.lehigh.edu/cape/tutoring) for undergraduate and graduate students who would like to improve their academic English skills and their understanding of American pragmatics and culture.

UNDERGRADUATE ENGLISH DEPARTMENT COURSES FOR CREDIT
Based on language test scores and an English placement test, undergraduate students who are non-native speakers of English (and those who speak varieties of English other than standard American English) may be required to register for ENGL 003 and ENGL 005 (Composition and Literature for International Writers I and II) as their required first-year English composition courses. These two courses, taken consecutively in the Fall and Spring semesters, are designed specifically with multilingual writers of English in mind, and they can substitute for ENGL 001 and ENGL 002 general composition courses.

ENGL 016 (Recitation Session for Critical Reading and Composition) and ENGL 017 (Recitation for Research and Argument) are additional 1-credit support seminars that will help students succeed in ENGL 001, 002, 003, and 005.

Multilingual English-speaking students who need additional focused practice to help them improve their academic English language skills may be required to register for ENGL 015 (Speech Communication for International Speakers) and/or ESLP 003 (Intelligibility and Comprehensibility in English).

GRADUATE & PROFESSIONAL ENGLISH (ESLP) COURSES FOR CREDIT
Based on language test scores and graduate department requirements, graduate students who are non-native speakers of English (and those who speak varieties of English other than standard American English) may be required to register for courses in academic writing, speaking & listening, and advanced academic presentations offered in both Fall and Spring semesters. These courses include ESLP 001 (Academic Writing and Grammar), ESLP 002 (Academic Writing and Reading for Research), ESLP 003 (Intelligibility and Comprehensibility in English), ESLP 004 (Advanced Academic Speaking), and/or ESLP 011 (Technical Writing and Composition).

INTERNATIONAL TEACHING ASSISTANTS FOR CREDIT/NON-CREDIT

For multilingual English-speaking Teaching Assistants, ESLP 012 (Advanced Presentation Skills for teaching Assistants) and/or ESLP 003 (Intelligibility and Comprehensibility in English) and/or tutoring may also be required, depending on required language testing. For language testing of teaching assistants, please see the following web site: https://global.lehigh.edu/cape/testing-services

STEPUP INTENSIVE ENGLISH PROGRAM FOR NON-CREDIT

The StepUp Program is a rigorous, non-credit English program for admitted as well as non-admitted Lehigh students who choose to, or are required to, improve their English skills while taking or prior to taking credit courses at Lehigh University. The StepUp program enhances students’ English skills in advanced academic reading and writing, spoken academic language, and American pragmatics through intensive practice, integrated skills focus, and experiential learning on campus. StepUp also serves as an excellent orientation to the Lehigh University culture and the expectations of a university classroom. StepUp courses may fulfill requirements for conditionally admitted students.

For program information, dates, fees, and registration forms, visit the StepUp website: https://global.lehigh.edu/cape/stepup

ENGLISH LANGUAGE AND LEARNING ASSESSMENT LAB (ELLA)

Graduate students can register for private tutoring appointments in ICAPE’s English Language and Learning Assessment Lab (ELLA). In each semester-long program, students will study individually with a professional ICAPE teacher utilizing a curriculum specifically customized to each student’s interests and needs. For program information, dates, fees, and registration forms, visit the ICAPE Tutoring website: https://global.lehigh.edu/cape/tutoring

International Internships

Carol S. Ham, Director
32 Sayre Drive, Coxe Hall, Room 100A, Bethlehem, PA 18015
(610) 758-3467
Debra Rubart, Coordinator
32 Sayre Drive, Coxe Hall, Room 101, Bethlehem, PA 18015
(610) 758-3193
iacoccaintern@lehigh.edu
iniii@lehigh.edu
global.lehigh.edu/internships

IACOCCA INTERNATIONAL INTERNSHIP PROGRAM

There are many opportunities for Lehigh University students to gain hands-on experience in an international setting. For a complete listing, please refer to the Study Abroad website (http://www.lehigh.edu/ouss). Lehigh University’s Iacocca International Internship Program, as referenced here, specifically relates to a program that provides students with fully-funded fellowships to participate in internship, research, or practicum experiences in organizations around the world. The program provides full-time, non-credit bearing experiences that run for six to twelve weeks over the summer, allowing for a true cultural immersion. For more information, please visit global.lehigh.edu/internships

International Students and Scholars Office

32 Sayre Drive, Coxe Hall, Bethlehem, PA 18015-3123. Tel: (610) 758-4859, Fax: (610) 758-5156. E-mail: intii@lehigh.edu; Website: http://global.lehigh.edu/oiss; iHome (online system for international students and scholars): https://iss.lehigh.edu

The Office of International Students and Scholars (OISS) is a university-wide resource for students and scholars from abroad, and for U.S. students and faculty who are interested in the global focus. Its mission is to provide support services for international students and scholars to ensure maximum opportunities for them to achieve their goals; be a resource to the faculty, staff and administration on issues related to international students and scholars, cross-cultural communication and diversity; support the University’s efforts to internationalize the campus; and create an environment where the Lehigh community is exposed to a multitude of cultures, traditions and viewpoints by presenting internationally-focused academic, cultural and social programming.

SERVICES

A variety of cross-cultural programs are initiated by the OISS, including undergraduate and graduate orientations, free English conversation classes for international spouse and family, seminars on immigration matters, the annual International Bazaar as well as the monthly social programs.

The year for international students and scholars at Lehigh begins with the International Orientation. The mandatory orientation takes place in conjunction with other programs offered by the undergraduate admissions office and/or graduate departments, starting immediately before the university-wide orientation at the beginning of each semester. Orientation is strongly recommended for all new international students and scholars. Issues discussed include maintaining immigration status, filing for a social security number, opening a banking account, health and wellness at Lehigh, and adjustment to university life at Lehigh and to the United States. International Orientation is a time to become accustomed to life in America, and to meet other international and domestic students.

ADDITIONAL SPECIAL SERVICES FOR INTERNATIONAL STUDENTS

Career Services

Advising and special workshops for careers for international students are provided.
Food Service
For undergraduate students on the meal plan, menus meet the international dietary needs of the students. There is a stir-fry bar and balanced meals for vegetarian diets.

Health AND WELLNESS Center
Fully staffed medical personnel meet both the physical and personal needs of all students. The Counseling Center has special services for international students.

COUNSELING & PSYCHOLOGICAL SERVICES
The Counseling Center has special services for international students.

Immigration/Visa Advising
Complete service is provided by OISS.

CENTER FOR ACADEMIC SUCCESS
Free tutors are provided in writing, math and science.

INTERNATIONAL AND CULTURAL Clubs
Clubs from all regions of the world are established on campus. They form an important part of the cross-cultural dimension of the campus, providing social events, films, and international dialogue.

Religious Services
Services for all the major religions are on campus or nearby, including Muslim, Christian, Jewish, Hindu and Buddhist.

Lehigh University/United Nations Partnership
Bill Hunter, Director, Fellowship Advising
32 Sayre Drive, Coxe Hall, Room 202, Bethlehem, PA 18015-3213
(610) 758-4505
wh3@lehigh.edu

Wehnty Szymodis, Assistant Director, Fellowship Advising
32 Sayre Drive, Coxe Hall, Room 203, Bethlehem, PA 18015-3213
(610) 758-4716
wes307@lehigh.edu (wes307@lehigh.edu)

Coordinator
(610) 758-3193
ofa.lehigh.edu

Lehigh University is the sixth university in the world to be certified as a Non-Governmental Organization affiliated with the United Nations (UN) Department of Public Information. Through this partnership, Lehigh students, staff, and faculty attend private briefings with ambassadors and UN officials, take tours of UN headquarters, and attend conferences, workshops and symposia at the UN. Lehigh also hosts a UN Speaker Series on campus and places interns each semester at the UN.

For more information about the Lehigh University/United Nations Partnership, see the website at: https://global.lehigh.edu/un-partnership

Study Abroad Office
Katie Welsh Radande, Director; Katy Rene, Assistant Director; Jodeen Gemmel, Advisor; Brian Wasserman, Advisor; Isaiah Allekotte, Advisor; Corinna Cuevas, Coordinator
32 Sayre Drive, Coxe Hall, Room 110, Bethlehem, PA 18015
(610) 758-3351; Fax (610) 758-5156
studyabroad@lehigh.edu

global.lehigh.edu/studyabroad

Lehigh University recommends international study. We support programs that offer rigorous academic environments, immersion in host cultures, and opportunities for personal growth. Students should return to Lehigh with an enhanced ability to appreciate global concerns.

Every student who studies abroad has different reasons and goals. High priorities for many students include developing sophisticated perspectives on global economic, social, and political issues, seeing the theoretical come to life in a real-world context, learning a new language, engaging with people and cultures different from their own, developing valuable career skills, and earning academic credit toward a Lehigh degree. Many students find that study abroad is a catalyst for intellectual and personal growth.

The Study Abroad Office conducts extensive advising activities, guiding students through the process of identifying programs that fit personal and academic goals; group and individual advising sessions take place regularly. Study Abroad options exist for all majors and can take place freshman through senior year. Students should start discussing study abroad options with their academic advisor and the Study Abroad Office as early as freshman year.

SEMMESTER/YEAR
Lehigh approves over 250 semester and year-long programs of academic study in over 60 countries. The programs are evaluated by faculty in order to ensure high academic quality and immersion in host cultures. Academic credit is given for programs approved by Lehigh faculty only. Students must receive a ‘C’ or better for credit to transfer.

Grades earned on semester and year programs are not factored into the student’s GPA. Semester study abroad may include a combination of traditional coursework along with credit-bearing internships, research, or service learning.

SUMMER AND WINTER TERM STUDY ABROAD
Lehigh offers several faculty-led summer and winter term study abroad courses. Past programs have included: Business and Music in Belgium; Business in Prague; Microfinance Abroad in various locations; Art and Architecture in Venice; History in Paris; Internships and Language in Shanghai; Sustainable Development in Costa Rica; Architecture in Munich; Research Practicum in Ireland. Several options include internship opportunities for credit in addition to coursework. Lehigh credit and grades are applied to a student’s transcript and are factored into the student’s GPA.

ADDITIONAL INTERNATIONAL EXPERIENCES
Lehigh offers additional short-term international experiences such as International Internships, ServeAbroad Antigua, Choir, Engineers without Borders (EWB), Philharmonic, Interfaith Dialogue: Lehigh in Rome, Athletics Leadership in Croatia, and others.

To view all program options and begin planning for a Study Abroad Experience, visit global.lehigh.edu/studyabroad.

Special Academic Programs

DISTANCE EDUCATION
As a proven leader in distance education and innovation, Lehigh University’s Office of Distance Education has been committed to providing graduate programs and certificates to working professionals for over 25 years. Our programs emphasize academic excellence with a distinguished faculty, a shared community of learners, and superior curriculum. We are accredited by the Middle States Commission on Higher Education. Our distance program provides the student with the same level of educational excellence for which Lehigh University is renowned and strives to maintain the same level of quality of instruction and student service that is available to our on-campus students.

Through a unique approach to learning, we utilize two learning platforms for our programs: Classroom LIVE, an integrated, web-based virtual environment that delivers graduate programs in real time from classrooms on Lehigh’s campus to students, in their homes, at their workplaces, or while traveling, and Classroom Online, an asynchronous online format that offers flexible scheduling and participation. To provide the best educational experience for our students, supplemental tools may be used, including podcasts, real-time web-based conferencing, shared applications, and use of Course Site, Lehigh’s course management system.

We offer 9 graduate degrees in a variety of disciplines which include Biological Chemical Engineering, Chemical Engineering, Chemical Energy Engineering, Healthcare Systems Engineering, Management Science & Engineering, Flex MBA, Mechanical Engineering, Molecular Biology, and Polymer Science & Engineering. We also offer 4 graduate certificates for credit. They include Healthcare Systems Engineering, Management Science & Engineering, Polymer Science & Engineering, and Technical Entrepreneurship.

For more information on programs and course offerings, admission, registration and technical requirements, visit the distance education website at www.distance.lehigh.edu or call (610) 758-4372.
CONTINUING EDUCATION

Lehigh University academic departments and research centers offer a varied selection of non-credit continuing education programs for adults. Reflecting Lehigh’s traditional educational strengths, these offerings focus on professional development, organizational problem solving, and technical skills. They carry no regular academic credit, but participants can often earn some form of continuing education credentials.

Lehigh continuing education programs are designed to meet specific needs. Contents, schedules, and timing are adapted to effectively serve the audiences for which they have been developed. Apart from programs presented on the Lehigh campus, a number of seminars are available for “in-house” presentation to organizations on a contract basis. For more information about these programs, contact the appropriate department or research center.
Undergraduate Studies

A listing of undergraduate and graduate courses offered by Lehigh University can be found in the Courses, Programs, and Curricula section (p. 53), under each departmental heading. For purposes of record, all approved courses are listed. It must be understood, however, that the offerings in any given semester are contingent upon a number of factors, including student needs as determined at the time of registration.

CREDIT HOURS
Each course is designated a credit value of the course in terms of semester hours ("credit hours").

COURSE NUMBERING
The course numbering system specifies which courses can be applied to the program of study as the student progresses toward the undergraduate or graduate degree. In general, the numbering series is as follows:

- 0-99. Courses primarily for freshmen or sophomores. Not available for graduate credit.
- 100-199. Intermediate-level undergraduate courses. Not open to freshmen except on petition. Not available for graduate credit.
- 200-299. Advanced undergraduate courses. Courses in the College of Business and specific departments as noted in the listings are open to freshmen and sophomores only with permission. Not available for graduate credit in the major field.
- 300-399. Advanced undergraduate courses. Same as 200-299, but available for graduate credit in major field.
- 400-499. Graduate-level courses, open to undergraduates only by petition.

PROVISIONAL COURSES
Each instructional department is authorized to offer provisional courses, or those offered on a trial basis, as well as special opportunities courses. Such courses can become a permanent part of the university curriculum. These courses are numbered, as is appropriate, 95-98 . . . 195-198, . . . 295-298, . . . 395-398, for a maximum of two years.

PREREQUISITES
Academic preparation required for admission to courses is indicated under “prerequisites” included at the end of each course description. Prerequisites are stated in most cases for purposes of convenience in terms of Lehigh courses. Academic status required for admission, where numbering does not fully describe this status, is also indicated under “prerequisites.”

A student who does not have the status (e.g., sophomore standing) or the academic preparation set forth as prerequisites may request special consideration. A student may obtain online permission from the designated college or department officer or demonstrate academic work completed elsewhere meets the prerequisites listed. Each student is responsible to make sure they meet and maintain all conditions of prerequisite for their coursework prior to the start of classes. If a student fails to meet a prerequisite after registration for a given course, the college dean’s office, Registration & Academic Services, and/or the instructor may take action to drop the student from a course with unmet prerequisites.

In a few cases, co-requisites are indicated. In such instances the co-requisite course is taken in the same semester.

INFORMATION LIMITS
The course descriptions are intended to guide the student in selecting appropriate courses. For reasons of space, descriptions are brief. In most cases, courses will have a significantly broader scope than the topics listed in the description. In some courses, material may change from what is described. If there is doubt concerning the appropriateness of any course for the individual's educational objectives, it is suggested that the student confer with the adviser.

ABBREVIATIONS
Whenever possible, course listings contain information indicating what requirements the course satisfies, the semester or semesters in which it is offered, and the name of the scheduled instructor or instructors.

While all information herein is subject to change, the information is included to serve as a guide in the selection of appropriate courses that best fulfill the student’s academic requirements and personal goals.

The symbols following course descriptions for some College of Arts and Sciences courses include:

- GC. Courses that meet the Global Citizenship program requirements.
- HU. Courses that meet the Humanities distribution requirements.
- NS. Courses that meet the Science distribution requirements.
- SS. Courses that meet the Social Science distribution requirements.
- MA. Courses that meet the Mathematical distribution requirements.
- ND. Not designated to meet distribution requirements.

The symbols following course descriptions for some College of Engineering and Applied Science courses include:

- ES. This code plus the following number indicates that the course satisfies a number of hours of engineering science requirements for ABET accreditation.

Graduation Requirements

Students are expected to maintain regular progress toward the baccalaureate degree by carrying the “normal” course load—between 12 and 18 credit hours each semester. Each student is expected to complete the baccalaureate degree by attending four consecutive years and eight semesters. They may, however, wish to accelerate the pace toward graduation by using advanced placement credits, summer session study, and receiving credit for courses through examination. Students will have a limit of 8 calendar years to complete the requirements for the bachelor’s degree. Students may petition the Committee on Standing of Students (COS) for up to a one-year leave of absence for special circumstances beyond their control.

Students in good academic standing earn their degrees by meeting the requirements of their specific degree curriculum as well as general university requirements. Students are expected to satisfy the credit-hour requirements of their chosen curricula. Students should confer with their advisors on matters related to curriculum.

Basic military science credit hours are in addition to the credit hours specified in the curriculum. A maximum of six credit hours of advanced military science courses may be applied toward the baccalaureate degree.

Undergraduate Residency Requirement

To be eligible to receive a Lehigh baccalaureate degree, the candidate must have completed either a minimum of 90 credit hours, or 60 of the last 75 credit hours at the University or in residency programs.

Five-Year, Two-Bachelor-Degree Programs

The university’s five-year, two-degree programs enable a student to receive two bachelor degrees upon completion of five years of study.

The civil engineering and earth and environmental sciences program that affords two bachelor degrees, and the electrical engineering and engineering physics two-degree program are examples of programs in the College of Arts and Sciences and the P.C. Rossin College of Engineering and Applied Science.

Some five-year, two-degree programs appear in the description of courses under Arts-Engineering and Five-Year Programs. It is possible to arrange for a dual bachelor degree program even after studying at Lehigh for some time. Engineering students, for example, who decide at any stage of study that they wish to meet the requirements for both the bachelor of arts and bachelor of science degree may sometimes complete the combined requirements in five years if the decision is made before the third year.

A student entering Lehigh to obtain a second bachelor’s degree, those Lehigh students who wish to declare a second degree in another college, or students wishing to pursue both a B.A. and a B.S. degree within the College of Arts and Sciences must have a minimum of 30 additional credit hours beyond the first degree credit-hour requirements in order to qualify for the second degree. All of the 30 additional credit
hours must be taken at Lehigh or in Lehigh residency programs. All special second degree programs must be approved by the dean of the college in which the degree is to be offered and the Standing of Students Committee.

Several ways exist for students to obtain two degrees in five years of study. See listings under ARTS-Engineering; Civil Engineering and Earth and Environmental Sciences; Electrical Engineering and Engineering Physics; and College of Education.

Advisement

The academic advisor is one of the most valuable resources in the educational process, not only to assist in making academic selections to match the student’s particular background, interests, and future objectives, but also to identify program options, to work out an academic pace, and to develop career planning strategies. The advisor will help to identify other resources and support systems available at the university, such as the Center for Academic Success, Counseling and Psychological Services, and the Center for Career and Professional Development.

Every undergraduate in the College of Arts and Sciences is assigned a faculty advisor upon matriculation. This advisor will usually change when the student selects a major or program. First year students in the P.C. Rossin College of Engineering and Applied Science are advised by the college advising staff until they declare a program near the end of the first year. At that point they are assigned a faculty advisor from their program of study.

Every undergraduate in the College of Business is assigned to a professional advisor in the College of Business Undergraduate Programs Office. Once a major is declared, a faculty mentor from the major department will be assigned for more in-depth conversations about major courses and career paths.

Pre-professional advisors, such as Pre-law, Pre-medicine and Pre-MBA are located in the Center for Career and Professional Development.

Guide to Academic Rules and Regulations

Over the years, the University has adopted numerous rules and regulations. Some of the principal rules and regulations are given here so that currently enrolled and potential undergraduates and graduate students will be apprised of what is expected of them, and what they can expect of the University.

This section concerns academic regulations. Additional regulations can be found in the Lehigh Student Handbook (http://studentaffairs.lehigh.edu/handbook), and there is a comprehensive statement of all policies in the publication Rules and Procedures of the Faculty. The Rules and Procedures of the Faculty can be found online on the Provost’s website.

Eligibility for Degree

Candidates for a baccalaureate degree must achieve a minimum cumulative average of 2.00.

To be eligible for a degree, a student must not only have completed all of the scholastic requirements for the degree, but also must have paid all university fees, and in addition all bills for the rental of rooms in the residence halls or in other university housing facilities. Payment also must have been made for damage to university property or equipment, or for any other indebtedness for scholarship loans or for loans from trust funds administered by the university.

Responsibility for meeting academic requirements.

Each student is solely responsible for his or her progress toward meeting specific requirements for graduation. Academic advisers, department chairs and the associate deans staff are available to assist the student. It is strongly recommended that the student specifically consult with his or her adviser prior to the senior year to ascertain eligibility for the degree for which he or she desires to qualify and to determine that all program and hours requirements are met.

A student degree audit (http://go.lehigh.edu/degreeaudits) is available 24/7 via the online student information system for all undergraduate students. Students should review their audit before registering for each semester, including each in their senior year. The degree audit is provided as a tool to aid in advising and to track academic progress and degree completion. The student degree audit attempts to note all program deficiencies based on real-time academic history and current registration information. However, each student is responsible for the completion of all graduation requirements as outlined in the University catalog.

Final date for completion of requirements.

For graduation, all requirements, scholastic and financial, must be satisfied no later than the Friday preceding the degree award date.

Application for Degree

Candidates for graduation on University Day in May must apply on or before February 1; candidates for graduation in August must apply on or before July 1; candidates for graduation in January must apply on or before October 1. Students must apply online using the Banner Student Information System.

Applications submitted after the specified deadline will be charged a late application fee. No applications will be accepted within three weeks of the graduation date. Students who fail to submit an application must apply for the next available degree awarding date.

Undergraduate Credit and Classification

A “semester hour,” used interchangeably with “credit hour,” is a course unit normally involving three to four hours of student effort per week during one semester. This includes both in-class contact hours and out-of-class activities. The major parameters influencing the in-class/out-of-class division include the mode of instruction and the level of the course.

Student Classification Guidelines

Student classification is based on completed credit hours. Currently enrolled courses are not used for this calculation. The following outlines total earned credits required for each classification:

<table>
<thead>
<tr>
<th>EARNED CREDITS</th>
<th>CLASSIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-23</td>
<td>Freshman</td>
</tr>
<tr>
<td>24-53</td>
<td>Sophomore</td>
</tr>
<tr>
<td>54-83</td>
<td>Junior</td>
</tr>
<tr>
<td>84+</td>
<td>Senior</td>
</tr>
</tbody>
</table>

Definitions of Grades

Course grades are A, A–, B+, B, B–, C+, C, C–, D+, D, D–, P, F, N, SP, X, Z. The meaning of each grade is as follows: A, A–, excellent; B+, B, and B–, good; C+ and C, competent; C–, continuation competency (the student has achieved the level of proficiency needed for the course to satisfy prerequisite requirements); D+, D, and D–, passing, but performance is not adequate to take any subsequent course which has this course as a prerequisite. P, pass-fail grading with a grade equivalent to D– or higher; F, failing; N or SP, incomplete; X, absent from the final examination; Z, absent from the final examination and incomplete.

Grades are weighted as follows: A, 4.0; A–, 3.7; B+, 3.3; B, 3.0; B–, 2.7; C+, 2.3; C, 2.0; C–, 1.7; D+, 1.3; D, 1.0; D–, 0.7; F, 0. Quality points for each course are assigned according to the number of credit hours in the course.

Other symbols used for courses on student records are: W, withdrawn; CR, credit allowed; NCR – no credit. NR is used when no final grade was received from the instructor of record by the final grade submission deadline.

Grades in the range of A through D–, P, and CR may be credited toward baccalaureate degrees within the limits of program requirements. Grades of F, N, SP, X, Z, W, and NR cannot be credited toward the degree. Grades of W do not count as hours attempted.

Grades in which courses in which grades of D+, D, D–, F, NCR, W, NR, N, SP, X, or Z are recorded do not meet prerequisite requirements. The student may request to waive a prerequisite. Upon presentation of evidence of substantially equivalent preparation, and with the approval of the instructor of the course, the teaching department chairperson and the
The grade N (grade), may be used to indicate that one or more course requirements (e.g., course report) have not been completed. It is the obligation of the student to explain, to the satisfaction of the instructor, that there are extenuating circumstances (e.g., illness or emergency) that justify the use of the N grade. If the instructor feels the N grade is justified, he or she assigns a grade of N supplemented by a parenthetical letter grade, (e.g., NF). In such cases, the instructor calculates the parenthetical grade by assigning an F (or zero score) for any incomplete work unless he or she has informed the class in writing at the beginning of the course of a substitute method for determining the default grade.

In each case in which an N grade is given, the course instructor will provide written notification to the department chairperson stating the name of the student receiving the grade, the reason for the incomplete work, the work to be done for the removal of the N grade and the grade for the work already completed.

A student who incurs an N grade in any course is required to complete the work for the course by the fifth day of instruction in the next regular semester. The N grade will be converted into the parenthetical grade after the tenth day of instruction in the next regular semester, following receipt of the N grade, unless a petition to request an extension has been approved, or the instructor has previously changed the grade using the removal-of-incomplete procedure. The parenthetical grade will be dropped from the transcript after the assignment of the course grade.

The SP (grade) may be assigned for coursework or projects that do not conform to standard terms (e.g., thesis, research courses, open learning or multi-term project based learning coursework, etc.) when the student is making satisfactory progress; otherwise, the student should be assigned F. An SP grade will not be converted automatically but rather will remain until changed by the instructor or department chair when instructor is no available. SP grades count towards credits completed but do not affect GPA until converted.

The grade X (grade) is used to indicate absence from the final examination when all other course requirements have been met. In such cases, the instructor calculates the parenthetical grade by assigning an F (or zero score) for the missing final exam. The X grade may be removed by a make-up examination if the absence was for good cause (e.g., illness or other emergency). To be eligible for a make-up exam the student must submit a petition to the Dean of Students. If the student fails to petition, or if the petition is not granted, or if the student fails to appear for the scheduled make-up examination, then the X grade will be converted into the parenthetical grade after the first scheduled make-up examination following the receipt of the X grade. If the petition is granted and the final examination is taken, the X grade will be changed by the instructor using the make-up examination procedures and the parenthetical grade will be dropped from the transcript.

Where valid reasons exist for not taking the make-up examination at the scheduled time, the student may petition for a later examination with a good cause (e.g., illness or other emergency). To be eligible for a make-up examination following the receipt of the X grade. If the deadline for completion of the work for the course by the fifth day of instruction in the next regular semester following receipt of the Z grade. In no case shall the deadline for completion of the work be later than the last day of classes in the first full semester in residence (except summer) following receipt of the Z grade.

N, X and Z grades do not count as hours attempted and are not used in computations of cumulative averages.

Where failure to complete coursework prevents the student from taking the make-up examination at the scheduled time, the student may petition the Committee on the Standing of Students for a later examination.

Grades that were originally assigned an N, X, or Z grade, when converted or computed, will be noted with an “*” asterisk prefix.

If no grade is received by Registration & Academic Services before student grades are officially posted, a grade of NR will be assigned. It is the responsibility of the faculty member who failed to submit a grade to resolve the situation. If a correct grade is not submitted or the situation is not otherwise resolved then the NR grade will be converted to a grade of F on the tenth day of instruction of the next academic year semester.

Scholastic Averages and Probation

Scholastic requirements for undergraduate students are expressed in terms of the cumulative grade point average (GPA)—the weighted average of all grades received in residence or at institutions specifically approved for grade transfer. The cumulative GPA is computed at the end of each semester and the second summer session. The University transcript reports a student's cumulative GPA to two decimal places. When considering cumulative GPA for graduation honors and academic standing, the University truncates the GPA to two decimal places, without rounding.

All undergraduates are required to maintain a 2.0 cumulative average, the minimum average required for graduation, to remain in good academic standing. Students who do not meet this GPA requirement will be placed on scholastic probation.

Non-degree students with less than 12 credit hours attempted will not have their progress evaluated until they earn at least 7 credit hours total. A non-degree student with two or more F grades is eligible to be reviewed by the Committee on the Standing of Students, and may be placed on probation or dropped for poor scholarship at the committee’s discretion.

Any undergraduate student who achieves a 1.69 or lower cumulative grade point average in a given term, or who fails more than eight hours of coursework, is eligible to be reviewed by the Committee on the Standing of Students, and may be placed on academic probation.

SCHOLASTIC PROBATION

Students on scholastic probation are ineligible for (a) intercollegiate competition and other extracurricular activities in which they publicly represent the university; (b) major office in any university organization; and (c) other activities which require more time than should be diverted from primary purposes by students whose academic survival is at risk. The Dean of Students shall monitor and enforce this ruling.

REMOVAL FROM PROBATION

Students are removed from probation at such time as they meet the standard listed above, effective at the end of any semester or the second summer session.

DROPPED FOR POOR SCHOLARSHIP

A student who makes a 2.2 GPA or better in the probationary semester but fails to meet the standards stipulated is continued on probation for another semester. A student who makes less than a 2.2 GPA in the probationary semester and fails to meet the standards stipulated above, is dropped for poor scholarship.

If a student goes on scholastic probation for a second (although not necessarily consecutive) term, a review by the Committee on the Standing of Students will determine whether the student will continue on scholastic probation or be dropped for poor scholarship.

UNSATISFACTORY PROGRESS POLICY FOR STUDENTS USING VETERANS EDUCATIONAL BENEFITS

The law requires that educational assistance benefits to Veterans and other eligible persons be discontinued when the student ceases to make satisfactory progress toward completion of his or her training objective. Based on this requirement, any student using Veterans Education Benefits will become in eligible for benefits when placed on academic probation or dismissed from the university.

Benefits may be resumed if the student is removed from academic probation or is readmitted after at least one semester away. The beneficiary must re-enroll in the same educational institution and in the same program.

When a student fails to maintain prescribed standards of progress the VA will be informed so that benefit payments can be discontinued in
accordance with the law. The termination date assigned by the school will be the last day of the term or other evaluation period in which the student's progress became unsatisfactory.

Upon re-certification the school's certifying official should maintain a statement that describes the conditions for the student's continued certification to VA. This may include an academic plan as outlined to the SOS Committee upon petition for readmission. These conditions will prescribe the minimum performance standards to be achieved by the student during the next enrollment/evaluation period.

**Academic Grievances**

If a student has a complaint about a grade or other academic grievance, the first step is to talk to the instructor involved. If the matter is not settled satisfactorily, the student should contact the department chair or division director about the complaint and submit the complaint through the formal grievance procedure within the department. The department decision may, if the student still feels aggrieved, be appealed to the appropriate dean.

**Course Withdrawal**

A student dropping a course within the first ten days of the semester (three days for summer sessions) will have no record of the course on the transcript. A student dropping all courses for which he or she is registered is considered to be withdrawn from the university (p. 28).

A student who withdraws from a course with the approval of his/her advisor and section instructor after the tenth day of instruction and before the end of the eleventh week of instruction will have a grade of “W” assigned to the course.

An Add/Drop form signed by the student’s advisor must be submitted to Registration & Academic Services before the deadlines noted above to be official. No course may be dropped after the eleventh week of classes during a term as noted on the University Calendar.

**University Withdrawal**

An undergraduate student withdrawing from the university (dropping all courses during a given term) must submit the withdrawal request (https://cm.maxient.com/reportingform.php?LehighUniv&layoutid=120) to the dean of students office. Graduate students should review the policies and complete the appropriate form (https://gradlife.web.lehigh.edu/policies-forms) for the Graduate Student Life Office. Withdrawal after registration day will be noted on the academic transcript by assigning a grade of “W” to all courses. The date of the withdrawal will be noted on the academic transcript for a withdrawal at any time during the term.

A student who reduces his or her course load below the minimum required for full time status, but does not withdraw from the university, becomes a part-time student for the rest of that semester. Some areas affected by part-time status are financial aid, athletic eligibility, veterans affairs, immigration status, insurance and loan deferment.

**Undergraduate Leave of Absence**

Each student is expected to complete the baccalaureate degree by attending Lehigh for four consecutive academic years. Once a student who has matriculated at Lehigh chooses to deviate from this attendance pattern, a revised degree plan, coordinated with his or her advisor and associate dean, must be submitted. Students must submit a request for a Leave of Absence through the Dean of Students. The form must be signed by the student’s advisor and the associate dean of the college, and the completed form must be submitted prior to the start of any subsequent enrollment at another college or university.

Current Lehigh University students are prohibited from concurrent enrollment at any other college or university. Courses taken concurrently will not be eligible to apply towards a Lehigh degree. An exception is made for cross registration at another LVAIC institution.

Students cannot assume that a leave will be granted to study at another college or university (this policy does not apply for study abroad through the auspices of Lehigh Abroad or LVAIC programs). The program of study and reason for the leave must be approved by the SOS committee.

If unapproved leaves are taken, students are declared as non-returning and must apply for readmission through the Dean of Students if they wish to re-enroll. Courses taken at another college or university while on an unapproved leave will not be permitted to transfer toward a Lehigh University baccalaureate degree.

In addition, students taking an unauthorized leave of absence must be aware that their eligibility for student aid is jeopardized.

Any student who is uncertain about attending a future fall or spring term at Lehigh University is urged to discuss the matter with the Dean of Students Office prior to taking any action to withdraw or attend another college or university.

Students may take courses at another institution during a summer term without requesting an academic leave of absence. They should check with Registration & Academic Services for limitations and processes for transfer course approval prior to taking the courses.

**Release of Final Grades**

Grades for undergraduate students are available online as soon as possible following the deadline for reporting of grades using the Banner Student Information System. Undergraduate students who require a printed grade report must submit the request in writing to Registration & Academic Services each term. Instructors may develop their own policies for release of unofficial reports of academic progress to individual students, or to their advisers, deans, or financial aid officers, on a need-to-know basis, including early release of unofficial final course grades. Any such policies must respect the rights of students privacy.

**Repeating of Courses**

A student may repeat a course only twice -- a total of three attempts. Withdrawal from a course counts as an attempt (effective Fall 2017).

If a course is repeated the final grade received upon repetition of the course is counted in the cumulative average. Only the most recent grade and the credit associated with that course and grade counts towards degree requirements. The original grade and associated credit hours received will be excluded from the cumulative average and degree requirements.

A grade that was originally received in a course may not be changed by repeating the course under the pass-fail option.

Overload approval will not be granted for the purpose of repeating a course.

For deletion of a grade from the cumulative average after repeating a course, a student must repeat the identical course with a final grade at Lehigh.

All instances of repeated courses are displayed on the student’s academic transcript regardless of repeated status. Students are responsible for determining any academic or financial implications for repeating courses.

**Pass-Fail Systems for Undergraduates**

**STUDENT OPTION SYSTEM**

The pass-fail grading option is intended to encourage undergraduate students to take challenging courses outside the major field. Courses numbered below 100 are generally not available for optional pass/fail grading system. However, the College offering a course may establish a petition process to determine, on a case-by-case basis, whether a student is allowed to take a course numbered below 100 with pass-fail grading. Courses 400 and above are not available for the optional pass/fail grading system.

A student may register for no more than one course pass-fail numbered above 100 and below 400 in any one semester. Students should check the pass/fail restrictions for specific courses. He or she may take a maximum of six courses pass-fail per undergraduate career if the student is on a four-year program, or a maximum of eight courses per undergraduate career with a five-year, two-degree program. If a student changes a course from pass-fail grading to regular grading, that course will still count toward the maximum number of courses taken
Transfer Credit

Transfer of credit from other institutions is the responsibility of Registration & Academic Services. Any students planning to take work at other institutions in the United States or elsewhere should initially check with Registration & Academic Services on policies and procedures. Full time students may not be concurrently enrolled at any other institution, except for the LVAIC Consortium cross registered courses, without the advanced approval of the Committee on Standing of Students. Transfer of grades from institutions other than the LVAIC System is not possible.

- Pass/Fail credit/non-credit courses are not acceptable for transfer.
- Courses taken at a two year or four year institution where a grade lower than a “C” has been earned will not transfer. (C- or below will not transfer)
- Transfer courses may not be used to delete a prior grade from one’s cumulative grade point average at Lehigh University. Transfer grades are NOT calculated in the Lehigh GPA.
- No student may receive more credit at Lehigh than was granted at the original institution. Courses taken on the quarter system will have credit granted on a 3-2 ratio, no partial credit will be awarded. The student will receive credit equivalent to the number of credits indicated on the transcript, up to the number of credits for the equivalent course at Lehigh. Registration & Academic Services has the final authority for the amount of credit awarded toward a Lehigh degree.
- No credit will be granted for a course in which the student has already received credit for its equivalent at Lehigh.
- No credit will be granted for continuing education units courses, correspondence, independent study or any course less than 3 weeks and/or 15 contact hours per credit without the advanced approval of a petition to the Standing of Students Committee.
- Students requesting transfer credit for online courses must submit the online course syllabus to Registration & Academic Services for review.
- Courses must be taken at an institution that is accredited by one of the six regional associations.

TRANSFER CREDIT FOR HIGH SCHOOL DUAL ENROLLMENT PROGRAMS:
Credit for courses completed through high school dual enrollment programs will be awarded only if a course is regularly offered by an accredited two-year or four-year college or university and a majority of the students in the course were candidates for a degree at that college or university. Eligible coursework must also meet the transfer credit policies noted above. Additional verification paperwork is required to begin the transfer credit process.

Students who completed dual enrollment courses that do not fall under the above credit rules may pursue Advanced Placement exams prior to enrolling at Lehigh University, or may consider anticipatory exams during orientation for eligible subject areas.

Course Auditing

A student who is in good academic standing and has not failed any courses in the previous term may be approved to audit not more than one course per semester, which must be outside the curriculum requirements. Application to audit a course is by petition approved by the departmental chair and the Standing of Students Committee. In no case shall a student who has attended a course as an auditor be given an anticipatory examination for credit or register for the same course in the future. A student completing a course in this manner will have the course and the notation AU indicated on the permanent record. A student rostered on an audit basis may be withdrawn from the course with a grade of W for poor attendance. Audit courses do not count toward full-time status.

Review-Consultation-Study Period

The Review-Consultation-Study (RCS) period is intended to provide a period of time for informal academic work between the end of the formal instruction period and the beginning of the final examinations. It is expected that students will use this period to consolidate their command of the material in their courses. Faculty members make themselves available to their students at announced times during this period.
No quiz or exam may be given during the last five class days of the semester.

**Graduation Honors**

Honors are awarded by vote of the university faculty to those students who have earned a minimum of 90 credit hours in residence at Lehigh University or in programs approved by the faculty to have grades and credit accepted toward the undergraduate degree. Graduation honors are awarded as follows:

- **Honors:** 3.40
- **High Honors:** 3.60
- **Highest Honors:** 3.80

For the purposes of graduation honors calculations, courses taken more than once at Lehigh will only have the most recent grade used in the calculation. Courses taken under the cross-registration policy of the LVAIC and the Washington Semester program will be used.

Students who spend part of their career at another institution, or are transfer admits to degree programs, must have at least sixty earned credit hours of regularly graded (not pass/fail) courses that meet the residency requirement in order to be eligible for graduation honors.

**Department Honors**

Many departments offer honors work adapted to its curriculum for students who wish to demonstrate unusual academic ability and interest in exploring a chosen field through independent study and research. The precise nature of the program for each student is determined by the academic major department, but may include: unscheduled work or independent study, participation in graduate (400-level) courses, and an honors thesis or project.

Qualified candidates should inform their academic advisers by the end of the junior year of their intention to work for departmental honors. The adviser will give the college and Registration & Academic Services names of graduating seniors working for departmental honors in particular majors. Student names will be published on the Commencement website.

**Honor Societies**

There are at least 18 honor and course societies. The three best-known are:

- **Phi Beta Kappa.** The oldest honor society in the United States is represented at Lehigh by the Beta chapter of the Commonwealth of Pennsylvania, the 27th oldest chapter in the nation. The chapter’s council considers for invitation into its membership those students in each of Lehigh’s three undergraduate colleges who satisfy the following profile:
  - At least 60 credit hours of coursework completed at Lehigh
  - A minimum cumulative GPA of 3.75
  - A minimum of 8 credit hours in the natural sciences (including a lab)
  - A minimum of 8 credit hours in the social sciences
  - A minimum of 8 credit hours in the humanities, especially textual analysis beyond first-year writing (the council typically does not recognize some courses that carry Humanities credit at Lehigh, such as Public Speaking, Stage Design, one-credit Music lessons, etc.)
  - Calculus or advanced mathematics that requires calculus as a prerequisite
  - Two years of college-level foreign language study or its equivalent (may be satisfied by four years of high school study with excellent grades)
  - No disciplinary violations sufficient to warrant probation, suspension, or expulsion

Please note: Satisfaction of this profile guarantees consideration by the Phi Beta Kappa council; it does not guarantee election to Phi Beta Kappa. Any undergraduate who has questions about any of the items in this profile should contact Prof. Ziad Munson (https://socanthro.cas2.lehigh.edu/content/ziad-munson), Executive Secretary of Lehigh’s chapter. Office phone: 610-758-3821; e-mail: munson@lehigh.edu

- **Beta Gamma Sigma.** Election to membership in Beta Gamma Sigma is the highest scholastic honor that a student in business administration can achieve. Beta Gamma Sigma is the only national honorary scholarship society in the field of business administration recognized by The Association to Advance Collegiate Schools of Business.

- **Tau Beta Pi.** Tau Beta Pi recognizes engineering students who have a history of distinguished scholarship and exemplary character. The national organization was founded at Lehigh in 1885. A bronze marker in front of Packard Lab commemorates this event.

Among course societies are the following: Alpha Pi Mu, for those in industrial and systems engineering; Alpha Sigma Mu, materials science and engineering (http://www.alphasigmamu.org/). Beta Alpha Psi, accounting; Chi Epsilon, civil engineering; Eta Kappa Nu, electrical engineering; Lambda Mu Sigma, marketing; Omicron Delta Epsilon, economics; Omicron Delta Kappa, leadership; Order of the Omega, leadership in Greek activities; Phi Alpha Theta, history; Phi Beta Delta, international; Phi Eta Sigma, freshman scholastic excellence; Pi Tau Sigma, mechanical engineering; Psi Chi, psychology; Sigma Tau Delta, English; and Sigma Xi, research.

**Special Undergraduate Academic Opportunities**

The academic programs in the colleges are supplemented by five-year, two-degree programs as well as opportunities for advanced, foreign, and experiential study.

**ARTS-ENGINEERING OPTION**

The curriculum in arts-engineering is designed for students wanting a professional education in a field of engineering and also the opportunity to study a second field.

Arts-engineers fulfill all requirements for the professional engineering degree for which they are working. However, the first three years of science and engineering courses are scheduled over four years for the arts-engineer. During this period the arts-engineer is a student in the College of Arts and Science pursuing a bachelor of arts or bachelor of science major program.

In many instances it may be advisable to take the two degrees at the end of the fifth year. Arts-engineers working towards the bachelor of science in biology, computer science, environmental science, geological sciences, geophysics, molecular biology, and statistics are advised to pay special attention to the engineering humanities and social science requirements, which must be met in time for the student to qualify for the B.S. in engineering.

Arts-engineers have the same opportunities for multiple majors and special interdisciplinary majors as are available to students working for the baccalaureate (B.S. or B.A. degree only) in the College of Arts and Sciences. Additional information may be obtained by contacting Prof. Nikolai Nikolov, Art and Architecture, Chandler-Ullmann.

**BACHELOR/MASTER DEGREE PROGRAMS**

Of increasing interest to undergraduates are the two-degree programs that may lead to both a bachelor and a master’s degree in five years. The fifth-year program in the College of Education enables those receiving a B.A. or B.S. degree to accomplish professional teacher training and serve as salaried interns in public schools. After the completion of one year of full-time teaching, secondary teachers can receive the master of arts and elementary teachers can receive master of education degrees.

Many other five-year, graduate-level combination programs exist, and students are advised to consult with their adviser in planning such programs. All students receiving masters degrees must be registered as full time degree graduate students for at least one full term.

**Apprentice Teaching**

The apprentice teaching program is designed to benefit juniors and seniors who wish to learn about teaching under the guidance of an experienced teacher. Apprentices often do a limited amount of supervised lecturing or leading of discussions, assist in making up
and evaluating written assignments, and are available for individual consultation with students.

To participate in the apprentice teaching program a student must:

1. Have an over-all cumulative grade point average of 2.80 or better;
2. Have a cumulative major grade point average of at least 3.3 and have completed at least two courses in the major field in which apprentice teaching is done;
3. Have previously taken for credit the course or its equivalent in which the apprentice teaching will be done;
4. Meet the guidelines on file in each college dean’s office.

A student may register for apprentice teaching only once each semester, only once in a given course, and only twice during a college career.

To register for apprentice teaching each student-teacher partnership will submit an apprentice teaching agreement, including the duties and obligations for approval to the department chair and the dean of the student’s college in which the course is taken. This form must be submitted to Registration & Academic Services before the first day of classes in the semester. To complete the course, the apprentice teachers must submit a written report of their experience to the supervising teacher, who will forward it to the Office of the Provost.

**Credit by Examination**

Upon petition and presentation of evidence that he or she has qualified for it, a student already enrolled at Lehigh may be permitted by the Standing of Students Committee to take a special examination for credit towards graduation. Special examinations are granted only for extraordinary reasons and upon petition. There must be adequate supporting evidence of sufficient cause accompanying each petition. There is a fee for all special examinations.

Students taking a special exam after matriculation at Lehigh will have the grade and credits assigned to their permanent Lehigh record. Special exam credit will be counted as in residence credit and the grade will be used in all grade point average calculations. No special exam will be granted in a course that the student has already taken (except senior reexaminations) for credit or on an audit basis, or in a course in which the student has already completed more advanced work at Lehigh.

**Preparation for Graduate Work**

Students planning to continue in graduate programs should take advantage of the flexibility in many undergraduate programs to design an upper-division curriculum that meets requirements in the anticipated graduate program.

The policies of the colleges provide as much flexibility as possible for students who wish to change to new but related fields of study after the baccalaureate degree. Students should consult with their previous program adviser and the department representative of the new field of study after the baccalaureate degree. Students who wish to change to new but related fields of study after the baccalaureate degree should consult with their previous program adviser and the department representative of the new field of study after the baccalaureate degree.

Students who wish to transfer from one undergraduate college to another may do so provided that they have achieved sophomore status and have completed at least 12 credits while in their college of matriculation. Students on academic probation may transfer between colleges with the permission of the committee on standing of students. In addition, each receiving college may require the completion (with a minimum grade of C-) of no more than three introductory courses – courses without prerequisites – before transfer occurs. Students considering such a transfer must confer with their advisers to begin the process.

The College of Business requires a student to successfully complete either MATH 081 or MATH 021, and ECO 001 before transferring to that college. Courses considered equivalent to these courses will also satisfy the requirement such as approved transfer credit (including AP courses) for these courses taken at other institutions, or the successful completion of MATH 075 and MATH 076, or MATH 031, which are equivalent to MATH 021.

A completed Petition to Change Colleges must be submitted no later than three weeks prior to the start of registration for the semester in which they wish to make the transfer.

Students who transfer to another college may require more than the traditional eight semesters to complete the course sequence in their degree program.

**Provisional Courses**

Instructional departments may introduce provisional courses temporarily within a semester, either experimentally or as a response to a contemporary social or scientific issue. If successful, such courses may become a permanent part of the university curriculum. These courses, identified with a 95, 96, 97 or 98 number (preceded by a 0, 1, 2, 3 or 4 indicating level) may be offered for a maximum of two years.

**LVAIC Cross-Registration**

Currently enrolled full-time degree seeking undergraduate students in good academic standing who have achieved sophomore status may register for up to two courses per term at any one of the member institutions (DeSales University, Cedar Crest College, Lafayette College, Moravian College, and Muhlenberg College). The student must obtain the appropriate approvals of his or her own adviser and the host institution registrar. The courses must not be available at the home institution and must be in the normal academic load and not produce an overload. Graduate students and graduate-level courses are not eligible for cross registration.

All grades of courses taken through the LVAIC cross registration process will be accepted by the home institution and entered on the permanent record, and such grades will be used in computing the grade point average. Credits taken through the cross-registration process will be calculated as in-residence. The number of credit hours assigned to a course is the responsibility of the home institution registrar.

Students may not repeat a course at another LVAIC institution with the expectation of a Lehigh cumulative grade point average adjustment.

Lehigh University students are not permitted to cross-register for courses in all January intersession programs, the evening program at Muhlenberg College, all weekend courses at Cedar Crest College, or the Access program at DeSales University. All independent study, tutorial,
music lessons or groups, and correspondence courses are prohibited from cross-registration.

SUMMER CROSS-REGISTRATION
Lehigh students must have been registered full time in the prior spring semester to be eligible to cross-register for a summer term. A maximum of two courses per session may be rostered. Students may not cross-register for a course being offered at Lehigh during the summer term.

Additional information on cross-registration can be found on the LVAIC website (http://lvaic.org/for-students/cross-registration).

General College Division

The General College Division provides an opportunity for qualified persons not planning to seek a degree to pursue work of a general or specialized nature that their preparation and interests make desirable; provides a trial period for those who wish to become candidates for baccalaureate or graduate degrees, but whose preparation does not satisfy the entrance requirements for the established curricula; and provides an opportunity for qualified students to continue their education without being committed to a restricted or specialized program of studies. Courses taken in the General College Division may not be submitted to meet the requirements for a graduate degree.

For admission to the General College Division, the student must submit a special, simplified application to the undergraduate admissions office; the application must be submitted at least one month prior to the start of the semester in which the student hopes to enroll. The applicant must show maturity, seriousness of purpose and evidence of ability to pursue with profit the program of studies he or she desires. The student must have the established prerequisites for courses in which he or she wishes to enroll, and may register for courses up to and including those at the 300-level. 400-level courses are prohibited.

There is no established curriculum for the General College Division. Each student works on a program outlined to meet his or her special needs. Each program must be approved by the registrar or his/her designee, who serves as the director of the division. Students must obtain permission of the instructor for each course in which they seek to enroll each semester. Students in this division are granted final approval for enrollment on a case by case and space available basis. Students in the division are not permitted to take courses using the optional pass/fail grading system, course audit, or cross register for courses in LVAIC.

Students in the division, as non-degree candidates, do not meet the eligibility criteria for federal student aid, under Title IV, including Federal Pell Grants and Federal Stafford Student Loans. Similarly, institutional financial aid also is limited to degree candidates.

Students in the division are not candidates for degrees and must maintain a minimum 2.00 grade point average. A student may transfer to regular matriculated undergraduate status in any of the colleges only upon petition to, and with the approval of, the Committee on the Standing of Students. Transfer to the graduate school is possible only through the normal graduate admission process.

With the exception above, students in the General College Division are subject to the same rules and regulations as students of the university. They pay the tuition and fees established for regularly matriculated students.
Graduate Study and Research

HISTORY
Lehigh began awarding graduate degrees in 1882. The first recipient, T.H. Hardcastle, of the Class of 1880, wrote his thesis on Alexander Pope, entitled it The Rights of Man, and read it aloud at commencement in June 1882.

The first Ph.D. was granted in 1893 to Joseph W. Richards, Class of 1886. Richards, who had a background in metallurgy and electrochemistry, taught at Lehigh until his death in 1921.

Women were admitted to the graduate program in 1918 when the faculty and the board of trustees agreed to grant the degrees of M.A. and M.S. to women, provided they attended classes in the late afternoon and on Saturdays “so that the general character of campus life shall not be affected.” Three women received graduate degrees in 1921, the first women to complete graduate work at Lehigh. In 1929, the rule was changed, and women were admitted on much the same basis as men.

In 1936, the Graduate School was established to administer the graduate program. The Ph.D., which was temporarily discontinued in 1894, was reinstated in nine departments: chemistry, chemical engineering, civil engineering, geology, history, mathematics, mechanical engineering, metallurgical engineering, and physics.

Tomlinson Fort, professor of mathematics, was selected in 1938 as the first dean of the Graduate School.

In 1995, graduate programs were decentralized and are now administered by the four colleges of the university, as described below.

COLLEGE OF ARTS AND SCIENCES
Interim Dean
Dominic Packer, associate dean for research and graduate programs

The College of Arts and Sciences offers graduate degrees in the humanities, social sciences, mathematics, and natural sciences. The master of arts, master of science, and the doctor of philosophy degrees are given in most of the traditional academic departments and in some interdisciplinary programs. Advanced degrees may be obtained in the departments of biological sciences, chemistry, earth and environmental sciences, english, history, mathematics, physics, political science, psychology, and sociology. In addition, interdisciplinary degrees are available in American studies, environmental policy design, photonicx, and polymer science and engineering.

Although degree requirements vary from department to department, most require a combination of formal coursework and independent research. Students work closely with a faculty adviser in formulating and carrying out their research programs. Students admitted to a traditional department who are interested in an interdisciplinary approach may design a program of study and research which draws on faculty and facilities in other areas of the college or university.

For the most up to date information, interested students should check the CAS graduate website (http://cas.lehigh.edu/grad) or contact the Office of Research and Graduate Programs, College of Arts and Sciences, 9 West Packer Ave., Bethlehem, PA. 18015, 610-758-4281 or email to inca@casdrl@lehigh.edu.

COLLEGE OF BUSINESS
Georgette Chapman Phillips, Dean
Yuliang Yao, Associate Dean

The College of Business offers the master of science degree in accounting and information analysis; master of science degree in applied economics; master of science degree in management; master of business administration with concentrations in business administration, business analytics, corporate entrepreneurship, finance, marketing, international business, project management and supply chain management; and the doctor of philosophy degree in business and economics. In addition, the College of Business and the P.C. Rossin College of Engineering and Applied Science offer an MBA and Engineering degree. Students in this program will have the opportunity to concentrate in both a business area and an engineering area during their studies. The College of Education and the College of Business offer a joint masters degree in MBA and Educational Leadership, which will develop skills in business disciplines and prepare educators for roles in school administration. The College of Business, the P.C. Rossin College of Engineering and Applied Science, and the College of Arts and Sciences offer a master of science degree in financial engineering, which provides a strong education in advanced finance and quantitative financial analysis tools. Students will be prepared to create innovative solutions for real financial problems using state-of-the-art analytical techniques and computing technology.

There are six departments in the college: Accounting, DATA (Decision and Technology Analytics), Economics, Perella Department of Finance, Management, and Marketing. More information about the various degree programs appears below. Information on the college’s graduate programs may be obtained at www.lehigh.edu/business or by contacting the College of Business, Graduate Programs Office, Rauch Business Center, 621 Taylor Street, Bethlehem, PA. 18015, 610-758-4450.

COLLEGE OF EDUCATION
William Gaudelli, EDD, Dean
George J. DuPaul, PHD, Associate Dean for Research
Arpana Inman, PHD, Associate Dean for Graduate Studies

The College of Education is a nationally recognized graduate college. Our distinction resides in our ability to function as a community of scholars and teachers. The diversity of our partnerships, the quality of our research and teaching, and the invigorating and supportive learning environment distinguish us as leaders among graduate colleges of education.

The College of Education offers a master of arts in education, a master of education, a master of science in education, the educational specialist, a joint master in business administration/master of education, post-baccalaureate certificates in various concentrations, the doctor of education, and the doctor of philosophy. There are six academic programs within the college including: Comparative and International Education, Counselling Psychology, Educational Leadership, School Psychology, Special Education, and Teaching, Learning and Technology. The focus of these programs is to prepare students for leadership roles in groundbreaking, cross-disciplinary inquiry that shapes educational practices nationally and internationally. While the College of Education does prepare individuals for leadership roles in school systems, we also prepare individuals for a variety of positions in business and industry, healthcare, private practice, and community-based organizations. We embrace the philosophy that a top quality education should provide the instruction, resources, and experience necessary to create a new type of educator; one who understands the nature of learning, social equity and cultural diversity; values collaboration and teamwork; and embraces societal challenges.

In addition to these six core academic programs, there are three other units within the College of Education:

Centennial School

Centennial School is an approved Private School, governed by Lehigh University and funded by the Commonwealth of Pennsylvania. Centennial School meets the educational needs of students with emotional disturbance and autism as defined under the Individuals with Disabilities Education Act (IDEA). With an emphasis on evidence based practices, Centennial School effectively uses an apprenticeship model to train graduate students in special education and other school-based professions such as school psychology, counseling, and educational leadership. The close partnership between Centennial and the College of Education provides Lehigh graduate students with unique research opportunities and fulfillment of practicum and internship requirements.

The Center for Promoting Research to Practice

The center's mission is to generate new knowledge that will truly impact the lives of individuals with or at risk for disabilities and to enhance the translation of new knowledge into practice. All too often research that is created for these individuals remains at the development level and is not disseminated into best practices. The Center is focused on conducting and disseminating applied research and assuring research outcomes get into the hands of parents and practitioners as quickly as possible.
Lehigh University Autism Services is a clinic housed in the Center for Promoting Research to Practice. The mission of the clinic is to develop and disseminate research-based practices that improve the well being of children with autism and their families and to serve the local community. The clinic provides intervention programs for young children with autism spectrum disorders (diagnosis to age 5) and their families. http://wordpress.lehigh.edu/cprp/autism-services/

Global Distance Graduate Degrees and Training Office
The Office of Global Distance Graduate Degrees and Training provides online graduate education and training to students in the U.S. and worldwide within Lehigh University's College of Education. The Global Distance Office's international initiatives include offering graduate degree programs, principal certification, non-degree graduate certificates, and summer institutes via online courses and in-person throughout the academic year. Additionally, the Global Distance Office serves as an academic resource to College of Education faculty by working with them to identify research opportunities globally, facilitating partnerships with domestic and international professional organizations, and organizing customized professional development programs at K-12 international schools worldwide. For more information, visit: https://ed.lehigh.edu/distance.

Information on the various degree programs can be obtained by contacting the College of Education, 111 Research Dr., Bethlehem, PA 18015, 610-758-3231 or visiting our website: http://ed.lehigh.edu/.

P.C. ROSSIN COLLEGE OF ENGINEERING AND APPLIED SCIENCE
Stephen P. DeWeerth, dean
John P. Coulter, senior associate dean for research
Donna M. Mohr, assistant dean
There are eight academic departments within the P.C. Rossin College of Engineering and Applied Science: bioengineering, chemical and biomolecular engineering, civil and environmental engineering, computer science and engineering, electrical and computer engineering, industrial and systems engineering, materials science and engineering, and mechanical engineering and mechanics. Master of science and doctor of philosophy degrees are available in each of these departments, as well as in environmental engineering, computer engineering, structural engineering, and polymer science and engineering. In addition, master of science programs are provided in analytical finance, management science and engineering, manufacturing systems engineering, and photonics. Master of engineering degrees are offered in biological chemical engineering, chemical engineering, chemical energy engineering, civil engineering, computer engineering, computer science, electrical engineering, energy systems engineering, environmental engineering, healthcare systems engineering, industrial and systems engineering, management science and engineering, materials science and engineering, mechanical engineering, polymer science and engineering, structural engineering and technical entrepreneurship. In cooperation with the College of Business, students can also pursue a Master of Business Administration and Engineering (MB&E) degree. Certificate programs are available in the areas of healthcare systems engineering, management science and engineering, nanotechnology, polymer science and engineering and technical entrepreneurship.

Graduate study in the P.C. Rossin College of Engineering and Applied Science is most often related to the college's extensive research activity, and graduate students are expected to engage in analytical or experimental research as part of their programs of study. This activity involves students in the process of creating new knowledge under the direction of the college's distinguished faculty and brings them into contact with some of the most modern and advanced experimental techniques. Many college research programs are supported by contracts, fellowships, and grants from industry and from federal, state, and local governments. This funding not only provides financial support for outstanding students but also allows them to deal with some of the more complex and pressing problems facing our society in the 21st century.

Many faculty members and graduate students in the P.C. Rossin College of Engineering and Applied Science are associated with interdisciplinary research centers and institutes as well their own departments. The opportunity for interdisciplinary study allows them to cross departmental lines in specific technological areas and to work with faculty and graduate students from other departments. Centers and institutes perform research that fall under five broad categories: materials and nanotechnology, infrastructural systems, applied life science and bioengineering, energy and the environment, and complex engineering systems. Information on individual centers and specific research activities can be found at URL www.lehigh.edu/engineering/research/centers/. Extensive research in many of these areas is also conducted within academic departments.

Further information on the graduate programs may be obtained through the Office of Graduate Studies and Research, P.C. Rossin College of Engineering and Applied Science, 19 Memorial Drive West, Bethlehem, PA 18015.

Admission to Graduate Study
A graduate of an accredited college or university may be considered for admission to graduate study. The decision to admit a student rests with the applicant's major department and stands for one year following the first semester for which admission was offered. If more than one year elapses, the prospective student's department reserves the right to reconsider the original offer. Students wishing to pursue an interdisciplinary degree may, in some cases, apply to the program directly.

Applications for admission may be completed online at https://www.applyweb.com/lehighg/index.ftl

An applicant may enter the graduate program as a student in the following categories: regular, associate, or non-degree. Except for qualified Lehigh undergraduates, only those who have been admitted officially by the graduate program office of an appropriate college or by a department in one of the categories above may register for graduate courses or take them for credit.

REGULAR GRADUATE STUDENTS
Only regular graduate students are candidates for graduate degrees. Applications for admission as a regular graduate student must be filed by July 15 for the following fall semester or by December 1 for the spring semester. Regular graduate students wishing to begin in the summer must apply before April 30. Certain departments or programs have earlier deadlines. Applicants should consult their respective departments or their dean's office. In order to be considered for admission as a regular graduate student, the applicant must satisfy at least one of the following conditions: have an undergraduate GPA of at least 2.75 out of 4.00 (note: College of Education GPA minimum is 3.0); have an average of at least 3.00 for the last two semesters of undergraduate study; have a graduate grade point average of at least 3.00 for a minimum of twelve credit hours of graduate work completed at other institutions; or have successfully satisfied the probationary conditions as an associate graduate student (discussed below). Satisfying one of these conditions is necessary for admission as a regular graduate student but may not be the only condition required.

Graduate students who are non-native speakers of English are required to show English proficiency. This may be done with the Test of English as a Foreign Language Internet-Based Test (TOEFL iBT) or the International English Language Testing System (IELTS). Please contact your department or program of choice about which test(s) are acceptable and for the required acceptance scores.

The English proficiency requirement may be waived if a student has obtained a degree from an English language university in an English speaking country and demonstrates effective English language skills. Applicants should consult with their respective departments or program of choice to confirm whether they are eligible for a waiver.

Individual departments may evaluate their candidates for admission according to higher standards and additional criteria. Students seeking admission to Professional Certification Programs may have to meet additional requirements to comply with Pennsylvania Department of Education Regulations. Departments should be consulted for information regarding required examinations for admission. For example, candidates for the MBA program are required to take the Graduate Management
Additional courses. can receive any transcript or grade report from the university or enroll for admission, but formal transcripts must be on record before the student application and registration forms confer admission to the non-degree program. The signature of the designated official on the appropriate college or other responsible official designated by the standards.

Non-native English speakers are program at an approved institution; or 3) evidence that the applicant is presently a student in good standing in an appropriate graduate which they wish to take courses;) or 2) evidence that the applicant bachelor's degree from an approved institution with an overall grade completion of an abbreviated application form which can be completed admission with non-degree status. In this case, the prospective student students who do not wish to enter a degree program may seek courses completed during a successful probationary period may count submission of any regular admission documents not already on file. When the probationary period of nine credit hours is completed, associate graduate students must petition for regular student status. In order to be granted regular student status, they must have completed those nine credits with at most one final course mark below B-. Associate graduate students receiving a final course mark lower than a C- will be dropped from the program. Students should note that individual departments may impose more rigorous probationary standards. For example, the College of Education has more stringent probationary standards; please see the handbook for details.

When the probationary period of nine credit hours is completed, associate graduate students must petition for regular student status in order to enroll for additional coursework. Such a petition requires the submission of any regular admission documents not already on file. Courses completed during a successful probationary period may count toward a graduate degree if they are part of an approved program.

NON-DEGREE STUDENTS
Students who do not wish to enter a degree program may seek admission with non-degree status. In this case, the prospective student completes an abbreviated application form which can be completed online at https://www.applyweb.com/lehig/index.fil

Admissions criteria for non-degree graduate students are: 1) a bachelor's degree from an approved institution with an overall grade point average of at least 3.0; (applicants with undergraduate GPAs below 3.0 may be admitted with the approval of the department in which they wish to take courses;) or 2) evidence that the applicant is presently a student in good standing in an appropriate graduate program at an approved institution; or 3) evidence that the applicant has received an appropriate graduate or other advanced degree from an approved institution. In addition, non-native English speakers are required to demonstrate English language skills equal to those required of degree-seeking students and are held to the same English proficiency standards.

Admission decisions for non-degree students are made by the dean of the appropriate college or other responsible official designated by him/her for this purpose. The signature of the designated official on the application and registration forms conveys admission to the non-degree graduate student status. Informal transcripts will be accepted for initial admission, but formal transcripts must be on record before the student can receive any transcript or grade report from the university or enroll for additional courses.

Non-degree Options
In addition to degree programs, there are two non-degree options: 1) Regular non-degree and 2) Non-degree for external certification. Regular non-degree admission is for students who wish to take up to 12 credits of graduate coursework without seeking a degree. Non-degree for external certification students are admitted to pursue coursework for the purpose of obtaining certification through an external accrediting agency. These students complete coursework for the appropriate certification, with the number of credits being dictated by the external accrediting agency. Given this external control of credit requirements, the number of credits will vary and will typically exceed the 12-credit limit for regular non-degree students. A student admitted as non-degree may subsequently be admitted to a degree program, but would need to submit all components required for admissions consideration by that degree program. Students should consult their respective college dean's office for proper procedure.

GRADUATE COURSE AUDITING
With the permission of the departmental chair, graduate students can be admitted to a course as auditors. This course will not count for credit towards any graduate degree, and may not subsequently be taken for credit. In no case shall a student who has attended a course as an auditor be given an anticipatory examination for credit or register for the same course in the future. A student completing a course in this manner will have the course and the notation "AU" indicated on the permanent record. A student rostered on an audit basis may be withdrawn from the course with a grade of "W" for poor attendance.

LEHIGH UNIVERSITY UNDERGRADUATES
A Lehigh undergraduate with a 3.0 cumulative grade point average who has achieved Junior standing may take any 400-level course for which he or she is qualified. The qualifications are defined by the department and are certified by the course instructor and department chairperson through petition to the Graduate and Research Committee. Additional information on constraints on undergraduates taking graduate level can be found in Guidelines for Undergraduates to Take Graduate Level Courses (p. 31).

Undergraduates at Lehigh who are within a few hours of meeting the requirements for a baccalaureate degree may, with the special approval of the Graduate and Research Committee, enroll for up to 12 credit hours of study for graduate credit. Lehigh undergraduates may apply course credits taken in the undergraduate program toward a graduate degree under the following conditions: 1) the course credits are not submitted as part of the requirement for an undergraduate degree; and 2) courses for possible graduate credit are approved in advance by the course instructor, department chairperson, and the dean of the college. The student must receive a final course mark of B- or better.

READMISSION
A student who has not been registered in a Lehigh graduate program for one year must petition for readmission. Petitions approved by the student's major department must be forwarded to Registration & Academic Services.

INTERNATIONAL STUDENTS AND SCHOLARS
International applicants must hold an American bachelor's degree or an equivalent foreign degree requiring at least 16 years of primary, secondary, and university education. International applicants applying for regular graduate student status must submit all documents required for that status (see above).

Registration

REQUIREMENTS
All graduate students using Lehigh University resources must be registered. The maximum roster of a full-time (no employment) graduate student shall not exceed 18 credit hours, but students can petition to SOGS for up to 20 credit hours. Graduate students who are full-time employees at the university may not take more than six semester hours of graduate work in any one semester. Graduate students who are half-time employees of the university (e.g., half-time teaching assistant or half-time research fellows) may not take more than ten semester hours of graduate work in any one semester. Graduate students under contract to devote not more than one-third of their time to university employment may take a maximum of twelve semester hours in any one
Committee. The instructor schedules and administers the make-up exam.

The Z grade is defined as for undergraduates (p. 26) except that graduate students have a calendar year to complete coursework following a Z grade unless an earlier completion deadline is specified by the instructor. The X portion of the grade is removed as described for undergraduates. Z grades which are not removed remain on the record of graduate students. All petitions for exceptions are sent to the Committee on Standing of Graduate Students (SOGS).

A student’s grade that was originally assigned an N, X or Z grade when converted or computed will be noted with an ** asterisk prefix.

**REPEATED COURSE POLICY**

If a graduate student repeats a course, each time that course is taken it is included in the academic record, as is the final grade assigned, and both appear on the official student academic transcript. All final course grades assigned are included in the calculation of the student's cumulative grade point average. Course credits from a repeated course, however, count only once toward satisfying graduation credit requirements.

A student may repeat a course only twice — a total of three attempts. Withdrawal from a course counts as an attempt (effective Fall 2017).

**WITHDRAWAL FROM A COURSE**

When a student drops a course within the first ten days of the semester (four days for summer sessions) no indication of this action is recorded on the academic transcript. A student that drops all courses for which he or she is registered is considered to be withdrawing from the university.

A student who withdraws from a course after the tenth day of instruction and before the end of the eleventh week of instruction will have a final course mark of “W” assigned to the course. This is a non-punitive grade.

An Add/Drop form signed by the student’s adviser must be submitted to Registration & Academic Services before the deadlines noted to be official.

**GRADUATE STUDENT SCHOLASTIC REQUIREMENTS**

The following guidelines state the minimum requirements for all graduate students. Individual degree programs may have higher standards.

**Associate and Non-Degree Students**

Associate and Non-Degree Students will be placed on probation when they receive their first final course mark below a “B-” and will be dropped for poor scholarship at the end of the term when the student has accumulated either two “C”, “C-” or “C+” final course marks or one final course mark below “C-“.

If an associate student is assigned two grades below a “B-” in the same term the student is eligible to be dropped without any term on probation.

Once on probation, students remain on probation until they are granted regular status or receive degree. Students who are eligible to be granted regular status but fail to apply by the regular student deadline will be evaluated according to the regular student criteria.

**Regular Students**

Regular Students will be placed on probation at the end of the term in which they are assigned their fourth final course mark below a “B-” in courses numbered 200 or above and will be dropped for poor scholarship at the end of any term in which they are assigned their fifth final course mark below a “B-“.

Once regular students are placed on probation they will remain on probation until they receive their degrees.

**Readmission**

Graduate students who have been dropped for poor scholarship are ineligible to enroll for the next regular term. After one term away they may petition for readmission. The department and the dean's office must review the petition. If approved, the student will be readmitted on probation and may be dropped again with any additional final course marks below a “B-“.
Academic Grievances

If a student has a complaint about a grade or other academic grievance, the first step is to talk to the instructor involved. If the matter is not settled satisfactorily, the student should contact the department chair or division director about the complaint and submit the complaint through the formal grievance procedure within the department. The department decision may, if the student still feels aggrieved, be appealed to the appropriate dean.

Graduate Leave of Absence

Graduate Student Leave of Absence Policy

During the course of graduate study, students may find themselves in circumstances that require them to interrupt their graduate work. When these occasions arise, the University allows students to request a leave of absence for either personal or medical reasons. The information provided below is designed to assist students in making a smooth transition away from graduate study and then back again.

Students are required to submit the Leave of Absence Request form to the Office of Graduate Student Life. If the student is eligible, the Office of Graduate Student Life will then notify the academic adviser, program director, department chair, graduate associate dean of the appropriate college and Registration & Academic Services. In order to enhance their successful return to graduate school, students are strongly encouraged to meet with their advisers to discuss their plans and to keep the lines of communication open.

Please note that a “withdrawal” indicates the student intends to discontinue graduate study and should fill out the Graduate Permanent Withdrawal Form (https://cm.maxient.com/reportingform.php?LehighUniv&layout_id=103). The “Leave of Absence” indicates that the student intends to return at a specified later date. This policy addresses circumstances that require them to interrupt their graduate work. When these occasions arise, the University allows students to request a leave of absence for either personal or medical reasons. The information provided below is designed to assist students in making a smooth transition away from graduate study and then back again.

Important Information about Requested Leaves of Absence:

• Only students who have successfully completed at least one semester of graduate work and are in good academic standing are eligible for a leave of absence. Students in their first semester who request a leave will need to petition for readmission.
• Funded students who are requesting a leave due to the birth or adoption of a child should apply for a Graduate Student Parental Leave. Students can access information and the form here:
  http://www.lehigh.edu/~inprv/pdfs/GraduateStudentParentalLeavePolicy11-17-09withForm.pdf
  • The University will grant a leave of absence for up to one year. If more time away is required, students may request a second year of leave. Should students require more than two years away from the University, they will be required to apply for readmission to the program at the end of their time away. A leave that commences during the semester will count as an entire semester away in terms of total leave time allowed.
• If students take a leave during the semester, they may be required to submit a drop/add form to Registration & Academic Services (http://www.lehigh.edu/~inengrit/gradforms/pdfs/add_drop.pdf). Students may be eligible for a prorated refund. Please consult the Bursar’s Office for details: (http://www.lehigh.edu/~inburs/refund.html).
• An approved leave of absence extends the time-to-degree deadline for the length of the approved leave, but only up to the university-mandated maximum of two years.
• While on leave, students are not registered with the University. This has important implications:
  • The student may not submit work, take exams, propose or defend theses or dissertations, or use faculty time.
  • The student will not have access to University services, including the Health and Counseling Centers, the Fitness Center, and Library and Technology Services. This means the student’s Lehigh email account will be suspended and he or she will be unable to use library services. However, the College Dean’s Office may request that the student returns.
• Student loans may come out of deferment and the student may be required to begin repaying his/her loans. Please consult Financial Aid: http://www.lehigh.edu/~infao/graduate/index.html.
• Immigration status may be affected for international students. Please consult the Office of International Students and Scholars: http://www.lehigh.edu/oiss/.
• Students living in campus housing will need to make other living arrangements, since only registered students in good standing are eligible for such housing. Unfortunately, Residential Services also cannot guarantee space upon the student’s return.
• Students enrolled in the University health insurance plan may be able to keep their health insurance during the term of the health insurance contract. In this case, students can contact the University Health Center to obtain a list of primary care doctors in the community to use during their leave of absence. Please consult the student health insurance brochure for eligibility restrictions: https://financeadmin.lehigh.edu/sites/financeadmin.lehigh.edu/files/offices/bursar/docs/HealthInsuranceBrochure.pdf
• Students requesting a leave for medical or psychological reasons must include documentation from their health provider which indicates a recommendation for the leave and expected time away.
  The documentation is submitted to and is only available to the Director of Graduate Life. Such documentation remains kept confidential.
• Students who need to be absent within the semester (no more than a few weeks in duration) must consult with their professors about the possibility of making up missed classwork and, if applicable, work related to their funding support. In these circumstances, students do not need to submit an official Leave of Absence request. Students may consult the Director of Graduate Student Life with questions and concerns.
• To formally request a leave of absence, students must complete the form at the following link: http://lehigh.edu/go/gradloa

Important Information about Involuntary Leaves of Absence:

• The University may require an involuntary leave of any student who appears to have a serious physical, psychological or emotional disorder which offers reasonable cause to believe he or she may be a danger to self or others, or may disrupt proper activities of the University community and its members, or may be unable to look after his or her affairs adequately. An involuntary leave of absence is included in the maximum leave of two years.
• Time-to-degree deadlines are not extended for students who are suspended due to Code of Conduct violations.

Returning from Leave and Resuming Graduate Studies

When ready to resume graduate study, students are required to complete the Graduate Readmission Form (https://publicdocs.maxient.com/reportingform.php?LehighUniv&layout_id=111).

Returning students are encouraged to contact their program adviser as early as possible to discuss registration.

Returning students may only re-enroll for a full semester or summer session. In order to meet this requirement, such students need to be aware of registration deadlines.

Students who take a leave from graduate study without requesting an official leave of absence will be required to petition the Standing of Graduate Students (SOGS) committee for readmission if they've
been away from the University for more than one year. Unapproved leaves count toward the two-year leave maximum.

If you have any questions about this policy or its application, please contact the Director of Graduate Student Life, Kathleen Hutnik, either by email kaha@lehigh.edu or telephone 610-758-3648.

Graduate Withdrawal Non-Returning

If you have decided to terminate your graduate program without intention of returning, please fill out the Graduate Permanent Withdrawal Form (https://cm.xaint.com/reportingform.php?LehighUniv&layout_id=103).

We also ask that you contact either the associate dean for graduate life (610-758-4722) or your college graduate associate dean. We would like to talk with you about your decision and answer any questions you might have.

Please note: if you plan on suspending your program with the intention of returning, please read the Graduate Leave of Absence Policy (http://catalog.lehigh.edu/graduatestudyandresearch/graduateleaveforabsence) and complete the Graduate Leave of Absence Form (https://cm.xaint.com/reportingform.php?LehighUniv&layout_id=101) instead.

Graduation

DEGREE REGISTRATION
A student must be registered in the semester in which the degree is conferred. If a student is not registered for a course, he/she must register for maintenance of candidacy. Candidates for September degrees do not need to be enrolled the summer preceding the degree if they were enrolled both fall and spring of the previous academic year.

APPLICATION FOR DEGREE
Candidates for graduation on University Day in May must apply on or before February 1; candidates for graduation in August must apply on or before July 1; candidates for graduation in January must apply on or before October 1. Students must apply online using the Banner Student Information System.

Applications submitted after the specified deadline will be charged a late application fee. No applications will be accepted within three weeks of the graduation date. Students who fail to submit an application must apply for the next available degree awarding date.

CLEARANCE
Graduate students must receive clearance from the university prior to the awarding of the degree. The following obligations must be satisfied:

- Students must complete all coursework, including any incomplete grades they may have received.
- Theses must be cleared by Registration & Academic Services.
- Dissertations must be cleared by the appropriate dean’s office.
- All financial obligations must be cleared with the bursar. Tuition fees, bookstore charges, library fines, and motor vehicle fines must be paid before graduation.
- All library books on loan must be returned.
- Students must turn in their student identification cards at the I.D. card office.
- The interdepartmental clearance sheet must be completed and reviewed with the department coordinator in which the student has studied.

Tuition and Fees

TUITION PAYMENT
Graduate students who register at least six weeks prior to the start of classes will receive an email notification to their Lehigh email account that their tuition bill is ready to view online at the e-Bill Suite. Students that register less than six weeks prior to the start of classes will most likely not have a tuition bill generated prior to the start of classes. To remain in good standing, tuition charges must be paid prior to the start of classes even if the student has not received a tuition bill because of his/her late registration for classes. Students can review their current account balance online 24/7 by logging into the e-Bill Suite or the Campus Portal. Information about the various payment options is available at the Bursar’s Office web site at www.lehigh.edu/inburs/ or by calling the Bursar’s Office.

TUITION REFUNDS
A student in good standing who formally withdraws or drops a course(s) before 60% of the semester has been completed is eligible for a tuition refund. Academic fees are non-refundable after the first day of classes. The “first day of classes” is considered the first day of the semester, not the first day a particular class meets.

Courses not following standard semester dates will have percent-of-semester-completed refunds based on dates for that specific course. Online courses percent-of-semester-completed are based on access availability, not if/when student first accessed course material. No tuition refunds will be made for courses of one week or less after the first day of class.

TUITION AND FEES FOR 2019-2020 PER CREDIT HOUR

<table>
<thead>
<tr>
<th>Program</th>
<th>Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>College of Arts &amp; Sciences</td>
<td>$1,500</td>
</tr>
<tr>
<td>College of Business &amp; Economics</td>
<td>$1,110</td>
</tr>
<tr>
<td>College of Education, and for fulltime elementary and secondary teachers and administrators enrolled in the other three colleges</td>
<td>$565</td>
</tr>
<tr>
<td>College of Engineering &amp; Applied Science</td>
<td>$1,500</td>
</tr>
<tr>
<td>Special Programs MBA &amp; Engineering</td>
<td>$1,500</td>
</tr>
<tr>
<td>MBA/Educational Leadership</td>
<td>$840</td>
</tr>
<tr>
<td>MS/Analytical Finance</td>
<td>$1,500</td>
</tr>
<tr>
<td>MS Accounting and Information Analysis</td>
<td>$1,280</td>
</tr>
<tr>
<td>M² - Masters of Science in Management - 9 month program (30 credits)</td>
<td>$49,530</td>
</tr>
<tr>
<td>Accelerated MBA (1-year)</td>
<td>$64,750</td>
</tr>
<tr>
<td>Audit charge per course – same as credit charge in the appropriate college</td>
<td></td>
</tr>
<tr>
<td>Maintenance of candidacy – same as a one-credit charge in the appropriate college</td>
<td></td>
</tr>
<tr>
<td>Master's candidate registration fee – same as onecredit charge in the appropriate college</td>
<td></td>
</tr>
</tbody>
</table>

LIVING ACCOMMODATIONS
The university maintains a graduate student housing complex in the Saucon Valley that has 135 living units. This complex, Saucon Village Apartments, provides units generally on a yearly lease basis. For the 2019-2020 period beginning in September, the following are the monthly rents exclusive of utilities:

<table>
<thead>
<tr>
<th>Accommodation Type</th>
<th>Rent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency apartment</td>
<td>$640</td>
</tr>
<tr>
<td>One-bedroom apartment</td>
<td>$730</td>
</tr>
<tr>
<td>One-bedroom w/AC</td>
<td>$760</td>
</tr>
<tr>
<td>Small two-bedroom</td>
<td>$830</td>
</tr>
<tr>
<td>Two-bedroom apartment w/o AC</td>
<td>$830</td>
</tr>
<tr>
<td>Two-bedroom apartment w/AC</td>
<td>$870</td>
</tr>
<tr>
<td>Three-bedroom apartment</td>
<td>$940</td>
</tr>
</tbody>
</table>

230 W Packer/Packer House Rent
The university also maintains graduate housing on the Asa Packer campus. 230 W. Packer and Packer House provide single bedrooms within small houses where residents share bathrooms and a common kitchen. These rooms are provided on a 9 month (230 W. Packer) or yearly (Packer) basis. For the 2019-2020 period beginning in September, the following are the monthly rents:

<table>
<thead>
<tr>
<th>Accommodation Type</th>
<th>Rent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Bedroom</td>
<td>$580</td>
</tr>
<tr>
<td>Large Bedroom</td>
<td>$600</td>
</tr>
</tbody>
</table>

OTHER FEES
Application fee: Consult with individual college (for graduate admission consideration)
Late pre-registration: $100
Late application for degree $50
Late payment (after announced date) $200
Returned check fine $35
Identification card (replacement) $30
Thesis distribution $55
Dissertation distribution $90
MBA Orientation Fee $375
MS Orientation Fee 100
Supervision fee 2 $225 to $350

1 Assigned to full-time graduate students who do not select their full credit load during the designated period each term.
2 College of Education (per 3 credits) Intern courses require a special supervision fee which varies from $225 to $350. Inquire in your department.

Financial Aid

Financial aid is available only for regular, full-time graduate students. Teaching assistantships, research assistantships, graduate assistantships, fellowships, and scholarships are academic awards made by individual academic departments. Several graduate assistantships unrelated to a particular area of study can be obtained by applying to administrative offices. International students are also encouraged to apply for funding to outside sponsoring agencies and/or home governments. Finally, please note that all student loan programs are administered by the Office of Financial Aid located at 27 Memorial Drive West. (Please read the section below regarding loans and work-study.)

ACADEMIC AWARDS

Requests for fellowships, scholarships, research assistantships, teaching assistantships, and graduate assistantships to begin in the fall semester must be filed with academic departments no later than January 15. (Some departments have earlier deadlines.) Generally, a special committee formed by department faculty selects the recipients of these awards based upon merit; students are not required to submit a financial statement.

In addition to their stipends, graduate students holding half-time teaching appointments generally receive tuition remission. Fellowship holders also receive a stipend and tuition award. Scholarship recipients are awarded tuition. Research assistants receive a stipend for research services, but their tuition is commonly paid directly by research projects.

TEACHING ASSISTANTS AND GRADUATE ASSISTANTS

Teaching assistant and graduate assistant (TA/GA) are technical terms used to describe specific types of Lehigh University graduate students. The duties of TAs and GAs are generally set by the departments or offices that appoint them, but certain conditions must be satisfied before a student can be classified as a teaching assistant or a graduate assistant. These include:

- Each TA/GA must be a regular full-time resident Lehigh graduate student, which normally requires registration for at least nine credit hours per semester.
- A TA/GA is a half-time position and each TA/GA provides services to Lehigh University of up to twenty hours per week. Quarter-time and eighth-time TA/GA appointments are possible for full-time resident graduate students, with stipends and tuition remission appropriately reduced.
- Each TA/GA must be paid a specific stipend, which is set for the academic year by the dean of the appropriate college after consultation with the Director of Budget.
- Qualified TAs/GAs receive tuition remission for at most ten credit hours in a regular semester. No TA/GA may register for more than ten credit hours. A student who is a TA/GA during the preceding academic year is entitled to at most three hours of thesis, research, or dissertation registration (not course credit) in the following summer without payment of tuition (except in the College of Education).
- Each TA/GA is appointed by a process which begins with a formal letter of appointment issued by the appropriate department chairperson. The appointment letter specifies standard university conditions including stipend level, time of arrival, length of service, and the requirement of satisfactory academic progress and performance of duties. Each department chairperson submits written notification of TA/GA appointments to the appropriate college dean or vice president.

The Graduate and Research Committee endorsed academic guidelines for new teaching assistants which exceed minimum admission requirements. Each TA should satisfy one of the following: have a GPA of 3.0 or better in the undergraduate major field of study; have a GPA of 3.5 in the senior year major field; rank in the 85th percentile or higher on the Graduate Record Exam or other standardized test; or have a GPA of 3.5 in at least twelve hours of graduate work in the major field. Exceptions to these guidelines shall be made only with the approval of the appropriate dean.

In addition, each teaching assistant must make normal progress toward a terminal degree. The definition of normal progression varies among departments, but the criteria for satisfactory progress are established by the department faculty and the Graduate and Research Committee. Teaching assistants who fail to satisfy these criteria are ineligible for reappointment.

In addition to achieving the minimum TOEFL iBT scores necessary for admission, potential Teaching Assistants and Graduate Assistants whose first language is not English who will be working with Lehigh undergraduates in academic settings (classrooms, recitations, labs, office hours, etc.) must pass Lehigh University’s Test of Presentation and Speaking Skills (TOPSS) prior to beginning their instructional responsibilities. At the Department’s discretion, students who score in the conditional range on the TOPSS may be appointed as a TA or GA but will be required to attend English as a Second Language courses, re-take the TOPSS, and achieve a passing score within one semester.

Tuition remission for qualified TAs/GAs is authorized by the appropriate dean or vice president as part of the registration process. Each college dean or appropriate vice president will be provided tuition remission accounts against which TA/GA remissions will be charged. The accounts will be budgeted at an amount equal to the nine-hour TA/GA tuition rate times the approved number of TA/GA positions and will be included in the annual operating budget. The budgets shall not be exceeded. If additional TA/GA positions are desired on a temporary basis, the account executive must provide for the transfer of budget support to the remission account. These budgets are to be used exclusively for tuition remission for authorized TA/GA positions.

There are a limited number of summer TA/GA appointments. These TA/GAs must receive the same monthly stipend as academic year TAs/GAs and devote up to twenty hours per week to the GA/TA responsibilities. A Summer TA/GA registers for a maximum of three credit hours in each summer session of appointment and receives tuition remission for that registration.

OTHER GRADUATE ASSISTANTSHIPS

Graduate students may apply directly to administrative offices for graduate assistantships unrelated to their areas of study. The availability of these assistantships is based upon the needs of the individual departments. GAs are appointed regularly by the office of the vice provost for student affairs, the dean of students office, the university counseling service, and by career services.

LOANS AND WORK-STUDY AWARDS

Graduate students may apply for Federally funded loans (Direct Unsubsidized Loan or Graduate PLUS Loan) through the Office of Financial Aid. Federal funds are awarded using the Free Application for Federal Student Aid (FAFSA) which can be completed on the web at www.fafsa.ed.gov. In addition to the FAFSA, Lehigh University requires a university application (Graduate Student Financial Aid Application). Applications for Federal loans cannot be processed and funds cannot be disbursed, until the FAFSA is received and reviewed.

Eligibility for student loans is based on the number of credits to be taken and the total amount of assistance received. Any change to the number of credits to be taken or the amount of aid received may affect loan eligibility. To avoid problems with your loan application, it is important that you notify the Office of Financial Aid of any changes in your enrollment or in the amount of aid received. It is the student’s responsibility to notify the Office of Financial Aid of any changes.
The following degrees are offered by the university: the master of arts, the master of business administration, the master of business administration and educational leadership, the master of business administration and engineering, the master of education, the master of engineering, the master of science, the doctor of philosophy, the doctor of education, and the doctor of arts.

Students pursuing multiple graduate level degrees must meet minimum unique degree credit-hour requirement for courses taken at Lehigh. A single master’s degree requires a minimum of 30 credits (see transfer credit policy for any exceptions); a single doctoral degree requires a minimum of 72 credits, or 48 for a student with a prior master’s degree. No credit used for a master’s degree may be counted towards reducing the minimum requirement of 48 Lehigh credit hours for a doctoral degree.

Candidates for the master’s degree have six years in which to complete their programs. Students should confer with their advisers to be certain that specific department and program course requirements are met. The following requirements must be satisfied by master’s candidates in all departments.

**PROGRAM FOR THE MASTER’S DEGREE**

A student’s program must include: not less than 30 credit hours of graduate work; not less than 18 credits of 400-level coursework (research or thesis registration counts as part of the 400-level coursework requirement); and not less than 18 credits of coursework in the major, of which 15 credits must be at the 400 level. Coursework for the master’s degree must be taken under at least two instructors and must be approved by Lehigh University. With the approval of the department chair, between 9 and 15 credits of graduate coursework taken elsewhere may be transferred to a Lehigh master’s program. The number of credits that may be transferred depends on the number of credits in the master’s program: Up to 9 credits for programs of 36 credits or less; up to 12 credits for programs of 37 to 48 credits; and up to 15 credits for programs of 49 to 60 credits. Programs, departments and colleges may have more restrictive transfer rules, however, and students should consult their program offices to learn of any such restrictions.

Course transfers require submission of completed course-transfer petitions, with course descriptions and transcripts, as well as departmental recommendation. Final course marks of B or better are required, such courses may not have been applied toward any prior degree, the courses must have been completed at an institution accredited by one of the six regional accrediting associations, and those courses must have been completed within four years of the first enrollment in the Lehigh master’s program.

Students pursuing a second Lehigh master’s degree can apply a limited number of credits to both the first and second masters degrees. Individual program requirements limit the level to which this can be done, but in all cases the credits counted toward any single masters degree cannot include more than 50% of credits that are also utilized to satisfy a second masters degree.

A student must complete the form, “Program for Master’s Degree,” setting forth the courses proposed to satisfy the degree requirements. This form should be approved by the department and then submitted to Registration & Academic Services as soon as possible after 15 credit hours toward the degree have been completed. Approval of the program by Registration & Academic Services signifies that the student has formally been admitted to candidacy for the master’s degree.

**THESIS AND COMPREHENSIVE EXAM**

Candidates in some programs may be required to submit a thesis or a report based on a research course of at least three credit hours, or to pass a comprehensive examination given by the major department. The department will specify which of these requirements apply and may require both. If required, the thesis or report shall not count for more than six credit hours, and thesis registration is limited to a maximum of six credit hours. If the thesis or research project involves human subjects, the student must complete the university human subjects review packet and receive written approval from the Institutional Review Board. All approved thesis/dissertations copies must be submitted by the appropriate deadlines in electronic form by following the procedures and guidelines found on the LTS Web site URL: http://libraryguides.lehigh.edu/etd. Please contact your college dean’s office for further clarification.

A non-thesis option exists for certain programs in the Colleges. Students should check with their departments regarding that option.

**PROGRAM FOR THE DOCTORAL DEGREE**

A candidate for the doctor of philosophy degree ordinarily is expected to devote at least three academic years to graduate work. In no case is the degree awarded to someone who has completed fewer than two full academic years of graduate work. All post-baccalaureate work toward the doctorate must be completed within ten years. A student beginning doctoral coursework after an elapsed period of at least one semester after the master’s degree has been conferred is granted seven years in which to complete the doctoral program.

Doctoral students whose graduate study is carried out entirely at Lehigh University must register for a minimum of 72 credits beyond the bachelor’s degree. Students who have earned a master’s degree at another university for a minimum of 48 credits. These requirements include registration for research or dissertation credits. Students participating in approved dual-degree doctoral programs involving external institutions may transfer up to 25% of their total required doctoral program research credits to Lehigh for work that was performed at the external partner institution. Approval of such programs is required by the dean of the relevant Lehigh college.

Full-time students working toward the doctorate normally register for a minimum of nine credits each semester. If the minimum degree registration requirement of 72 or 48 credits is attained prior to formal admission to doctoral candidacy, continued registration of at least three credits per semester is necessary. Such registration does not automatically grant full-time student status, however. Full-time student status must be confirmed on the graduate full-time certification form.

Students seeking to receive both a master's degree and a doctoral degree must complete a minimum of 72 graduate credits at Lehigh and must meet all requirements of both degrees.

After admission to doctoral candidacy, a student must maintain candidacy by registering at least two times each calendar year (in each academic semester or in one academic semester and one summer session). After completion of the minimum registration requirement, plus any additional requirements of the student’s department or program, students are permitted to register for ‘Maintenance of Candidacy’ and will be charged a single credit hour of graduate tuition at the appropriate rate for the degree program in which they are enrolled. Full-time status must be certified on the full-time certification form each semester.

**CONCENTRATED LEARNING REQUIREMENT**

Each doctoral degree candidate must satisfy Lehigh’s concentrated learning requirement. This requirement is intended to ensure that doctoral students spend a period of concentrated study and intellectual engagement with other scholars. Two semesters of full-time Lehigh graduate study, or 18 credit hours of Lehigh graduate study, either on or off campus, within a fifteen-month period must be completed.

Individual departments may impose additional stipulations. Candidates should check with their advisers to be certain that they have satisfied their concentrated learning requirements.

**LANGUAGE REQUIREMENTS**

Language requirements for the Ph.D. are the option of, and in the jurisdiction of, the candidate’s department. Since proficiency in a language is not a university requirement, each department decides which languages, if any, constitute part of the doctoral program.

**QUALIFIERS**

Many departments require students who wish to enroll in doctoral programs to pass qualifying examinations. Since these examinations vary among departments, students should ask their advisers or department chairpersons for more detailed information. If a qualifying examination is not used, students should find out how and when eligibility to pursue doctoral studies is determined.
ADMISSION TO CANDIDACY
With the help of an academic adviser, the student names the faculty members of the doctoral committee, a special committee formed to guide the student through the doctoral program. The committee is responsible for assisting the student in formulating a course of study, satisfying specific departmental requirements, submitting a suitable dissertation proposal and for overseeing progress in research, and evaluating the completed dissertation. At least four faculty are appointed to the committee; one must be a member of an outside department. Committee membership must be approved by the university’s Graduate and Research Committee or its designee.

A doctoral student should apply for candidacy no later than two years after completion of the master’s degree or its equivalent and after passing qualifying examinations, if they are required by the major department. The prospective doctoral candidate must submit to the doctoral committee a written program proposal that includes a discussion of proposed dissertation research. Upon receiving committee approval of the proposal, the candidate submits the proposal, signed by the committee members, to the appropriate dean for action by the Graduate and Research Committee or its designee. The dean will advise the student of the committee’s decision.

If the dissertation research involves human subjects, all research procedures and instruments must be approved by Lehigh University’s Institutional Review Board (IRB) prior to the involvement of the subjects.

GENERAL EXAMINATIONS
Examinations composed and administered by the members of the student’s doctoral committee are designed to test the candidate’s proficiency in a particular field of study. These examinations, which may be either written or oral, should be passed at least seven months before the degree is to be conferred. If a student fails the general examination, a second examination may be scheduled not earlier than five months after the first. If the results of the second examination are unsatisfactory, no additional examination is scheduled.

DISSERTATION AND DEFENSE
The doctoral candidate is required to write a dissertation prepared under the direction of a Lehigh University professor. The dissertation must address a topic related to the candidate’s specialty in the major subject, show the results of original research, provide evidence of high scholarship, and make a significant contribution to knowledge in the field.

Upon approval of the advising professor and, if required by the department, secondary readers, the final draft of the dissertation is submitted to the appropriate dean (or designee) for inspection by the date posted in the academic calendar. Upon its return, the student should distribute copies of the draft to the members of the doctoral committee for review and for suggestions for revision. The candidate then schedules a dissertation defense before the doctoral committee, additional faculty members the department may add to the examining committee, and the general public. After the dissertation has been defended and revised accordingly, the student must submit the finished dissertation to the appropriate dean for review by the university’s Graduate and Research Committee (or its designee) no later than the date specified in the academic calendar for completion of all degree requirements. All approved dissertations must be submitted by the appropriate deadlines in electronic form by following the procedures and guidelines found on the LTS Web site URL: http://libraryguides.lehigh.edu/etd. Please contact your college dean’s office for further clarification. Guidelines stipulating the standard form of the dissertation are available in the dean’s office.

Graduate Studies Organizations

THE GRADUATE AND RESEARCH COMMITTEE
The Graduate and Research Committee consists of twelve members representing the faculties of Lehigh’s colleges: four from the College of Arts and Sciences; two from the College of Business; four from the P.C. Rossin College of Engineering and Applied Science; and two from the College of Education; plus the college deans, the registrar, the vice provost for research, the director of the office of research; two non-voting graduate student members, and a member of the student senate. The committee formulates policies and regulations on graduate education and it recommends policies and procedures for research-related activities. The committee interprets and applies faculty rules governing graduate students and degrees, including questions concerning student petitions and appeals.

GRADUATE STUDENT SENATE
The Graduate Student Senate is comprised of graduate student representatives from each academic unit. The general assembly meets bi-monthly during the academic year. This body represents the graduate student community regarding graduate programs and graduate student life at Lehigh. Graduate students selected by the Graduate Student Senate are non-voting members of the Graduate and Research Committee and other university committees.

The Senate provides a forum for discussion with university officials and committees, advocates for policy change, disseminates information, and plans social events in order to facilitate communication and community building among graduate students.

Research Centers and Institutes

Lehigh has developed a number of centers and institutes to provide greater research and academic opportunities for students and faculty. Centers and institutes are generally interdisciplinary and complement the scholarly activities of academic departments and represent scholarship and research based on the expertise and capabilities of a group of faculty members. Frequently, centers relate to the broad-based research needs of government, industry, and the social community.

RESEARCH ORGANIZATIONS/ DIRECTORS AND STAFF
Directors and staff members of the university’s research centers and institutes are listed. Complete degree information may be found in the faculty and student alphabetical listings. In some cases, areas of research interest are given.

All addresses are Bethlehem, Pa. 18015, and the area code is (610).

Advanced Technology For Large Structural Systems (ATLSS) Research Center

117 ATLSS Drive, lmbl Laboratories, Mountain Campus
610-758-3525; Fax 758-5902; www.atlss.lehigh.edu

Administration: Richard Sause, Ph.D., ATLSS Director, Manager Infrastructure Monitoring Program; James M. Ricles, Ph.D., ATLSS Deputy Director; Chad Kusko, Ph.D., Administrative Director; Ian Hodgson, P.E., Manager Industrial Testing Program; Peter Y. Bryan, B.S., Manager Computer Systems; Doris Oravec, B.S., Financial Services; Leila Mazarul, Coordinator; Geraldine Kery, Research Coordinator; Richard Sause, Ph.D., Co-Director Pennsylvania Infrastructure Technology Alliance (PITA) and Research for Advanced Manufacturing in Pennsylvania (RAMP); James M. Ricles, Ph.D., Director Real-Time Multi-Directional Testing Facility (RTMD)

Faculty Associates: Helen M. Chan, Ph.D., Materials Science & Engineering; John N. DuPont, Ph.D., Materials Science & Engineering; Dan Frangopol, Ph.D., Structural Engineering; Joachim L. Grenestedt, Ph.D., Mechanical Engineering & Mechanics; Wojciech Z. Misiolek, Ph.D., Materials Science & Engineering; Clay J. Naito, Ph.D., Structural Engineering; Herman F. Nied, Ph.D., Mechanical Engineering & Mechanics; Sibel Pamukcu, Ph.D., Civil & Environmental Engineering; Raymond A. Pearson, Ph.D., Materials Science & Engineering; Stephen P. Pessiki, Ph.D., Structural Engineering; James M. Ricles, Ph.D., Structural Engineering; Richard Sause, Ph.D., Structural Engineering; Shamim Pakzad, Ph.D., Structural Engineering; Muhammad T. Suleiman, Ph.D., Geotechnical Engineering; Paolo Bocchini, Ph.D., Structural Engineering; Spencer Quiel, Ph.D., Structural Engineering

Faculty Emeritus Associates: John W. Fisher, Ph.D., emeritus, Structural Engineering; Alan W. Pense, Ph.D., emeritus, Materials Science & Engineering; Ben T. Yen, Ph.D., emeritus, Structural Engineering

Research/Staff Associates: Ian C. Hodgson, M.S., Infrastructure Monitoring/Structural Testing; Thomas M. Marullo, M.S., Software Development/System Administration – RTMD; Robin Hendricks, M.S., Structural Testing
The ATLSS Engineering Research Center is a national center for research and education on structures and materials of the infrastructure. Established in May 1986 with a grant from the National Science Foundation (NSF), the Center now addresses the research goals of the NSF, the U.S. Department of Transportation, the Commonwealth of Pennsylvania, the U.S. Department of Defense, and numerous national, state, and local industry and government organizations and agencies. Approximately 80 people, including graduate and undergraduate students, research associates, faculty and staff members representing the disciplines important to large structural systems are active at the Center.

ATLSS research areas include: Advanced Structural Systems and Materials; Measurement, Simulation, and Evaluation of Structural Systems; Infrastructure Reliability, Maintenance, and Life-Cycle Performance; Intelligent Structural Systems; and Infrastructure Hazard Mitigation with particular emphasis on Earthquake-Resistant Structures. The research is conducted in close association with engineers and scientists from several Lehigh departments, industry, government, design and professional groups and other universities.

ATLSS has excellent research facilities and equipment, including two world-class structural testing facilities; the Fritz Engineering Laboratory and the ATLSS Multi-Directional Testing Laboratory, in which researchers study large-scale structural subassemblies under static, dynamic, and/or cyclic multidirectional loading with complete computer-controlled experimentation. A recent grant from the NSF created the real-time multi-directional (RTMD) experimental facility to evaluate the performance of engineering designs and materials during earthquakes, hurricanes and other storms, tsunamis, landslides, and other disasters as part of NSF's Natural Hazards Engineering Research Infrastructure (NHERI) program. ATLSS also has outstanding resources for computing, mechanical testing, welding, metallography, and non-destructive evaluation.

**RESEARCH ACTIVITIES**

Advanced Structural Systems and Materials
Research is conducted on new structural forms and structural systems to promote efficiency through innovation and to promote the competitive use of high-performance steel, concrete, fiber-composites, and mixed systems for bridge, building, and ship-hull applications.

Measurement, Simulation, and Evaluation of Structural Systems
Techniques for measuring and simulating the behavior of structural systems under realistic loading conditions are being developed and implemented in the laboratory and in the field. Lab and field assessments are made on bridge, highway, railway and ship structures for evaluating their behavior under load, and evaluating the effects of corrosion, fatigue, and other damage.

Infrastructure Reliability, Maintenance, and Life-Cycle Performance
Research is conducted on optimal design, maintenance, monitoring and management of infrastructure systems, and on structural health monitoring, structural damage models and assessment, and predicting the remaining life of structures considering uncertainty.

Infrastructure Hazard Mitigation
Research is conducted on engineering processes and structural systems and materials technology to predict and reduce economic losses and injuries from hazard events, such as earthquake, blast, fire, and vehicular impact.

Intelligent Infrastructure Systems
Research is conducted on materials, components, and systems for sensing, processing and utilizing sensor information, and adaptively controlling the behavior of the large-scale structures of the infrastructure.

Educational Opportunities
The ATLSS Engineering Research Center facilitates broad programs of study and research in the fields of structures and materials. Graduate students in the Center’s programs receive master of science, master of engineering, or doctor of philosophy degrees, usually in structural engineering, materials science and engineering, or mechanical engineering. Financial support for graduate students is available through ATLSS by means of fellowships and research assistantships related to sponsored research programs.

Undergraduates participate in the Center’s research through summer internships and academic-year special projects.

For more information, write to Dr. Richard Sause, Director, rsause@lehigh.edu or Dr. Chad Kusko, Administrative Director, chk205@lehigh.edu; ATLSS Engineering Research Center, Lehigh University, 117 ATLSS Drive, Bethlehem, PA 18015-4728; web-site address www.atlss.lehigh.edu.

**Baker Institute for Entrepreneurship, Creativity and Innovation**

Whitaker Lab 318, 5 East Packer Ave, Bethlehem, PA 18015, (610) 758-5626 www.lehigh.edu/entrepreneurship

Lisa Getzler, Executive Director; Andreaa Kiss, Ph.D., Director, Entrepreneurship Minor


The Baker Institute for Entrepreneurship, Creativity and Innovation actively fosters and champions the entrepreneurial culture at Lehigh to advance creativity and innovation for economic, cultural and social development. The Baker Institute is designed to create a culture of entrepreneurship across the university, promote innovative thinking and the realization of entrepreneurial ideas in any field. To that end, the principal goals of the Institute are to:

- Nurture the creative entrepreneurial mindset and skills—in any discipline—among students, faculty, staff and the community to develop a culture committed and able to bring about transformative change;
- Provide opportunities for Lehigh students of all disciplines and levels to graduate with the skills, experience and attitudes necessary to move creative ideas and new solutions for social problems successfully into sustainable practice;
- Provide supporting infrastructure that enables and significantly increases the likelihood of practical scaling up of innovative ideas and technologies to implementation and launch of new organizations.

Based squarely on a cross-university approach, the Baker Institute aims to expand the creative pipeline of innovation-related curricular and extracurricular opportunities for students, faculty and the broader community. The Baker Institute serves as an umbrella organization to support and help coordinate, deepen and improve synergies among the substantial network of entrepreneurship-related programs on campus. By expanding resources for that network, and serving as a visible central portal, the Institute champions, highlights and promotes entrepreneurship opportunities on campus and throughout the community.

Institute operations include:

- Strategic oversight for enhancing internal and external exposure and competitively differentiating Lehigh’s overall entrepreneurship activities as a whole greater than its parts;
- Offering immersive experiences to augment curriculum, together with youth and enhanced executive education programs;
- Managing and expanding entrepreneurship-related competitions and clubs;
- Leveraging opportunities for partnerships with government agencies and economic development organizations (national, state and local).

The Baker Institute also supports the entrepreneurship-related activities of academic departments and programs by:

- Funding curricular innovation and materials;
- Modifying existing courses to incorporate entrepreneurial thinking;
- Piloting new courses in disciplines across the entire university;
- Exploring alternative structures for courses and course delivery, such as scheduling outside conventional calendar, short courses, modular courses, and Web delivery;
- Organizing cross-college curricular coordination, synergies, and continuous improvement;
The overall objective of the Institute is to cultivate the ability of our students, faculty, staff and community members to develop new ideas that produce innovations and sustainable organizations with economic, technical and social benefit.

**Center for Ethics**

Director: Robin S. Dillon, Ph.D. (https://philosophy.cas2.lehigh.edu/content/rsd2)

Email: rsd2@lehigh.edu | Phone: 610-758-3776

Website: www.ethicscenter.cas2.lehigh.edu

Supported by the Office of Interdisciplinary Programs, 610-758-3996; incasip@lehigh.edu

Williams Hall, 31 Williams Drive

The interdisciplinary academic Center for Ethics promotes rigorous inquiry into, probing reflection on, and responsible engagement with the ethical dimensions of life from the personal to the global.

Ethics has to do with issues of action, character, and governing values, with questions about right and wrong, good and evil, worthiness and unworthiness, justice and injustice, with matters of individual and collective responsibility, respect and discrimination, war and peace, and with the norms, habits, and systems that make the persons we are, the lives we live, and the societies in which we live together, better or worse. Ultimately, ethics concerns how we ought to live, individually and collectively. Ethical concepts, issues, questions, norms, and systems can be studied philosophically, psychologically, sociologically, anthropologically, historically, politically; ethical inquiry engages the natural and applied sciences and engineering and addresses concerns in economics and business; ethical questions are explored in religion and literature and through artistic expression.

The Center's organizing perspective is that there is no aspect of human beings, no space in human lives, that does not have ethical dimensions —our intrapersonal lives, our interpersonal relations, as well as the educational, professional, familial, social, cultural, religious, artistic, political, economic, environmental, scientific, and global dimensions of our lives together. The ethics domain thus encompasses all aspects of Lehigh University.

**Research and Educational Activities**

The Center for Ethics, which serves the entire Lehigh community, has three principal aims:

- Enhance student engagement with ethical issues and ethical decision-making
- Foster research in ethics and ethical issues
- Promote public ethics education

The Center functions in two ways. First, it provides resources to support, coordinate, and expand existing ethics-related educational and research activities and programs at Lehigh, thus highlighting and promoting the wide-range of opportunities to engage with ethical issues across the university and in the wider community.

Second, the Center focuses attention on vital but difficult questions and creates new opportunities for engagement with ethical issues in the following ways:

- Bringing to campus ethics leaders from academia, business, civic organizations, government, through the Peter S. Hagerman '61 Lecture in Ethics series;
- Supporting and enhancing curricular, co-curricular, and research opportunities for undergraduate and graduate students in every discipline to develop and apply intellectual tools that will enable them to identify, understand, and deliberate well about ethical issues;
- Nurturing cutting-edge research and scholarship, especially interdisciplinary work, that addresses both current ethical challenges and enduring moral questions;
- Organizing thought-provoking and penetrating explorations of, and informed and unbiased discussions about, the most important ethical problems of our times;
- Taking a major role in fulfilling Lehigh's responsibility to be a leader in public education about ethical issues and approaches to addressing them, and providing a resource of ethics expertise to the wider community.

The Center for Ethics engages with the connections and challenges of the multiplicity of ethical worldviews on our campus, in our communities and nation, and globally and cross-culturally. The Center thus serves to advance the study and practice of ethics; enrich the quality of understanding of, discussions about, and deliberation and decision-making concerning moral questions, issues, and problems; assist students to become engaged, ethically sensitive citizens who are well-prepared to grapple with the difficult life-choices and ethical challenges they face at Lehigh and will face after graduation; and catalyze ethical leadership.

**Center for Photonics and Nanoelectronics (CPN)**

Web: www.lehigh.edu/cpn

Locations: Sinclair Laboratory (7 Asa Drive, Bethlehem, PA 18015) and Sherman Fairchild Laboratory (16A Memorial Drive East, Bethlehem, PA 18015)

**Center Director:**

Nelson Tansu (ECE), CPN Director & Daniel E. ’39 and Patricia M. Smith Endowed Chair Professor

Office: Sinclair Laboratory Room 205; Phone: (610) 758-2678; Email: Tansu@Lehigh.edu

**Core Faculty:**

Nelson Tansu (ECE), CPN Director & Daniel E. ’39 and Patricia M. Smith Endowed Chair Professor; Michael J. Stavola (Phys), Sherman Fairchild Chair Professor; Filbert J. Bartolli (ECE), Chandler Weaver Chair Professor; Volkmar Dierolf (Phys), AGT Distinguished Professor; Himanshu Jain (Mat Sci), Diamond Distinguished Chair Professor; Ivan Biaggio (Phys), Full Professor; Yujie Ding (ECE), Full Professor; Miltiadis Hatalis (ECE), Full Professor; James C. M. Hwang (ECE), Full Professor; H. Daniel Ou-Yang (Phys), Full Professor; Slava V. Rotkin (Phys), Full Professor; Svetlana Tatic-Lucic (ECE), Full Professor; Jean Toulouse (Phys), Full Professor; Xuanhong Cheng (Mat Sci), Associate Professor; Jonathan J. Wiener (ECE), Associate Professor; Yevgeny Berdichevsky (ECE), Assistant Professor; Mark Chen (Chem), Assistant Professor; Heath M. Jaeger (Chem), Assistant Professor; Sushil Kumar (ECE), Associate Professor; Chao Zhou (ECE), Assistant Professor; Siddha Pimputkar (MSE), Assistant Professor; Zakya H. Kafafi (ECE), Adjunct Professor

**Affiliated Faculty:**

Helen M. Chan (Mat Sci); James F. Gilchrist (Chem Eng); Brandon A. Krick (Mech Eng); Kai Landskron (Chem); Yaling Liu (Mech Eng);
The Center for Photonics and Nanoelectronics (CPN) at Lehigh is a center formed from the merger of two long standing centers (Center for Optical Technologies / COT, and Sherman Fairchild Center for Solid State Studies / SFC). Both SFC and COT has long history of innovation and scientific advances tracking back to the late 1970s and early 2000s, respectively. The merged center CPN inherits the faculty (diverse expertise and core technical backgrounds), students, facilities, resources, reputation, history, and legacy (faculty alumni and student alumni connections) of both Center for Optical Technologies (COT) and Sherman Fairchild Center (SFC). The success of the former Center leaderships in establishing both COT and SFC as the leading programs in photonics and solid state electronics, respectively, has provided a solid foundation for the CPN leadership to advance further in advancing and integrating the science and technologies of photonics and nanoelectronics. The CPN is entrusted with a substantial resource, which is used for initiating and integrating new initiatives, as well as enabling facility operational and graduate students fellowship. Additional information is available: www.lehigh.edu/cpn

Faculty Expertise
The Center for Photonics and Nanoelectronics (CPN) at Lehigh has more than 25 highly-research active tenure-track / tenured faculty members spanning 4 different departments (Electrical and Computer Engineering, Material Sciences Engineering, Physics, and Chemistry). The investments in multiple faculty hiring, new facility enhancement, and targeted research-education areas within the CPN result in the significant built-up in the activities in the enabling technologies and sciences for addressing new application directions. These faculty worked in collaborative manner to build large cluster of collaborations in the broad areas of photonics / optoelectronics / nanoelectronics.

PhD Research and Graduate Program
The CPN’s central mission is to produce first-rate and highly-competitive PhD graduates in the fields of photonics, optoelectronics, and nanoelectronics, and applications of these core technologies [energy, medical, communications, and environments]. The CPN has produced more than 70 PhDs in engineering and applied sciences during the past decade, and 8 of our (graduate student / faculty) alumni had been elected as members of the Academies. Significant research activities exist within the Center for Photonics and Nanoelectronics at Lehigh (www.lehigh.edu/cpn), and the current strengths span from III-Nitride and compound semiconductor technologies, organic based electronics and photonics, bio-related materials and devices, nonlinear optics, plasmonic and metamaterials, and flexible photonics technologies.

Integrated Nanofabrication and Cleanroom Facility
The CPN operates the integrated nanofabrication and cleanroom facility at Lehigh. The Integrated Shared Facility provides tremendous access for MOCVD epitaxy, cleanroom fabrication, nanofabrication, packaging capabilities, and device characterizations / measurements for photonics / optoelectronics / nanoelectronics devices. The Integrated Facility is run by a set of highly accomplished technical staff, and the access to this facility is available for faculty at Lehigh, faculty from other universities, and industrial users. The details of such facility is available at: http://www.lehigh.edu/~incpn/research/facilities/index.html

Collaboration – Universities, National Laboratories, and Industry
The CPN faculty actively seeks to collaborate on groundbreaking research work with external faculty members, partners in national laboratories, and partners in industry. The broad topics of pursued within CPN in photonics, optoelectronics, and nanoelectronics areas provide opportunities to develop complementary research from basic sciences, materials, devices, integrated systems, and applications. The attractive industrial membership program in supporting research at Lehigh is also available.

Developing Urban Educational Leaders (CDUEL) (The Center for)

111 Research Drive; 610-758-6093
www.lehigh.edu/education/cdue/
technologies that may be used in applications such as catalysis and photocatalysts for the hydrogen economy, photovoltaics and solar cells, and membrane separations. In the environmental area, in addition to seeking novel particle technology for contaminant remediation in water, tailor-made colloidal particles with desirable surface properties, should provide model systems for fundamental insight into surface phenomena, relationships between bacterial adhesion to a surface and cellular bioenergetics, and bacterial transport through unsaturated porous media. Similarly, model porous media constructed by engineered particles could benefit research on the sources, fate and transport of bacteria in the environment, new water treatment technologies for developing countries, and alternative water disinfection technologies.

Research support for institute activities is obtained from industrial organizations through their membership in the Emulsion Polymers Industrial Liaison Program as well as government agencies. Hence some considerable effort is made to relate the research results to industrial needs. Consequently, graduates can find excellent opportunities for employment.

EDUCATIONAL OPPORTUNITIES

Graduate students in the Institute undertake dissertation research leading to the master of science or doctor of philosophy degree in existing science and engineering curricula or in the Center for Polymer Science and Engineering. Programs of study are tailored to meet the individual needs of each student and considerable flexibility is permitted in the selection of courses and a research topic. Educational and research opportunities exist for postdoctoral scholars and visiting scientists as well as resident graduate students. In addition, the institute holds a short course each June, “Advances in Emulsion Polymerization and Latex Technology” that typically attracts a number of industrial participants as well as EPI students and is an excellent opportunity to interact with industrial scientists and engineers.

For more information, write to H. Daniel Ou-Yang, Emulsion Polymers Institute, Iacocca Hall, Lehigh University, 111 Research Drive, Bethlehem, PA 18015. Please visit our web site at http://www.lehigh.edu/~inemuls/epi/ for further details.

Energy Research Center

117 ATLASS Drive; 610-758-4090

The mission of the Energy Research Center is to find solutions to national and global energy and energy-related problems by collaborating with federal, state and local agencies, energy businesses, technology developers and suppliers, the research community and academic institutions. The Energy Research Center accomplishes this mission through its continued commitment to innovative research and development, while recognizing the important link between energy and the environment. Originally founded in 1972, the Center brings together faculty and professional staff within Lehigh University to conduct research, foster partnerships between government and industry, provide funding, research and educational opportunities to university graduate and undergraduate students, and promote international research collaboration.

ENERGY RESEARCH

ENERGY RESEARCH

Research within the Center falls into five major categories. Projects of interest include:

Energy Conversion/Power Generation

This research program area has several components. The largest focuses on the equipment and processes used in large fossil-fired electric power plants, with research on methods of improving power plant conversion efficiency, of reducing emissions of carbon dioxide and of other gaseous pollutants, and of reducing the cost of generating electricity. Other projects deal with topics such as fuel cell conversion systems, capture of carbon dioxide, treatment and reuse and decarbonization of the fossil power industry, and renewable energy, including energy storage.

Energy-Related Environmental Research

The Center’s environmental research program deals with air pollution, solid waste, and ground water contamination issues resulting from power generation and energy conversion activities; reduction of amounts of fresh water required for power plant cooling and wastewater treatment and reuse.

Energy-Related Materials Research

This focus area considers materials issues in the energy field. Examples include high temperature coatings for boiler tubes, welding processes for new alloys, containment vessels for nuclear waste materials, component life prediction, and development of catalysts for pollution control. Energy Conservation and Renewable Energy. The Center’s research program in energy conservation deals with reducing energy use in manufacturing and with the development of high efficiency electric motors. Renewable energy research focuses on utilization of biomass materials as fuels.

Basic Energy Sciences

Faculty and students in engineering and science also carry out research to improve our understanding of the basic phenomena that underlie the knowledge base required for developing new and improved energy technologies.

Educational Opportunities

The Center’s research programs provide opportunities for graduate students interested in working in the energy area. Most of the departments in the College of Engineering and Applied Science, as well as several departments within the College of Arts and Sciences, are active in energy research and offer both masters and doctoral degree programs suitable for studies of energy-related topics.

All degrees are granted by the academic departments and graduate students interested in energy enroll in traditional graduate degree programs in departments of their choice. These students specialize in energy by complementing their programs with a selection of energy-related courses. They pursue their graduate research in energy areas under the supervision of faculty from the Energy Research Center or from other research centers or academic departments.

Financial support for graduate students is available through fellowships and research assistantships.

OUTREACH AND INDUSTRIAL LIAISON ACTIVITIES

The Center’s Energy Liaison Program is a mechanism for providing consulting and problem-solving to member companies. The Liaison Program also provides opportunities for involving industry in sponsored research projects.

ADDITIONAL INFORMATION

For more information, write to Dr. Carlos E. Romero, Director, Energy Research Center, Lehigh University, 117 ATLASS Drive, Bethlehem, PA 18015, or e-mail at cerj@lehigh.edu (eklo@lehigh.edu). Please visit our website at www.lehigh.edu/energy.

Enterprise Systems Center (ESC)

The Enterprise Systems Center (ESC) was established in 1995. This multidisciplinary center is committed to providing students experiential learning and leadership development through industry value creation. ESC maintains a wide network of regional industry partner relationships to serve as a platform for course projects, summer and co-op projects and leadership immersion activities. Partnership and teaming on projects and programs is important and occurs frequently with the Department of Industrial and Systems Engineering as well as other departments and centers. The center seeks to advance interdisciplinary research and scholarship relating to analytics, information technology, new process development, sustainable manufacturing and enabling businesses to maintain global competitiveness. Additional research initiatives focus on discovering new methods for collaboration among academic, industry and government partners through the use of advanced technology. Emphasis is given to innovative systems approaches to problem-solving. Operating as one of the centers in the P.C. Rossin College of Engineering and Applied Science, the ESC is housed in Mohler Laboratory. The Enterprise Systems Center provides undergraduate and graduate students from all four colleges with the opportunity...
RESEARCH ACTIVITIES

The ESC conducts research into the development and implementation of enterprise strategies to improve the effectiveness of organizations. This research involves the utilization of systems thinking, information technology, and leadership approaches that add value to engineering education. In its applied research efforts, the Center focuses on analytics techniques, operational improvements, enterprise resource optimization, sustainable manufacturing and product development or enhancement. Operational improvement research with partner companies has included the development of decision support systems, processes for workflow analysis and facility reorganization, analysis of constraints and throughput improvement, evaluating sustainable manufacturing opportunities, agile business practices, utilization of analytics tools and creating new solutions for supply chain management. Work in enterprise resource optimization has included methodologies for business process reengineering and for the analysis and selection of Enterprise Resource Planning (ERP) systems. Applied research in product development and enhancement has included the use of computer modeling and simulation along with analysis and evaluation of existing products, and design for manufacturability and assembly support.

Involvement in these applied research activities with industry partners provides Lehigh students with hands-on learning experiences built on progressive responsibility and contribution to high-impact company projects. From these activities, students gain leadership skills and valuable industry experience.

The creation of technology-enabled educational resources augments traditional learning models. Coupled with knowledge management technology, these resources create integrated learning experiences and materials to support engineering courses. The ultimate objective is to identify key components of innovative behavior and develop the educational methods necessary to transfer to students the skills and experiences that will prepare them for leadership roles in society.

The Enterprise Systems Center houses laboratories and initiatives that enhance the overall center mission stated as follows: “The ESC is committed to helping students learn, while simultaneously providing value for our clients. We believe that our research should be driven by industry needs and enabled by close partnerships and collaboration.”

The newly established ESC Advanced Analytics Laboratory provides increased workspace and resources for industry projects and research programs. The laboratory supports a program structure designed to increase awareness, understanding and implementation skill development of a broad spectrum of analytics tools and techniques.

Within the ESC is the Learning Collaboratory, an innovative educational environment designed to promote inquiry-based and competency-driven experiential learning. It enriches the classroom lectures with practical experience through industry partner interactions. The Collaboratory supports team learning, action learning, and the application of technology to augment traditional educational resources.

EDUCATIONAL OPPORTUNITIES

The ESC provides support for courses in the analysis and design of manufacturing systems, decision support systems (DSS), computer graphics (CAD), computer integrated manufacturing (CIM), industrial engineering techniques, analytics, experimental projects in industrial engineering, and leadership development. These courses are offered through the Industrial and Systems Engineering department. The ISE senior project class utilizes ESC facilities and a video teleconferencing system to step beyond the traditional classroom experience in the preparation and presentation of its culminating presentation.

The ESC is continuously developing new programs as part of its Leadership Initiative. ESC has founded and is home to the engineering leadership minor, the leadership development course (IE382) was recently named as one of the top curriculum innovations by the Institute of Industrial Engineers. The Lehigh Chapter of the National Society of Leadership and Success and the Innovation and Leadership Residency Club are also managed as part of the Enterprise Systems Center operation.

Participation in industry partner projects is open to all Lehigh students, both undergraduate and graduate, regardless of academic major, based on an interview process.

For more information, contact Dr. Emory W. Zimmers, Jr., Director, Enterprise Systems Center, Lehigh University, Mohler Lab, Second Floor, 200 West Packer Avenue, Bethlehem, PA 18015 (ewz0@lehigh.edu) or visit our website http://www.lehigh.edu/~inesc/

Global Islamic Studies, Center for

Program Director: Robert Roehnthal, Ph. D. (Duke)
Email: ror2@lehigh.edu  |  Phone: 610-758-5695
Website: http://cgis.cas2.lehigh.edu

Supported by the Office of Interdisciplinary Programs, 610-758-3996; incasip@lehigh.edu

Williams Hall, 31 Williams Drive

Core Faculty
Taleb Berrada, PhD (Department of Modern Languages and Literatures); Nandini Deo, PhD (Department of Political Science); Khurram Hussain, PhD (Department of Religion Studies); Allison Michel, PhD (Department of Sociology and Anthropology); Ugur Pece, PhD (Department of History); Michael Raposa, PhD (Department of Religion Studies); Robert Roehnthal, PhD (Department of Religion Studies); and Bruce Whitehouse, PhD (Department of Sociology and Anthropology)

The Center for Global Islamic Studies (CGIS) is an intellectual community committed to the interdisciplinary study of Islamic civilization. The Center was established at Lehigh in 2009 with the generous support of the Andrew W. Mellon Foundation. Cutting across numerous academic disciplines and departments, CGIS supports the academic exploration of the diverse cultures and rich historical legacy of the Muslim world—from its roots in Abrahamic prophecy and Greek philosophy, to its long interaction with the West and profound impact on global culture, trade, art and architecture, literature, politics, philosophy, science and religious life, from Morocco to Malaysia to Bethlehem, Pennsylvania.

CGIS promotes teaching and research designed to take Islamic Studies into and beyond the classroom by offering students, faculty and the broader community a variety of forums for dialogue, debate and experiential learning. The Center’s intellectual core is distinguished by three distinct signatures:
• an integrated undergraduate academic program that provides Lehigh students with multiple outlets to encounter the diversity and dynamism of global Islam
• a comparative, interdisciplinary approach to Islamic studies that goes beyond narrow geographic areas and political issues to explore the broader landscape of Islamic civilization, both past and present
• the translation of theory into practice, linking rigorous scholarship on the Muslim world to direct, practical, hands-on learning beyond the boundaries of the Lehigh campus

RESEARCH ACTIVITIES

With seed funding from the Mellon Foundation and ongoing support from the Provost’s Office, CGIS promotes faculty and student research projects in interdisciplinary, comparative Islamic Studies.

EDUCATIONAL OPPORTUNITIES

The launch of the Center for Global Islamic Studies is a pivotal component in the continued expansion of the undergraduate educational experience at Lehigh University. Drawing on the university’s experience in building interdisciplinary programs, its institutional commitment to
international education, and its substantive relationships with numerous Muslim partners both in the Lehigh Valley and internationally, the Center for Global Islamic Studies plays a central role in the university's mission to provide Lehigh's students with transformative learning experiences that cross academic disciplines and broaden horizons on today's globalized world.

**Goodman Center for Real Estate**

**Director:** S. McKay Price  
**Assistant Director:** Shannon Smith

The Goodman Center for Real Estate was established in 1988 through a major gift from Murray H. Goodman, 48. The center is a self-supporting, interdisciplinary unit of the College of Business. The center promotes real estate studies in a variety of ways including scholarly research, engagement with practitioners in the real estate field, and coursework in real estate and real estate finance.

**Research Activity**

Knowledge generation and dissemination are at the heart of what we do. While this takes many forms, faculty scholars are actively engaged in intellectual discovery and regularly publish in the top academic real estate journals. Their work has been widely cited and incorporated into both real estate curricula and the practice of industry professionals. Additionally, real estate faculty frequently conduct peer-reviews of other scholars' work as well as serve on editorial boards and in academic real estate societies. Not only does this contribute to the real estate discipline broadly, but it solidifies the academic reputation of the Goodman Center and ensures the faculty are on the cutting edge of the field.

The center also supports interdisciplinary faculty, graduate, and undergraduate students with research interests in real estate. Funding possibilities include research grants, data acquisition, travel, and administrative support.

**Industry Outreach & Interaction**

The center supports a continuing series of seminars and presentations (https://cbe.lehigh.edu/centers/goodman-center-for-real-estate/events) by academics, real estate executives, and a wide array of industry practitioners. The center also sponsors property/site tours and networking events. Moreover, Lehigh’s proximity to major real estate markets enables the center to engage the practitioner community in a variety of joint projects. For example: Sponsored research projects; Continuing education programs and short courses; and, Special conferences and events of national and regional interest.

**Educational Opportunities**

The center serves as the administrative home of the real estate minor (https://cbe.lehigh.edu/academics/undergraduate/degree-programs/real-estate-minor). The program is open to undergraduate students from all majors and colleges. Additionally, graduate students may take real estate course offerings at the 300-level or higher. All classes are part of an innovative curriculum with hands-on experiences that enable students to expand their knowledge and prepare for real estate careers.

Coursework provides ample opportunity for students to engage with both academic faculty and industry practitioners as they dig into case studies, leading industry modeling applications, and other “real world” projects. Our large and growing alumni base of highly accomplished real estate professionals, parents, and friends of Lehigh enthusiastically serve as role models, sounding boards, and mentors to our students.

**Contact**

Shannon Smith  
goodmancenter@lehigh.edu

**Humanities Center**

Committee: Suzanne M. Edwards, English and Director Humanities Center; Thomas Chen, Modern Languages and Literatures; Mary Foltz, English; Khurram Hussain, Religion; Melpomene Katalakos, Theatre; Chad Kautzer, Philosophy; David M. Kramp, English; Olivia Landry, Modern Languages and Literatures; Monica Miller, Religion; Monica Najar, History; Lindsey Reuben Muñoz, Modern Languages and Literatures; Nicholas Sawicki, Art, Architecture and Design; Amardeep Singh, English; Maria Bárbara Zepeda Cortés, History

The humanities consider how we understand and record human experiences. Encompassing a wide range of disciplines including philosophy, history, literature, religion, visual arts, music, and language, humanistic study teaches us how to think creatively and critically about our own identities and our connections to others—whether they live across the street or across the world, whether they lived long ago or will live in the futures we imagine. The Humanities Center at Lehigh University is thus vital for building community both on and beyond our campus. The Humanities Center creates interdisciplinary intellectual opportunities for students, faculty, and staff engaged in humanistic inquiry across departments and programs. Through speaker series, reading groups, conferences, an undergraduate research journal, research grants, and informal gatherings, the Humanities Center fosters a broad community rooted in vibrant, rigorous, and creative inquiry into what it means and has meant to be human. The Humanities Center has designed an annual speaker series on a theme, hosted scholars, writers, artists, and activists to speak on a single issue and organized year-long faculty seminars to address specific intellectual topics. Recent themes have included Home, Movement, Contagion, Speaking Bodies, and the Posthumanities.

**RESEARCH ACTIVITIES**

The Humanities Center fosters interdisciplinary research activity in several ways. Faculty, graduate students, and undergraduates may apply for funding to support reading groups, colloquia, conferences and visiting speakers. Graduate students may apply for modest financial support to enable them to travel to present research at academic conferences. The center sponsors a works-in-progress series, which fosters dialogue about ongoing research projects in the humanities. Summer, Individual and Collaborative Research Grants are available for faculty and graduate students. The objective of these grants is twofold:

1. to strengthen the intellectual community of Lehigh’s scholars in the Humanities and
2. to provide support for faculty to pursue a humanistic research project or creative activity and for graduate students to finish their dissertations.

**EDUCATIONAL OPPORTUNITIES**

The Humanities Center hosts and sponsors the production of the Lehigh Review, an undergraduate research journal founded in 1992 by the Lehigh humanities faculty. Original articles range in topic and subject across the spectrum of undergraduate study, from English to Economics and Physics. Published annually, the entire publication process—from reviewing submissions to editing to design and illustration—is handled almost exclusively by undergraduate students and supervised by a graduate student instructor. The Humanities Center also hosts a wide range of informal activities to create a lively, unstructured humanistic community.

For more information visit the Humanities Center website http://humanitiesctr.cas2.lehigh.edu/ or contact the Director, Suzanne Edwards at the Humanities Center, 224 West Packer Avenue, Bethlehem, PA 18015 or by email at sme6@lehigh.edu.

**Institute for Interactivist Studies**

Interactivism is a philosophical and theoretical approach to modeling multiple biological, mental, and social phenomena. It is attracting interest from scholars and researchers around the world. For a general description, see: http://www.lehigh.edu/~mhbo/InteractivismManifesto.pdf

The primary functions of the Institute for Interactivist Studies are:

1. to build on the growing interest in the model,  
2. to promote interactivist research,  
3. to give Lehigh greater visibility within this wider community of people involved in the interactivist research program.

The primary focus of the Institute is the sponsoring of Summer Institutes on Interactivism. We have organized eight International Summer Institutes: 2001 at Lehigh; 2003 in Copenhagen; 2005 at Clemson University; 2007 in Paris; 2009 in Vancouver; 2011 in Syros, Greece; 2013 at the University of South Florida in Tampa, FL; and 2015 at
Bilkent University in Ankara, Turkey. These have attracted philosophers, psychologists, biologists, roboticists, and linguists from more than twenty countries.

The Institute also:
1. sponsors the Interactivist Forum, an email discussion group which currently has about 140 members from some 25 countries,
2. sponsors an institute web site — http://www.lehigh.edu/~interact/index.html,
3. encourages and sponsors visiting scholars, and
4. encourages collaborative work — we currently have about half a dozen publications co-authored by institute affiliates, and special issues on Interactivism in two journals are in press or planned.

For more information, contact Mark Bickhard, Director, mhbb0@lehigh.edu.

International Materials Institute for New Functionality in Glass

7 Asa Drive. 758-4217. www.lehigh.edu/imi

Himanshu Jain, Eng.Sc.D., Director
Lehigh’s International Materials Institute for New Functionality in Glass (IMI-NFG) was founded in 2004 on a program by the same name and sponsored by the National Science Foundation under an initiative to advance materials research globally by enhancing coordinated international collaboration between U.S. researchers and educators and their counterparts worldwide. The Institute’s long term goal is the creation of a worldwide network in glass research for new applications, and the development of a new generation of scientists and engineers with enhanced international leadership capabilities. Specifically on campus, it promotes new activities in glass research through international and national collaborations, and the development of new approaches to the education of glass. Faculty and students from various Departments of Rossin College of Engineering and Applied Science, and College of Arts and Sciences participate in its activities listed below.

Half of the 20 most significant inventions of the 20th century, as identified by the National Academy of Engineering, would not have materialized without glass. The solutions to 12 of the 14 grand engineering challenges of this century depend on the availability of glass either as a support material or as an active component for sensing, information storage, treatment delivery, etc. The discovery of new phenomena, along with continually improving properties and processing methods, will keep glass at the cutting-edge of technology. Unfortunately, in recent decades glass education has fragmented materialized without glass. The solutions to 12 of the 14 grand challenges listed below.

GLASS EDUCATIONAL MATERIAL

Development of Educational Material such as video DVDs and hands-on demonstrations by the leading international glass experts to promote the understanding of glass at all levels. A variety of over 300 video tutorial lectures and overviews of the latest progress is available via Internet to interested students without charge. For example, a full semester course on Optical and Photonic Glasses consisting of 39 lectures is accessible from IMI-NFG’s web site. The teachers at Lehigh and other universities and colleges will find this collection a useful resource for their lectures. Professionals in industry can learn the subject by studying these lectures.

For more information, contact Prof. Himanshu Jain, Director, International Materials Institute for New Functionality in Glass, Lehigh University, Sinclair Lab 120, 7 Asa Drive, Bethlehem, PA 18015. (Tel: 610-758-4217). Web site: www.lehigh.edu/imi or e-mail imi@lehigh.edu.

Lawrence Henry Gipson Institute for Eighteenth-Century Studies

Co-Director: Lyndon Dominique, Ph.D.
Email: lyd211@lehigh.edu ( lyd211@lehigh.edu) | Phone: 610-758-3334

Co-Director: Michelle LeMaster, Ph.D
Email: mil206@lehigh.edu ( mil206@lehigh.edu) | Phone: 610-758-3358

Website: http://www.lehigh.edu/~ihngi

Supported by the Office of Interdisciplinary Programs, 610-758-3396; incasip@lehigh.edu

Williams Hall, 31 Williams Drive

Gipson Council: William Bulman, PhD (Department of History); Marie-Helene Chabut, PhD (Department of Modern Languages and Literatures); Patrick Connolly, PhD (Department of Philosophy); Elizabeth Dolan, PhD (Department of English); Lyndon Dominique, PhD (Department of English); Scott Paul Gordon, PhD (Department of English); Michelle LeMaster, PhD(Department of History); Monica Najjar, PhD (Department of History); John Savage, PhD (Department of History); Maria Bárbara Zepeda-Cortés, PhD (Department of History)

The Lawrence Henry Gipson Institute for Eighteenth-Century Studies was established in 1971, to honor one of America’s most distinguished scholars, who served as a long-time member of the faculty at Lehigh. Gipson’s monumental life work, The British Empire Before the American Revolution (15 volumes) was written between 1936 and 1970. Gipson received the Pulitzer Prize in History in 1962 for Volume 10, subtitled, The Great War For Empire. When he died in 1971, Professor Gipson left his entire estate to Lehigh and provided the original endowment for the institute.

RESEARCH ACTIVITIES

The income from the endowment of the institute is used to encourage faculty and student research in the eighteenth century by providing grants to defray travel costs, copying, and other expenses to permit scholars to visit necessary libraries and depositories. The Gipson Institute normally awards one fellowship annually to a Ph.D. candidate enrolled at Lehigh University for dissertation research and writing in any field of eighteenth-century studies. The institute also helps provide additional resources to build the university library’s research collections in eighteenth-century studies.

EDUCATIONAL OPPORTUNITIES

The institute invites leading scholars to give lectures and supports relevant programs such as interdisciplinary seminars and visiting scholars interested in the eighteenth century. Occasional symposia honor Professor Gipson by bringing to campus distinguished scholars to lecture and discuss various topics. The essays generated at the symposia have been published and the institute maintains a continuing close relationship with Lehigh University Press for publishing original manuscripts on the eighteenth century.

Loewy Institute

Loewy Institute (formerly Institute for Metal Forming) 5 E. Packer Avenue; 758-4252

Wojciech Z. Misiolek Sc.D. director, John Coulter, Ph.D., John DuPont, Ph.D., Scott Gariggen, Ph.D., Christopher Marvel, Ph.D. Laura Moyer, Ph.D., Michael Rex, Brian Slocum, Wojciech J. Stepiowski, Ph.D., Masashi Watanabe Ph.D.

The Loewy Institute continues tradition of the Institute for Metal Forming, which was established in 1970 to teach the principles and applications of metal forming technology to graduate and undergraduate students, to provide instructions and equipment for graduate research in metal forming processes, and to assist industry with solutions to problems in metal forming.
The main objective of the institute’s research is to conduct cross-disciplinary process engineering studies to better understand and control manufacturing processes and their impact on the microstructural response of a material. The material microstructure developed during processing is responsible for physical properties of the material. Recently, classical metal forming research has been expanded to include projects in powder processing including additive manufacturing, microstructure characterization and analysis, as well as forming and processing technologies for polymers, glasses, and ceramics.

The study of the forming processes encompasses physical and numerical modeling; simulation of microstructure response to process parameters. Computer enhanced analysis of material flow also allows us to optimize tooling design in many manufacturing processes. The combined quantitative results of these techniques may then be compared with experimental data obtained from instrumented metal forming laboratories (such as those maintained at the institute), or from our research partners in industry.

RESEARCH ACTIVITIES
Current research areas include: deformation and processing of metals, metal and ceramic powders, glasses, polymers, light-optical and electron-optical micro-texture characterization, tooling design and tooling materials, thermo-mechanical processing of metals, rapid prototyping and rapid tooling aka additive manufacturing, and machinability of the sintered powder materials. Additionally new research projects have been initiated in development of materials for medical and energy applications.

EDUCATIONAL OPPORTUNITIES
Students interested in metal forming should refer to course offerings in the departments of materials science and engineering, mechanical engineering and mechanics, and industrial and manufacturing systems engineering.

For more information contact Wojciech Z. Misiolek, Institute for Metal Forming, 242 Whitaker Laboratory, Lehigh University, 5 East Packer Avenue, Bethlehem, PA 18015

Martindale Center for the Study of Private Enterprise

Main Office: Rauch Business Center, Suite 350 / 621 Taylor Street / 610.758.4771

Current Faculty: Todd A. Watkins, Ph.D., Executive Director, and Director of the Microfinance Program; Judith McDonald, Ph.D., Associate Director, and Director of the Canadian Studies Institute; Jesus M. Salas, Ph.D., Director of the Family Business Institute; Andrew Ward, Ph.D., Associate Director.

Faculty Emeriti: J. Richard Aronson, Ph.D., founding Director; Robert J. Thornton, Ph.D., former Associate Director and Editor of Martindale Publications.

Affiliated Faculty: Martindale Student Associates Honors Program Mentors: Stephen H. Cuthcliffe, Ph.D.; Vera Fennell, Ph.D.; Nandkumar (Nanu) Nayar, Ph.D.; Catherine M. Ridings, Ph.D.; Richard N. Weisman, Ph.D.; George P. White, Ph.D.

Staff: Janice Johnston Howie, Martindale Program Director; Melissa Gallagher, Administrative Coordinator.

Founded in 1980 thanks to a generous endowment from Elizabeth Fairchild Martindale and Harry Turner Martindale ’27, the Martindale Center for the Study of Private Enterprise is an interdisciplinary resource in Lehigh University’s College of Business. The Center engages students, faculty, and the business and policy communities in active inquiry tackling questions central to understanding and fostering sustainable private enterprises and inclusive economic systems throughout the world.

Each year since 1980, the Martindale Student Associates Honors Program has enabled a select group of the very best Lehigh juniors and seniors, from disciplines across the entire university, to actively explore global business and economic issues through research travel to organizations around the world, and interviews and meetings with decision makers, distinguished executives, and scholars. Students’ original research is published in the Center’s academic journal, Perspectives on Business and Economics (https://preserve.lehigh.edu/cbe-martindale). The program is the flagship of the Martindale Center and a hallmark of Lehigh’s commitments to student engagement, research excellence, and globalization.

Martindale’s Microfinance and Microenterprise Program, launched in 2005, advances understanding of the development and impact of microfinance locally and globally. It comprises a broad range of activities including faculty research, undergraduate and graduate student research, academic-industry initiatives, workshops and conferences, opportunities for field immersion in the US and abroad, and a community lending practicum and internships for students.

Martindale’s Canadian Studies Institute was established in 1984. It promotes understanding of Canadian economic and political issues by supporting topics of mutual interest to US and Canadian faculty, and by bringing Canadian speakers to campus.

Established in 2016, the Family Business Institute seeks to provide high-quality educational experiences, backed by world-class research, to assist families in managing, growing, and developing their businesses, and researchers exploring challenges unique to family business. The Institute pursues its mission through research programs, executive education initiatives, workshops, and activities that engage Lehigh students with family businesses, including internships and support for courses.

The Martindale Center produces a range of scholarly publications and provides sponsorship and support for faculty research, lectures, conferences, and visiting scholar and executive-in-residence programs.

Contact Us: Martindale Center for the Study of Private Enterprise Rauch Business Center, Lehigh University College of Business 821 Taylor Street, Bethlehem, PA 18015 Executive Director: Todd A. Watkins 610-758-4954 / tw4@lehigh.edu Martindale Program Director: Janice Johnston Howie 610-758-4492 / jah205@lehigh.edu Martindale Program Director: Judith A. MacDonald 610.758.5345 / jdm0@lehigh.edu Family Business Institute Director: Jesus Salas 610-758-4488 / jms408@lehigh.edu Administrative Coordinator: Melissa Gallagher 610-758-4771 / mmg314@lehigh.edu Website: https://cbe.lehigh.edu/martindale

Philip and Muriel Berman Center for Jewish Studies

Director: Hartley Lachter, Ph.D. (New York University) (http://religion.cas2.lehigh.edu/content/dr-hartley-lachter)

Email: inber@lehigh.edu | Phone: 610-758-3996

Website: http://cjs.cas2.lehigh.edu

Supported by the Office of Interdisciplinary Programs, 610-758-3996; incasip@lehigh.edu

Williams Hall, 31 Williams Drive

Core Faculty
Jodi Eichler-Levine, Ph.D.(Department of Religion Studies); Hartley Lachter, Ph.D. (Department of Religion Studies; Nitzan Lebovic, Ph.D. (Department of History); Roslyn Weiss, Ph.D. (Department of Philosophy); Ben Wright, Ph.D. (Department of Religion Studies)

Emeritus Faculty
Laurence J. Silberstein, Ph.D. (Department of Religion Studies) and Lenore E. Chava Weissler, Ph.D. (Department of Religion Studies)

The Philip and Muriel Berman Center for Jewish Studies, established in 1984, develops, administers, and coordinates a comprehensive program in Jewish studies at Lehigh University. The center is directed by Hartley Lachter, Philip and Muriel Berman Chair of Jewish Studies.

Several faculty members, including two Philip and Muriel Berman professors, teach Jewish studies classes at Lehigh. In 2007, the Helene and Allen Aptern Chair of Holocaust Studies and Ethical Values was created with the generous support of Helene and Allen Aptern ’61 and Lehigh’s College of Arts & Sciences.

Other activities of the center include designing and implementing new courses and seminars, an annual lecture series, scholarly colloquia held overseas, and academic conferences. The Berman Center also co-sponsors events with other departments and programs at Lehigh and at
Polymer Science and Engineering (Center for)

5 East Packer Avenue; 610-758-4222


The Center for Polymer Science and Engineering (CPSE) was formally established at Lehigh University in July 1988. The center provides a unique opportunity for faculty and students from the traditional departments of chemistry, chemical engineering, materials science and engineering, mechanical engineering and mechanics, and physics to perform interdisciplinary research in polymers. The center is an umbrella organization encompassing polymers research and graduate studies at Lehigh University. The center’s primary missions are preparation of first-rate scientists and engineers with proficiency in polymers, fostering cross-disciplinary polymer research, organizing and teaching continuing education short courses in areas of interest to the polymer industry; and organizing campus wide seminars.

The Polymer Science and Engineering (PSE) Graduate Program was established in 1975, when Dr. John A. Manson requested authorization to institute a graduate degree program in polymers. CPSE’s Polymer Education Committee currently coordinates the PSE graduate program through the participation of academic departments. PSE offers a graduate certificate as well as several graduate degrees: Master of Science, Master of Engineering, and Doctor of Philosophy in Polymer Science and Engineering. Students may also elect to pursue studies towards a classical degree in their respective departments with an emphasis in polymer courses and research. Both advanced undergraduate and graduate courses in polymer science and engineering are offered through the participating departments. Current course offerings include physical polymer science, organic polymer science, mechanical behavior of polymers, rheology, polymer processing, emulsion polymers, polymer blends and composites, colloid science, and polymer interfaces.

Research Activities

The center has a wide range of research activities covering the field of polymers. The following are the major research themes: emulsion polymerization and latex characterization, surface/interfacial aspects of polymer colloids, polymer adhesion, polymer blends, polymer matrix composites, melt processing of polymers, and polymers for microelectronic packaging.

Research Facilities

The following research instrumentation is available for the Center for Polymer Science and Engineering: X-Ray Photoelectric Spectroscopy (ESCA), Scanning Auger Electron Spectroscopy, Laser Raman Spectroscopy, Mossbauer Spectroscopy, Nuclear Magnetic Resonance Spectroscopy of both solids and solutions (NMR) (3 instruments; 90 MHz, 300 MHz and 500 MHz), Fourier Transform Infrared Spectroscopy (FTIR) (both conventional and photo- acoustic), a variety of advanced transmission and scanning electron microscopes, modulated differential scanning calorimetry, hi-res-thermogravimetric analysis, instruments for rheological studies (including a TA Instruments Dynamic Hybrid Rheometer), particle sizing instruments (Coulter N4M, Joyce-Loebl Disc Centrifuge, Capillary Hydrodynamic Fractionation, and Hydrodynamic Chromatography), Gel Permeation and Gas Chromatography units, Electrophoretic Mobility apparatus, mechanical testing machines, and Polymerization Reactors, including Bottle Polymerizer, Tubular Reactor, Stirred Tank Reactors with on-line sample analysis for residual monomer and interfaced with computer for control operations.

Educational Opportunities

Programs of study for individual students are designed to meet the student’s interests, the requirements of the academic department, and the student’s dissertation committee. Considerable flexibility is permitted in the selection of courses and a research topic. Lehigh University has been awarding interdisciplinary M.S. and Ph.D. degrees in Polymer Science and Engineering since 1975 and online masters degrees since 2002. Graduate students conducting polymer research may also earn the M.S. and Ph.D. degrees in the classical fields of chemistry, chemical engineering, materials science and engineering, physics, or mechanical engineering and mechanics. For further information please refer to the Polymer Science and Engineering Graduate Program in the section: Interdisciplinary Graduate Programs.

For more information about admission to graduate school, or financial aid, contact: Dr. Raymond A. Pearson, Director, Polymer Science and Engineering Graduate Program, 5 East Packer Avenue, Bethlehem, PA 18015; (610) 758-3857 or Lisa Arechiga, Coordinator, Lehigh University, 5 East Packer Avenue, Bethlehem, PA 18015; (610) 758-4222. Please apply directly to the Polymer Science and Engineering graduate program. Please send e-mails to rp02@lehigh.edu and lia4@lehigh.edu

Promoting Research to Practice - Schools, Families, Communities (Center for)

L111 Iacocca Hall, 111 Research Drive 610-758-3267

Lee Kern, Ph.D., Director; George DuPaul, Ph.D.; Robin Hojnoski, Ph.D.; Brook Sawyer, Ph.D.

The mission of the Center for Promoting Research to Practice (CPRP) is to generate new knowledge that will truly impact the lives of individuals with or at risk for disabilities and to enhance the translation of new knowledge into practice. All too often research that is created for these individuals remains at the development level and is not disseminated into best practices. The Center is focused on conducting and disseminating applied research and assuring research outcomes get into the hands of parents and practitioners as quickly as possible.

APPLIED RESEARCH OPPORTUNITIES

The CPRP focuses on applied research that has a significant impact on the lives of individuals who have identified areas of disability or are considered at risk for developing disabilities. Research conducted through the CPRP is supported through federal grants. Projects focus on assessment and intervention in schools.

PARTNERSHIP

The Center forms and maintains partnerships at national, regional, and local levels. Several objectives are established to accomplish this goal. The CPRP assists with the development and implementation of research projects designed in local school districts and intermediate units, as well as early childhood education and intervention providers. Many school districts, particularly small and rural districts, do not have the capacity to engage in wide-scale research efforts. Yet, these districts often have very significant needs for empirically based decision making. The CPRP provides a cost effective vehicle for these districts to engage in such research efforts. Another level of partnership for the CPRP is interdisciplinary research within the University community. This objective is met through facilitating cross-college and cross-program proposals. Continuous efforts are made to invite colleagues from across departments and colleges in the University to join with faculty in the College of Education in pursuing research interests that are within the mission of the Center. Research also is conducted with colleagues across institutions.

DISSEMINATION

The CPRP is a resource for facilitating the translation of research into practice. Investigators conducting research have published the outcomes of findings in professional journals and outlets. In addition, the CPRP disseminates research findings and state-of-the-art interventions and strategies to parents, teachers, and other practitioners through our website and other dissemination activities.

LEHIGH UNIVERSITY AUTISM SERVICES

Lehigh University Autism Services is a clinic housed in the Center for Promoting Research to Practice. The mission of the clinic is to develop and disseminate research-based practices that improve the well-being of children with autism and their families and to serve the local community. The clinic provides intervention programs for young children with...
autism spectrum disorders (diagnosis to age 5) and their families. http://
wordpress.lehigh.edu/cppr/autism-services/

For more information, contact Dr. Lee Kern, Director, Center for Promoting Research to Practice, College of Education, Lehigh University, Iacocca Hall, 111 Research Drive, Bethlehem, PA 18015; 610-758-3267 or email lek6@lehigh.edu; Web site: http://
www.lehigh.edu/go/cppr.

Supply Chain Research (Center for)

Rauch Business Center, 621 Taylor St.

CENTER MISSION

The Lehigh Center for Supply Chain Research (CSCRL) bridges theory and practice to promote a collaborative exchange of ideas on critical issues affecting supply chain management. By leveraging Lehigh’s faculty, students, alumni and industry partners, the Center brings the latest developments in research and best practices together to generate new ideas for education and future knowledge in the field of supply chain management.

WHAT THE CENTER DOES

• Provides a unique, multidisciplinary approach to research, offering exciting new opportunities for innovation by integrating analytical and quantitative engineering approaches with process-driven and field-based business research.
• Conducts professional development seminars and symposiums, APICS certification courses, and executive round tables.
• Disseminates research findings through professional conferences, scholarly publications, and curriculum development.

AFFILIATED FACULTY

Zach Zacharia, Ph.D., Director,; Robert Trent, Ph.D.; Philip Coles; Saif Mir, Ph.D.; Oziás Moore, Ph.D.; Catherine Ridings, Ph.D.; Oliver Yao, Ph.D.; David Zhang, Ph.D.; Haoyan Sun, Ph.D.

For more information, contact Prof. Zach Zacharia, Director, (zgz208@lehigh.edu), Center for Supply Chain Research, Lehigh University, Rauch Business Center, 621 Taylor Street, Bethlehem, PA 18015; (610-758-5157). Web site:https://cbe.lehigh.edu/centers/lehigh-center-for-supply-chain-research

Other-University Related Centers

BEN FRANKLIN TECHNOLOGY PARTNERS OF NORTHEASTERN PENNSYLVANIA

The Ben Franklin Technology Partners of Northeastern Pennsylvania (BFTP/NEP) is headquartered in Ben Franklin TechVentures® on the Mountaintop campus and is a wholly-owned subsidiary of Lehigh. Serving a 21-county region, the Center is part of a four-member, state-funded economic development program that is an initiative of the PA Department of Community and Economic Development and is funded by The Ben Franklin Technology Development Authority. Ben Franklin frequently utilizes the faculty, students, and resources of Lehigh to accomplish its tasks.

BFTP/NEP fosters innovation to stimulate economic growth. By providing knowledge and investment resources, Ben Franklin facilitates the creation of new products, sophisticated technologies, and novel processes among entrepreneurs and established companies to help them prosper. The result: the creation and retention of highly paid, sustainable regional jobs and a strong economic climate.

The goals of BFTP/NEP include helping early-stage technology-oriented firms to form and grow, helping established manufacturers to improve productivity through the application of new technologies and practices, and promoting an innovative community-wide infrastructure that fosters a favorable business environment for high-growth companies. Founded in 1983, the Ben Franklin Technology Partners of Northeastern Pennsylvania has:

• Created and retained 55,864 jobs.
• Established 520 new companies.
• Commercialized and developed 1,935 new products and processes.

The Ben Franklin program is structured to help companies achieve sustainable competitive advantage. Statewide, new tax revenue generated because of Ben Franklin represents a 3.9-to-1 payback to the Commonwealth.

Assistance includes expertise, largely contributed in the northeast by the center’s association with Lehigh and other leading research universities, and funding, with investments ranging from $30,000 to $150,000 per year for up to three years. Faculty and students involved with Ben Franklin gain experience in solving real issues for working companies. Technical and business assistance services are provided on a year-round basis.

BFTP/NEP owns and operates Ben Franklin TechVentures, an award-winning business incubator and post-incubator facility. Sixty-nine successful companies have graduated from the BFTP/NEP incubator, grossing more than $1.2 billion in annual revenue last year and creating more than 6,900 jobs. Ben Franklin TechVentures is LEED Gold certified.

For more information, contact the Ben Franklin Technology Partners of Northeastern Pennsylvania, Ben Franklin TechVentures®, 116 Research Drive, Bethlehem; 610-758-5200; www.nep.benfranklin.org (http://www.nep.benfranklin.org); E-mail - info@nep.benfranklin.org; Twitter @benfranklinNEP; Facebook - Ben Franklin Technology Partners of Northeastern PA; LinkedIn - Ben Franklin Tech Partners NEPA.

MANUFACTURERS RESOURCE CENTER (MRC)

Founded in 1988 as a wholly owned subsidiary of Lehigh University, MRC is one of seven statewide Industrial Resource Centers (IRCs) established to help small and mid-size manufacturers grow and remain competitive. In 1994, MRC joined the National Institute of Standards and Technology (NIST) Manufacturing Extension Partnership (MEP) which is comprised of 59 nationwide centers. MRC works with manufacturing companies by leveraging its own staff of experienced Business Development Managers with public and private sector resources. Through our assistance and work with manufacturers, we help raise the economic level of the region by creating high impact, cost-competitive manufacturers.

Due to space restrictions MRC moved off the Goodman Campus to the Hanover Plaza in Allentown, a central location for Lehigh Valley manufacturers. MRC serves all of Lehigh, Northampton, Berks, Carbon and Schuylkill counties and offers services in six broad areas:

• Technology Acceleration Services that include Technology Scouting and Technology Driven Market Intelligence (TDMI), Innovation Engineering, and Product Development.
• Strategic Business Growth Services and top line initiatives that include strategic planning, market opportunity research, focused lead generation, website and brand strategies, marketing/sales coaching, export services and supplier development.
• Operational Excellence services that include Lean, Six Sigma, Quality and Hoshin Deployment programs. We incorporate sustainability and coaching components into our Lean training and now apply a Green lens for greater profitability and cost savings;
• Business Performance Services to help mentor companies in financial analysis and strategies, capital sourcing and management, mergers and acquisitions, establishing visual business intelligence systems, technology and innovation strategies, “Green” and Sustainability transformations, tax credit opportunities, and other related services.
• Leadership Development & Training that includes the Manufacturing Leadership Institute (MLI), individual Culture Assessments, CoreValue® Business Assessments, Customized Leadership Coaching, Human Resource Development and the Image of Manufacturing. Through one-on-one coaching, strategic “doing” management and milestone development, we can help you grow your effectiveness as a leader.
• A strategic mix of Training and Certification programs that are beneficial to any manufacturing organization. We connect manufacturers with experienced, proven resources that specialize in Lean manufacturing training, tools, coaching and certification. We also offer our own 13-part “Lean Master Certification” program, a “train and do” curriculum that includes everything you need
to prepare for and pass the SME Bronze Exam. The course curriculum includes ex-Toyota keynote instructors and other national presenters, as well. The hands-on elements of the program are also adding to the excitement from the classes. Participants get to actually use the tools when they are taught – reinforcing the proper protocol and use in real time. MRC also offers Six Sigma Training and Certifications, as well as coaching, mentoring and SPC-based assessments. We also offer Quality Certifications that connect manufacturers in need of quality management process solutions with best-in-breed resources. Whether it’s ISO, AS, API, HACCP or another quality-related certification, we have the experts and connections to help you gain certification.

For further information or assistance, please contact MRC at 961 Marcon Boulevard, Suite 200, Allentown, PA 18109. Jack E. Pfunder is President & CEO and can be reached at (610) 628-4575 or email him at jack.pfunder@mrcpa.org. Please visit our website at www.mrcpa.org.

PHILIP RAUCH CENTER FOR BUSINESS COMMUNICATIONS (THE)
621 Taylor Street; 758-4863
Joseph M. Manzo, MBA, director

The Rauch Center for Business Communications supports the business curriculum for both undergraduate and graduate programs.

Courses/programs administered through the center include BUS 005 and the Excel Competency program. BUS 005 is a one credit required course in the undergraduate program which addresses the foundations of business integrity. The Excel Competency program addresses the analysis and presentation of data in the context of business. This program is a prerequisite for 3 core courses in the undergraduate curriculum.

The center also partners with the faculty to develop methods for improving students’ writing and presentation skills. Programs are developed with the faculty and are integrated into the syllabus for the faculty member’s course where writing and/or presentations are required.

For more information, write to Anne Nierer, Coordinator, The Philip Rauch Center for Business Communications, Lehigh University, 621 Taylor Street, Bethlehem, PA 18015-3117, or email JMM6@lehigh.edu or phone 610-758-4863.

SMALL BUSINESS DEVELOPMENT CENTER
James A. Fischer, Director; Brett Smith, BA, MBA, Associate Director and Program Director LEXNET; Robert Mineo B.S., MBA, program director, Financing Assistance Program; Jasmita Saini, BA, MBA, Consultant; Andrea Hampton, Consultant; (https://sbdc.lehigh.edu/)

Established in 1978, the SBDC provides general management assistance to over 1,000 entrepreneurs and small businesses per year in the Lehigh Valley and surrounding areas. Primary funding for this program comes from major grants from the U.S. Small Business Administration and the Commonwealth of Pennsylvania.

Specialized Programs
The Management Assistance Program delivers general management consulting to existing small firms and startup ventures. Services are offered to retail, service, wholesale, construction and manufacturing firms. Research is offered through electronic data base research. Seminars are offered on many topics of interest to start-up and growing firms.

International Trade Development Program (ITDP)
The International Trade Development Program (ITDP) is a specialized outreach effort of the Small Business Development Center. The ITDP helps companies with exportable products to develop export marketing plans and establish direct contacts with international markets. Seminars, trade missions and research projects support the efforts of this program.

Financing Assistance Program
The Financing Assistance Program provides assistance in loan packaging and financial planning and helps clients identify appropriate financing sources. The program administers the Lehigh Valley Small Business Loan Pool and the Lehigh Valley Chapter of the Northeastern Pennsylvania Angel Network, a partnership program with the Ben Franklin Technology Partners of Northeastern PA. Contracts with the Lehigh/Northampton Revolving Loan Fund, the Lehigh Valley Economic Development Corporation and other funding agencies provide resources for this assistance.

Lehigh Valley Export Network (LEXNET)
The Lehigh Valley Export Network (LEXNET) is the regional office of the Team Pennsylvania Export Network. Throughout the year LEXNET brings PA foreign office representatives to the Lehigh Valley to meet with SBDC clients and discuss in country export assistance needs. LEXNET also assists with export finance programs such as Market Access Grants allowing small and midsized manufacturing or service companies to participate in international trade events. Specialized training events and seminars are also held throughout the year.

Business Education and Training Program (BETP)
The Business Education and Training Program of the Small Business Development Center provides specialized workshops, seminars and customized training for the small business community.

For more information, write to James Fischer, Director, Small Business Development Center, 416 E 5th Street, Bethlehem, PA 18015.
Courses, Programs and Curricula

For more information about specific academic programs and opportunities, see the following pages.

College of Arts and Sciences (p. 53)
College of Business (p. 277)
College of Education (p. 318)
P.C. Rossin College of Engineering and Applied Science (p. 357)
Interdisciplinary and Inter-College Undergraduate Study (p. 437)
Interdisciplinary Graduate Study and Research (p. 450)

College of Arts and Sciences

Interim dean; Diane T. Hyland, senior associate dean; Dominic Packer, associate dean; Susan Szczepanski, associate dean; Jackie Krasas, associate dean.

The College of Arts and Sciences is the heart of Lehigh University, offering a wide variety of academic majors, minors, and interdisciplinary programs, while also providing essential liberal arts access to all Lehigh students. Arts and Sciences faculty are engaged as active scholars, are highly accessible, and are committed to the teaching mission of our undergraduate programs. A hallmark of our college is the faculty’s ability to engage students interactively and experientially in teaching, research, and scholarship.

Students in the College develop new habits of mind that have become the hallmarks of a liberal arts education, testing assumptions, seeking evidence to support their understanding of the world, and probing the unknown with curiosity. These habits prepare our graduates to thrive in an uncertain world. Through a combination of college-wide distribution requirements and major field requirements in their chosen discipline, Lehigh Arts and Sciences students investigate and acquire knowledge of human cultures and the physical and natural world by studying arts, humanities, mathematics, natural sciences, and social sciences.

Studying broadly in these areas while pursuing a deeper concentration in a major field helps develop the intellectual curiosity and requisite skills necessary to creating lifelong learning habits as our graduates confront constant changes in society, technology, as well as their careers and personal lives.

The College of Arts and Sciences offers several curricular options:

- A four-year arts and sciences curriculum leading to a bachelor of arts or bachelor of science degree in designated fields.
- A five-year arts-engineering curriculum leading to a bachelor’s degree from the College of Arts and Sciences and a bachelor of science degree from the College of Engineering and Applied Science.
- Dual degree programs within the college and in conjunction with the other two undergraduate colleges.
- A five-year program leading to a bachelor’s degree from the College of Arts and Sciences and a master’s degree in Education from the College of Education. Please see below for more information.

MAJOR DEGREE PROGRAMS IN THE COLLEGE

Bachelor of Arts and Bachelor of Science Degree Programs

Two distinct bachelor-degree programs are offered by the College, the BA and the BS, each distinguished by the number of courses taken in the major field and ancillary disciplines. For the Bachelor of Arts degree a student takes a comparatively smaller number of courses to fulfill the major requirements plus a selection of courses in various fields outside the major. For the Bachelor of Science degree (offered in designated disciplines), a student takes a more extensive concentration in the major field, along with a proportionally smaller number of courses outside the major. Except for this distinction, the same basic requirements must be met for both degree programs (including the minimum number of 120 hours for graduation and the minimum grade point average in the major of 2.0). No more than six hours of military science may be applied toward either degree.

Bachelor of Arts Degree

BA degrees are offered in the following areas

ARTS
Architecture, art, art history, design, music, music composition, theatre

HUMANITIES
Asian studies, classical civilization, classics, English, Latin American and Latino Studies, modern languages and literature (Chinese, French, Francophone Studies, German, Japanese, & Spanish and Hispanic Studies), philosophy, religion studies

Social Sciences
African studies, anthropology, cognitive science, economics, environmental studies, global studies, health, medicine & society, history, international relations, IR/MLL joint major, IR/ECO joint major, journalism, journalism/science writing, political science, psychology, science, technology and society, sociology, sociology and anthropology, women, gender and sexuality studies

Mathematics and Natural Science
Astronomy, behavioral neuroscience, biology, chemistry, computer science, earth and environmental science, mathematics, molecular biology, physics

BA degrees in premedical science or preoptometry science are available to students who are admitted to certain combined degree programs (see Pre-Health Professions Programs).

Bachelor of Science Degree

BS degrees are offered in the following areas

Astronomy, behavioral neuroscience, biochemistry, biology, chemistry, cognitive science, computer science, earth and environmental science, mathematics, molecular biology, pharmaceutical chemistry, physics, psychology, statistics

GENERAL PLAN OF UNDERGRADUATE STUDY

Students in the College are encouraged to declare their major as soon as possible and are expected to do so by the end of their fourth semester. For most students, the credits earned for the major and those earned for college distribution requirements are not enough to meet the graduation requirement of 120 credit hours. Students normally take elective courses in areas of interest to earn these remaining credits.

Three types of courses - one in the student’s area of concentration (the major-field requirements), a second set drawn from certain designated disciplines (the distribution requirements), and a third set without constraints (the free electives) - comprise the educational program of the College.

Major Field of Concentration

By majoring in a specific discipline a student establishes a foundation of knowledge and develops expertise and intellectual sophistication in their field.

The minimum number of credits for a major is 30. A student must maintain a minimum grade-point average of 2.0 in the major field, and in the entire coursework.

Standard major sequences

When a student declares a major they are assigned a major advisor from that department or program's faculty. The major advisor assists students with course selection, research opportunities, internship selection, and other areas of professional development. In all cases, the final responsibility for meeting both major and non-major requirements rests with the student.

Special interdisciplinary majors

In addition to our established major programs, specially structured interdisciplinary majors linking multiple disciplines are possible. For example, a student interested in a professional school of urban or regional planning might wish to structure a special major consisting primarily of courses in political science, environmental studies, sociology, or any other relevant disciplines.

Any student may, with the aid of faculty members chosen from the disciplines involved, devise an interdisciplinary major program to include no less than thirty credits of related course work, with at least 15 credits...
from advanced courses. The major advisors and the dean of the college
must approve the program.

Multiple majors and Dual degrees
A student who wishes to fulfill the requirements for more than one
major program has two options: a double major or a dual degree. A
double major is a single BA degree with two majors. A student pursues
a double major by declaring both majors. Typically, double majors can
be completed in four years, but sequencing of courses and time conflicts
with required courses can introduce delays. No more than three courses
may be used to meet both majors’ requirements.

A dual degree program is a combined BA and BS program or two
BS degrees in one or more of our undergraduate colleges. The BA
is offered by the College of Arts and Sciences, and the BS may be in
CAS or in one of the other undergraduate colleges. A student pursues
a dual degree by declaring the first program and then petitioning the
Standing of Students Committee for permission to pursue the second
degree program. A semester-by-semester plan and a major declaration
for the second degree must accompany the petition to pursue a dual
degree. The dual-degree student must satisfy major and distribution
requirements for both degrees and earn a minimum of 30 additional
credits beyond those required for the first degree. All of the 30 additional
credits must be taken at Lehigh or in Lehigh residency programs.
The requirement of 30 additional credits typically makes the dual
degree program a five-year program. There is no limit on the number
of overlapping courses between two degrees, but there must be at
least 30 credits of stand alone coursework in each degree program. For
administrative purposes, students who take two degrees or two majors
must designate one as their primary major or primary degree program.

Distribution Requirements
Whatever expertise in a single discipline an undergraduate may achieve,
curiosity lures most of us beyond the confines of a single chosen
specialty. Furthermore, in a swiftly changing world, careers are rapidly
being redefined and only a person of broad intellectual mindset can
consider where their talents may be most useful to society. Many
of the basic modes of thought and work in various fields are being
reformulated, often producing surprising influences in the public and
private spheres. To develop a satisfying professional life and be a
responsible citizen of our increasingly global world, one needs exposure
to the concepts and methods of a variety of disciplines.

CAS distribution requirements draw upon five primary domains of
learning: arts, humanities, mathematics, natural sciences, and social
sciences. The faculty believe exposure to these broad areas will
help students develop a basic understanding of the various forms of
knowledge generated in these fields. Specific credit hours are required
in each of the following four domains: arts and humanities, mathematics,
natural sciences, and social sciences.

Distribution Requirements for the B.A. and the B.S.
First-Year Seminar
One course during the first year
English Composition
Two courses during the first year
Mathematics
Chosen from designated courses in mathematics, philosophy, or
computer science
Natural Sciences
Chosen from designated courses in astronomy, astrophysics,
biological anthropology, biosciences, chemistry, earth and
environmental sciences, physics, and neuroscience.
At least one science course must also include the associated
laboratory.
Social Sciences
Chosen from designated courses in anthropology, classics,
economics, political science, history, international relations,
journalism, psychology, social psychology, social relations,
sociology, and STS.
Arts and Humanities
Chosen from designated courses in architecture, art, classics,
history, modern languages and literature, English, music,
philosophy, religion studies, and theatre.

Junior Year Writing Intensive
Only courses designated as “WI” in the class schedule or select
independent studies may be used to fulfill this requirement.

Total Credits
39-41

Total required for graduation: 120 credits

FIRST-YEAR SEMINAR PROGRAM
During their first academic year, preferably in the fall, every student
in the College of Arts and Sciences is required to enroll in a First-
Year Seminar. College seminars provide an intimate and supportive
environment that facilitates the transition to university life. Within
the seminar students develop skills that serve as a framework for their future
scholarly work – how to read closely, think critically, write clearly, learn
cooperatively, speak persuasively, and solve problems creatively.

Courses in this program are an excellent way to explore a subject
that may be new, or to enter more deeply into an area of previous
interest. Whatever the topic, FYS emphasize reading assignments,
papers, and oral presentations, while others include tests, laboratory
work, or fieldwork.

JUNIOR-YEAR WRITING CERTIFICATION
The faculty of the College of Arts and Sciences value writing as an
essential tool for learning. Writing well is indispensable for performing
responsibly in any profession and in most areas of life. Beyond the two
English courses required in the first year, students are encouraged to
take courses that provide continued practice in writing. In particular,
each student must complete at least one “writing-intensive” course,
normally during their junior year. Students must follow the guidelines
for this requirement set up by their major department. Some major
programs require the writing-intensive course be taken in the major field,
while others allow it to be chosen freely from writing-intensive courses
offered by any department or program. Courses that satisfy the writing-
intensive requirement may also be used to fulfill major or distribution
requirements. Please note: only courses designated as “WI” on the
course schedule, or select independent studies may be used to fulfill
this requirement. Transfer credits may not be used to meet the Writing
Intensive requirement.

MINOR PROGRAMS IN THE COLLEGE
Certain departments, divisions, and programs in the College afford
students an opportunity to minor in an additional field of concentration
other than their major field of study. Minors require a minimum of 15 credits, but the specific content is
determined by the department, division, or program offering that minor. A
minor is optional, and if successfully completed, will be shown on
the university transcript in the same manner as the major field. A 2.0
minimum grade-point average is required for courses in the minor.
Because of this requirement, no course in the minor program may be
taken with Pass/Fail grading. No more than one course may be double-
counted toward a major and a minor, and no more than one course may
overlap between two minors.

The following are established minors in the College of Arts and
Sciences:
• Actuarial Science (Mathematics)
• Africana Studies (Interdisciplinary Programs)
• Anthropology
• Applied Mathematics
• Architecture
• Art
• Art History
• Asian Studies (Interdisciplinary Programs)
• Astronomy
• Biology
• Chemistry
• Chinese
• Classical Civilization (Interdisciplinary Programs)
• Classics (Interdisciplinary Programs)
• Cognitive Science (Interdisciplinary Programs)
• Computer Science
• Creative Writing
• Data Science (Computer Science)
• Design
• Documentary Storymaking (Interdisciplinary Programs)
• Earth and Environmental Science
• Economics
• English
• Environmental Studies (Interdisciplinary Programs)
• Ethics (Interdisciplinary Programs)
• Film Studies (Interdisciplinary Programs)
• French and Francophone Studies
• German
• Global Studies (Interdisciplinary Programs)
• Graphic Design
• Health, Medicine, and Society (Interdisciplinary Programs)
• History
• International Film (Modern Languages and Literatures)
• International Relations
• Japanese
• Jewish Studies (Interdisciplinary Programs)
• Journalism: Science and Environmental Writing
• Latin (Interdisciplinary Programs)
• Latin American and Latino Studies (Interdisciplinary Programs)
• Military Science
• Molecular Biology
• Museum Studies (Art, Architecture, and Design)
• Music
• Music Industry (on hiatus for 2019-2020 but courses still offered)
• Philosophy
• Physics
• Political Science
• Probability and Statistics
• Product Design
• Psychology
• Public Administration (Political Science)
• Religion Studies
• Russian
• Science, Technology, and Society (Interdisciplinary Programs)
• Sociology
• Sociology and Anthropology
• Spanish and Hispanic Studies
• Studio Art
• Sustainable Development (Interdisciplinary Programs)
• Theatre
• Women, Gender, and Sexuality Studies (Interdisciplinary Programs)
• Writing (English)

*For minors outside of the College of Arts & Sciences, please see below.

OPPORTUNITIES

ECKARDT SCHOLARS PROGRAM

The Eckardt Scholars Program is a highly selective and unique honors program in the College of Arts and Sciences. The program prioritizes intellectual curiosity, independent work, and close mentoring relationships between students and faculty. Each incoming class includes approximately twenty Eckardt Scholars. These students receive unique academic privileges that provide them with great opportunities at Lehigh and beyond. Students in the program are exempt from the Arts & Sciences distribution requirements and work with their major advisor and the Eckardt Scholars Program Director to create a flexible course of study that best suits their academic interests and ambitions. Although exempt from distribution requirements, students will complete the requisite number of credits for their degrees and all correlatives requirements for their majors. The program includes participation in two Eckardt Scholar Seminars and completion of an independent project (e.g., a thesis, artistic creation, or other capstone experience) during the senior year.

Participation in the Eckardt Scholars Program is restricted to only the most well-qualified students. Some students are invited to enroll when first admitted to Lehigh, while others are identified by faculty and encouraged to apply during their first few semesters. Admission to the program is decided on the basis of academic records, written statements of educational goals, and at least two faculty recommendations.

FOREIGN LANGUAGE STUDY

Students planning to pursue graduate study toward a doctorate should be aware that most graduate schools require doctoral candidates to demonstrate a reading knowledge of one or two foreign languages. Proficiency in foreign languages is advantageous for careers in law, government, journalism, commerce, industry and other fields.

INTERNSHIPS

Many departments and programs offer credit for specific internship experiences. Students should consult with their home department for information on arranging internships. The University faculty has established three important criteria that must be met by all internships: 80 hours of work are required for each credit awarded, no credit can be awarded for an internship ex post facto, and the student must register for the internship course during the same term that the internship work is performed. Students must pre-arrange all internship experiences with the appropriate department. Internship credits cannot be awarded for work experiences lacking a distinct, identifiable educational component. A memorandum of understanding circulated among the employer, student, and departmental internship course director helps to promote a common understanding of the educational and work objectives of the internship. Students are advised that not all work experiences advertised as "internships" warrant academic credit, even though they may be otherwise worthwhile.

*For information on the Five-Year Bachelors Plus Master’s of Education and Secondary Teacher Certification please see below.

PRE-LAW PROGRAM

In keeping with the policy of the Association of American Law Schools, the university does not have a prescribed pre-law curriculum; however, Lehigh has a strong pre-law tradition. Successful candidates for law school demonstrate skills in critical analysis, logical reasoning, and communication and have pursued rigorous coursework of significant breadth and depth. Lehigh students have attained entrance to law schools from diverse curricula in all three of the undergraduate colleges. Specifically law-related courses are offered in the College of Arts and Sciences (e.g., Constitutional Law and Politics, Civil Rights and Civil Liberties, Law and Order) and the College of Business (e.g., Introduction to Law and Legal Environment of Business).

In addition to formal academic instruction, Lehigh provides other opportunities for learning about the law and legal careers. The annual Tresolini Lecture series brings nationally recognized speakers to campus for extended interactions with faculty and students. Tresolini lecturers have included present and past U.S. and state Supreme Court justices and renowned legal scholars and practitioners. Lehigh also provides opportunities for gaining academic credit in several off-campus programs that provide practical experience in law and public affairs.
Advising is available to prospective pre-law students on a continuous basis from first-year orientation through the law school application process in the senior year. The pre-professional advisor in the Center for Career and Professional Development coordinates these pre-law counseling services.

**PRE-HEALTH PROFESSIONAL PROGRAMS**

Schools of medicine, dentistry, optometry, podiatry, and veterinary medicine stress the importance of a strong liberal arts education as well as prescribed studies in the sciences. Although most pre-health students will choose a major in a pure or applied science, as long as candidates have the essential courses in biology, chemistry, physics, and mathematics, they may major in any of the three undergraduate colleges.

A health professions advisory committee, which includes the pre-professional advisor and faculty members from the sciences and social sciences, provides career and academic counseling and works closely with students from first-year orientation through the entire process of applying to professional schools. Students with an interest in the health professions are urged to consult with the pre-professional advisor in the Center for Career and Professional Development as early as possible in their academic career.

**Combined-Degree Program in Dentistry**

In cooperation with the School of Dental Medicine at the University of Pennsylvania, Lehigh offers an accelerated program that enables selected students to earn both the baccalaureate degree (B.A.) with a major in preclinical science and the doctor of dental medicine degree (D.M.D.) after seven years of study at the two institutions. In the first three academic years at Lehigh, credit hours are earned toward the 120 credits required for the baccalaureate degree. The next four years are spent in the regular program of dental education at the Penn School of Dental Medicine in Philadelphia. By successfully completing their first year at the dental school, students acquire the necessary additional credit hours for the Lehigh baccalaureate degree.

During their first three years at Lehigh, students are expected to make satisfactory progress in prescribed academic areas as well as in the area of personal growth, developing those attributes ultimately needed to become a dentist. Penn Dental School receives student grades and monitors student progress through feedback from Lehigh. Students are expected to attain specified grade point averages and DAT scores. Students’ undergraduate credentials are processed through the Admissions Committee of Penn Dental School before a final definitive acceptance is offered. The dental college reserves the right to withdraw an acceptance, or require that a student spend additional time on the undergraduate level, on the grounds of academic or personal maturation concerns.

Application for admission to this program is made through Lehigh’s Office of Admissions. Application deadline is January 1.

**Required Science and Math Courses**

**Chemistry**

Select one of the following: 8

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM 030 &amp; CHM 031</td>
<td>Introduction to Chemical Principles and Chemical Equilibria in Aqueous Systems</td>
</tr>
<tr>
<td>CHM 040 &amp; CHM 041</td>
<td>Honors General Chemistry I and Honors General Chemistry II</td>
</tr>
<tr>
<td>CHM 110 &amp; CHM 111</td>
<td>Organic Chemistry I and Organic Chemistry Laboratory I</td>
</tr>
<tr>
<td>CHM 112 &amp; CHM 113</td>
<td>Organic Chemistry II and Organic Chemistry Laboratory II</td>
</tr>
</tbody>
</table>

**Biology**

<table>
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<tr>
<th>Course</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>BIOS 041 &amp; BIOS 042</td>
<td>Biology Core I: Cellular and Molecular Biology and Biology Core I: Cellular and Molecular Lab</td>
</tr>
<tr>
<td>BIOS 115 &amp; BIOS 116</td>
<td>Biology Core II: Genetics and Biology Core II: Genetics Laboratory</td>
</tr>
</tbody>
</table>

**Physics**

Select one of the following: 5

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>PHY 010 &amp; PHY 012</td>
<td>General Physics I and Introductory Physics Laboratory I</td>
</tr>
<tr>
<td>PHY 011 &amp; PHY 012</td>
<td>Introductory Physics I and Introductory Physics Laboratory I</td>
</tr>
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Select one of the following: 4-5

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>PHY 013 &amp; PHY 022</td>
<td>General Physics II and Introductory Physics Laboratory II</td>
</tr>
<tr>
<td>PHY 021 &amp; PHY 022</td>
<td>Introductory Physics II and Introductory Physics Laboratory II</td>
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**Math**

Select one of the following: 7-8

<table>
<thead>
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<th>Course</th>
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<tbody>
<tr>
<td>MATH 021 &amp; MATH 022</td>
<td>Calculus I and Calculus II</td>
</tr>
<tr>
<td>MATH 051 &amp; MATH 052</td>
<td>Survey of Calculus I and Survey of Calculus II</td>
</tr>
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Total Credits 54-56

**Required Non-Science Courses**

<table>
<thead>
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<th>Course</th>
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<tr>
<td>First-Year Seminar</td>
<td>3-4</td>
</tr>
<tr>
<td>English Comp &amp; Lit (I and II)</td>
<td>6</td>
</tr>
<tr>
<td>Humanities (two courses)</td>
<td>8</td>
</tr>
<tr>
<td>Social Sciences (two courses)</td>
<td>8</td>
</tr>
<tr>
<td>Junior Writing Intensive</td>
<td>3-4</td>
</tr>
</tbody>
</table>

Approved Electives 11-12

Total Credits 39-42

**Combined-Degree Program in Optometry**

In cooperation with the State University of New York College of Optometry in New York City, Lehigh offers an accelerated program in which students may earn both the baccalaureate degree (B.A.) with a major in behavioral neuroscience and the doctor of optometry degree (O.D.) after seven years of study at the two institutions. In the first three academic years at Lehigh, credit hours are earned toward the 120 credits required for the baccalaureate degree. The next four years are spent in the regular program of optometry education at SUNY College of Optometry. By successfully completing their first year at the optometry college, students acquire the necessary additional credit hours for the Lehigh baccalaureate degree.

SUNY College of Optometry receives student grades and monitors student progress through feedback from Lehigh. Students are expected to attain specified grade point averages and OAT scores. Students’ undergraduate credentials are processed through the Admissions Committee of SUNY Optometry before a final definitive acceptance is offered. The optometry college reserves the right to withdraw an offer of acceptance on the grounds of academic or personal maturation concerns.

Students may apply to this program either during their initial application or during their enrollment at Lehigh. Application for incoming students is made through Lehigh’s Office of Admissions. Application deadline is January 1.

**Required Science and Math Courses**

**Chemistry**

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**Physics**

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**Math**

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Total Credits 54-56

**Required Non-Science Courses**

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<td>Junior Writing Intensive</td>
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Approved Electives 11-12

Total Credits 39-42
Currently in the CBE, nor may these classes count as substitutes for CBE core classes should a student later decide to transfer into the CBE. For more information about this minor: http://cbe.lehigh.edu/academics/undergraduate/degree-programs/business-minor

**ENGINEERING MINOR**

The College of Engineering enables undergraduate students enrolled in the Colleges of Arts and Sciences and in the College of Business to earn a minor in engineering. This unique program provides students with insight into the world of engineers: who they are, what they do, and how they think. Students pursuing the Engineering Minor develop an understanding of the tools and techniques engineering use on a day-to-day basis.

The mission of the minor is to educate non-engineering students about engineering methodology, specifically how engineers solve problems; how they design, manufacture, and analyze problems; and how other factors such as economics, safety, ethics, and environmental issues affect the engineering design process. Fifteen credit hours of required and elective coursework are required to fulfill the engineering minor. For more information about this minor: http://www.lehigh.edu/~inengmnr/index.html

**ENTREPRENEURSHIP MINOR**

The purpose of the entrepreneurship minor is to enable students in any major to supplement their major with a creative entrepreneurial mindset and skills that increase their ability to identify opportunities for innovation, to challenge the status quo in any field, and to implement sustainable change, whether in emerging or established companies or non-profit enterprises. The program is designed to be accessible to students from all disciplines with an emphasis upon innovation, entrepreneurial thinking and creative processes, cross-functional integration, and hands-on experiential practice. The minor leverages the resources and support of the Baker Institute for Entrepreneurship, Creativity, and Innovation, as well as a broad array of related programs and infrastructure across the university.

Courses offered in this minor program are open to all undergraduate students. For more information about this minor please visit: https://cbe.lehigh.edu/academics/undergraduate/degree-programs/entrepreneurship-minor

**MARKETING MINOR**

Lehigh University’s marketing minor provides non-CBE students an opportunity to pursue a course of study in marketing that will enable them to supplement their major field and make them more marketable.

The overall learning objective of the program is to provide non-CBE students with the knowledge and skills which to make more informed marketing decisions.

A marketing minor consists of 12 credits. Students wishing to earn a Marketing Minor must take MKT 111, and then select three other marketing courses from the Marketing Minor in areas such as Marketing Analytics, Marketing Communications, Sales Management, Retail Management, or Brand Management and Innovation, allowing for a deeper understanding of a particular aspect of marketing. For more information about this minor: http://cbe.lehigh.edu/academics/undergraduate/degree-programs/entrepreneurship-minor

**REAL ESTATE MINOR**

Real Estate is, by far, the most significant store of global wealth; and most people spend the majority of their lives in the built environment. Closer to home, real estate related businesses typically generate over 25% of U.S. economic activity. Consequently, real estate presents a wide array of career opportunities in areas including (but not limited to) accounting, banking, brokerage, construction, consulting, design, development, engineering, finance, government, insurance, investment, law, management, marketing, planning, and valuation. The Real Estate Minor is, therefore, designed to complement a wide range of majors. Students must take five courses comprised of both required and elective courses which draw from several academic disciplines across campus. The program is housed in the Goodman Center for Real Estate and open to undergraduate students of all majors.

Contact: goodmancenter@lehigh.edu

### BUSINESSES OUTSIDE OF CAS

Students also have the opportunity to apply to the following minor programs:

**BUSINESS MINOR**

The purpose of the business minor program is to enable non-CBE students to pursue a course of business studies which enables them to supplement their major studies and enhances their career options upon graduation. The overall learning objective of the program is to provide non-CBE students with the knowledge and skills with which to make more informed business decisions.

Courses offered in the business minor program are not open to students currently in the CBE, nor may these classes count as substitutes for courses offered in this minor program are open to all undergraduate students of all majors.

<table>
<thead>
<tr>
<th>Biology</th>
<th></th>
</tr>
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<tbody>
<tr>
<td>BIOS 041</td>
<td>Biology Core I: Cellular and Molecula and Biology Core I: Cellular and Molecular Lab</td>
</tr>
<tr>
<td>BIOS 042</td>
<td>Biology Core I: Cellular and Molecula and Biology Core I: Cellular and Molecular Lab</td>
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<td>Biology Core II: Genetics and Biology Core II: Genetics Laboratory</td>
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<td>BIOS 121</td>
<td>Biology Core III: Integrative &amp; Comparative Biology and Biology Core III: Integrative and Comparative Lab</td>
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<td>BIOS 122</td>
<td>Biology Core III: Integrative &amp; Comparative Biology and Biology Core III: Integrative and Comparative Lab</td>
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<tr>
<td>BIOS 130</td>
<td>Biostatistics</td>
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<td>Central Nervous System and Behavior</td>
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<td>Experimental Neuroscience Laboratory</td>
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<tr>
<td>BIOS 278</td>
<td>Neurophysiology Laboratory</td>
</tr>
<tr>
<td>BIOS 279</td>
<td>Experimental Molecular Neuroscience Laboratory</td>
</tr>
<tr>
<td>BIOS 371</td>
<td>Elements of Biochemistry I</td>
</tr>
<tr>
<td>BIOS 372</td>
<td>Elements of Biochemistry II</td>
</tr>
<tr>
<td>BIOS 382</td>
<td>Endocrinology of Behavior</td>
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<td>PHY 012</td>
<td>General Physics I and Introductory Physics Laboratory I</td>
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<tr>
<td>PHY 011</td>
<td>Introductory Physics I and Introductory Physics Laboratory I</td>
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<td>PHY 012</td>
<td>Introductory Physics I and Introductory Physics Laboratory I</td>
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<td>PHY 013</td>
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<td>PHY 022</td>
<td>General Physics II and Introductory Physics Laboratory II</td>
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<tr>
<td>PHY 021</td>
<td>Introductory Physics II and Introductory Physics Laboratory II</td>
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<tr>
<td>Math</td>
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<td>MATH 021</td>
<td>Calculus I and Calculus II</td>
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<td>MATH 022</td>
<td>Calculus I and Calculus II</td>
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<tr>
<td>MATH 051</td>
<td>Survey of Calculus I and Survey of Calculus II</td>
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<td>MATH 052</td>
<td>Survey of Calculus I and Survey of Calculus II</td>
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<th>Required Non-Science Courses</th>
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<td>First-Year Seminar</td>
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<td>English Comp &amp; Lit (I and II)</td>
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<td>PSYC 001</td>
<td>Introduction to Psychology</td>
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<td>Social Science (one course)</td>
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<tr>
<td>Humanities (two courses)</td>
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<tr>
<td>Writing Intensive</td>
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<tr>
<td>Approved Elective</td>
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<td>Total Credits</td>
<td>32-34</td>
</tr>
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</table>
EDUCATION MINOR

The education minor helps undergraduates explore career options in school teaching or other professional careers with elementary, secondary, or special education students. The minor may accelerate entry into a teaching career because appropriate credits from undergraduate coursework may be applied to one of Lehigh's graduate-level Teacher Education Programs.

The minor offers a systematic background of professional education experiences, coordinating practicum activities with theory courses designed to provide a foundation for future educational studies. Its focus is exploratory.

The experiences of the minor are intended to enrich an individual's understanding of education as a central intellectual activity of our culture and to provide self-understanding of one's own potential as an educator.

An undergraduate may take these courses with the approval of the adviser and minimum GPA of 2.75. Completion of the minor does not assure admission to one of the Teacher Education Programs to become a certified elementary or secondary teacher.

Fifteen credit hours are required for the education minor. Completion of the minor does not guarantee subsequent admission into any of the College of Education degree or certification programs.

For more information about our Education Minor, visit https://ed.lehigh.edu/academics/programs/teacher-education or contact the Teaching, Learning and Technology Program Director at TLTProgram@Lehigh.edu or 610-758-3230.

FIVE-YEAR BACHELOR'S PLUS MASTER'S OF EDUCATION AND SECONDARY TEACHER CERTIFICATION

The College of Education offers a five-year degree program that is designed to allow students to earn both a bachelor's degree and a master's degree in five years instead of the traditional six.

The combined degree program leads to (1) a B.A./B.S. degree in an academic discipline from the College of Arts and Sciences, the P.C. Rossin College of Engineering and Applied Sciences, or the College of Business, and (2) an M.Ed. degree in elementary education or an M.Ed. or M.A. degree in secondary education. In addition, students also earn eligibility for an Instructional I teaching certificate from the Pennsylvania Department of Education (PDE). These PDE certification areas are:

- Biology 7-12
- Chemistry 7-12
- Earth and Space Science K-12
- English 7-12
- General Science 7-12
- Mathematics 7-12
- Physics 7-12
- PreK-4th grade
- Social Studies 7-12

Freshmen, sophomores and juniors with a minimum overall GPA of 2.75 may apply to the 5-year teacher education program. Those accepted typically begin education courses in the second semester of their sophomore year (junior year for those admitted later).

Criteria for admission to the program include:

- A demonstrable commitment to learning and intellectual growth
- An expressed interest in teaching as a career
- Previous experience in working with young people; this can be gained in the summers of freshman and sophomore years.

In the fall semester of their senior year, students must complete an application for admission to the graduate College of Education (elementary or secondary education) in order to continue in the program and complete the master's degree/Instructional I teacher certification eligibility portion of the program.

For more information about the 5-year Teacher Education Program, visit https://ed.lehigh.edu/academics/programs/teacher-education.

Africana Studies

Program Director: Vacant
Website: http://aas.cas2.lehigh.edu/
Supported by the Office of Interdisciplinary Programs, 610-758-3996; incasip@lehigh.edu
Williams Hall, 31 Williams Drive

The purpose of the Africana Studies Program is to engender in Lehigh students an intellectual appreciation of the life and culture of peoples of sub-Saharan Africa and the worldwide diaspora, especially in the Americas (the United States and Canada, the Caribbean, Central and South America), thereby enriching the Lehigh curriculum and increasing its relevance to a culturally diverse society and world. In the best tradition of a liberal arts education, Africana Studies expands Lehigh students’ critical understanding of their own heritage in interaction with other cultures.

The major and minor in Africana Studies constitute an interdisciplinary and comparative program of study for undergraduates who wish to integrate the insights and methods of several disciplines to understand the history, culture, social, and political experience of people of African descent globally.

Emeritus Faculty

Associate Professors. Lyndon Dominique, PHD (Princeton University); Monica R. Miller, PHD (Chicago Theological Seminary)

Assistant Professors. Natanya Duncan, PHD (University of Florida); Kwame Essien, PHD (University of Texas at Austin); Susan E. Kart, PHD (Columbia University); Valerie Jones Taylor, PHD (Stanford University)

Professor Of Practice. John J Vilanova, MA (University of Pennsylvania)

THE MAJOR

The major in Africana Studies consists of a minimum of ten (10) courses, constituting at least 30 credit hours and no less than four (4) upper level courses. It entails training across disciplinary lines as well as concentrated study in a single discipline.

AAS 003 Introduction to Africana Studies 4
Humanities (3 courses) 9-12
Social Sciences (3 courses) 9-12
Disciplinary Concentration (3 courses) 8-12
Total Credits 30-40

Departmental Honors
Africana Studies majors who attain a 3.5 grade point average in the major and a 3.2 grade point average overall may apply for departmental honors. Students must receive permission of the program director and complete a minimum of 4 credits of AAS 390 Honors Thesis.

THE MINOR

The minor consists of a minimum of four (4) courses, constituting at least 15 hours of study that includes an introductory course and at least one 300-level course. To declare a minor in Africana Studies, students should visit the Office of Interdisciplinary Programs, Williams Hall, Suite 101.

AAS 003 Introduction to Africana Studies 1 4
Electives 2 11-12
Total Credits 15-16

1 Additional courses may be substituted for the Introductory course with Program Director permission
2 Must include at least one course at the 300-level

101 Africana Studies
**CORE AND ELECTIVE COURSES**

Core courses concentrate on subject material directly relevant to the study of past and present experiences of people of African descent. Each semester, a complete list of Africana Studies course offerings can be found on the Africana Studies web site or in the Office of Interdisciplinary Programs, Williams Hall, Suite 101. In addition, students are encouraged to pursue independent study opportunities to enhance their knowledge of specific aspects of Africana Studies.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAS 003</td>
<td>Introduction to Africana Studies</td>
<td>4</td>
</tr>
<tr>
<td>AAS/HIST 005</td>
<td>African Civilization</td>
<td>4</td>
</tr>
<tr>
<td>AAS/REL 025</td>
<td>Introduction to Black Religions and Hip-Hop</td>
<td>4</td>
</tr>
<tr>
<td>AAS/ENGL 038</td>
<td>Introduction to African Literature</td>
<td>3</td>
</tr>
<tr>
<td>AAS 039</td>
<td>Special Topics in Africana Studies</td>
<td>4</td>
</tr>
<tr>
<td>AAS/THTR 059</td>
<td>West African Dance</td>
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<tr>
<td>AAS/THTR 062</td>
<td>Black Theatre</td>
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<tr>
<td>AAS/THTR 066</td>
<td>Hip Hop Dance</td>
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<tr>
<td>AAS/THTR 076</td>
<td>Hip Hop Dance II</td>
<td>2</td>
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<tr>
<td>AAS/ENGL/REL/JST 102</td>
<td>Promised Lands: Jewish and African American Children's Literature</td>
<td>4</td>
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<tr>
<td>AAS/SOC 103</td>
<td>Race and Ethnicity in the Contemporary U.S.</td>
<td>4</td>
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<tr>
<td>AAS/PHIL 117</td>
<td>Race, Racism, and Philosophy</td>
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<tr>
<td>AAS/ENGL 121</td>
<td>Topics in African-American Literature</td>
<td>4</td>
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<tr>
<td>AAS/ART/GS 124</td>
<td>Arts of the Black World 16th-20th Centuries</td>
<td>4</td>
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<tr>
<td>AAS/ART/GS 125</td>
<td>Art and Architecture of Africa from Colonial to Contemporary Times</td>
<td>4</td>
</tr>
<tr>
<td>AAS/HIST/WGSS 126</td>
<td>How Black Women Made Modern America</td>
<td>4</td>
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<tr>
<td>AAS/MUS 128</td>
<td>Jazz History I</td>
<td>3</td>
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<tr>
<td>AAS/MUS 129</td>
<td>Jazz History II</td>
<td>3</td>
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<tr>
<td>AAS/HIST 130</td>
<td>African American History</td>
<td>4</td>
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<tr>
<td>AAS/THTR 132</td>
<td>Hip Hop Theatre</td>
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<tr>
<td>AAS/MLL/LAS/FREN/POLS 133</td>
<td>Lehigh in Martinique: Globalization and Local Identity</td>
<td>4</td>
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<tr>
<td>AAS/HIST 134</td>
<td>History and Cultures of Ghana</td>
<td>4</td>
</tr>
<tr>
<td>AAS/ENGL 138</td>
<td>Introduction to African American Literature</td>
<td>4</td>
</tr>
<tr>
<td>AAS 139</td>
<td>Special Topics in Africana Studies</td>
<td>4</td>
</tr>
<tr>
<td>AAS/THTR 140</td>
<td>African American Theatre</td>
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</tr>
<tr>
<td>AAS/SOC 144</td>
<td>Global Hip Hop and Social Change</td>
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<tr>
<td>AAS/WGSS 145</td>
<td>African American Women Writers</td>
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<tr>
<td>AAS/SOC/LAS 155</td>
<td>Afro-Latino Social Movements in Latin America &amp; the Caribbean</td>
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<tr>
<td>AAS/SOC 163</td>
<td>Sociology of Hip Hop Culture</td>
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<tr>
<td>AAS/SOC 166</td>
<td>Wealth and Poverty in the United States</td>
<td>4</td>
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<tr>
<td>AAS/HIST/GS/HMS 176</td>
<td>Keeping Africa and Africans Healthy: A History of Illness and Wellness</td>
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<tr>
<td>AAS/SOC 177</td>
<td>Cuba: Race, Revolution and Culture</td>
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<tr>
<td>AAS/HIST/GS 178</td>
<td>Globalization and Health in Ghana</td>
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<td>AAS/HIST 179</td>
<td>Black Political Thought in America</td>
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<td>AAS/ANTH 183</td>
<td>Peoples and Cultures of Africa</td>
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<tr>
<td>THTR 185</td>
<td>Production Seminar</td>
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<tr>
<td>AAS/POLS 205</td>
<td>The Political Development of American Race Relations</td>
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<tr>
<td>AAS/POLS/WGSS 210</td>
<td>Revolution on Campus</td>
<td>4</td>
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<tr>
<td>AAS/ART/GS 221</td>
<td>Global Contemporary Art</td>
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<tr>
<td>AAS/POLS 230</td>
<td>Social Movements From the 1960s to Present</td>
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<tr>
<td>AAS 239</td>
<td>Special Topics in Africana Studies</td>
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<tr>
<td>AAS 263</td>
<td>Caribbean Artistic and Cultural Traditions</td>
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<tr>
<td>AAS/COMM 276</td>
<td>Media and Race</td>
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<td>AAS/COMM 277</td>
<td>Race Representations &amp; News Media</td>
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<tr>
<td>AAS/ES/POLS 305</td>
<td>Residential Segregation: Policies and Practices</td>
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<td>AAS/SOC/WGSS 310</td>
<td>Gender, Race and Sexuality: The Social Construction of Differences</td>
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<td>AAS/FREN 312</td>
<td>Modernity in the Maghreb</td>
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<tr>
<td>AAS/SOC 313</td>
<td>Keep the Change: Social Movements in Society</td>
<td>4</td>
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<tr>
<td>AAS/PHYS 314</td>
<td>Infections and Inequalities: HIV, TB and Malaria in the Global South</td>
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<tr>
<td>AAS/ENGL 318</td>
<td>African-American Literature and Culture</td>
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<td>AAS/ANTH/GS 324</td>
<td>Globalization and Development in Africa</td>
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<td>AAS/PSYC 326</td>
<td>The Doing and Undoing of Racism</td>
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<td>AAS/HIST 330</td>
<td>Africans and the Atlantic World</td>
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<td>AAS/HIST 331</td>
<td>United States and Africa</td>
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<td>Slavery and the American South</td>
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<td>AAS 335</td>
<td>Special Topics in African History and/or Diaspora</td>
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<td>Global Africa: Aid, Volunteerism, NGO's and International Studies</td>
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<td>Global Politics of Race: Asia and Africa</td>
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<td>Colonialism and the Black Radical Tradition</td>
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<td>AAS/COMM 375</td>
<td>Global Media and Culture</td>
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<td>AAS/COMM/WGSS 376</td>
<td>New Media, Race and Gender</td>
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<td>AAS/SOC 379</td>
<td>Race and Class in America</td>
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<td>Seminar on a topic in Africana Studies</td>
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<td>AAS 390</td>
<td>Honors Thesis</td>
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<td>AAS 391</td>
<td>Special Topics in Africana Studies</td>
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<td>ARTS 250</td>
<td>Communications, Cultures, Behaviors and Attitudes</td>
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<tr>
<td>MUS 130</td>
<td>Jazz Masters</td>
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</table>

**GRADUATE CERTIFICATE IN AFRICANA STUDIES**

A Graduate Certificate in Africana Studies is offered in the College of Arts and Sciences. Candidates for the certificate must complete 12 credit hours (4 courses) at the 300-level or above, with no more than 6 credits at the 300-level.

The Graduate Certificate in AAS is designed as a complement to a graduate program (e.g. English, History, Sociology, American Studies, Political Science) or as a standalone post-baccalaureate course of study. The Certificate is a small, flexible program that provides students with breadth and the challenge of working outside their home discipline in concentrated interdisciplinary study of Africana Studies. In recognition of contemporary educational and employment contexts that are increasingly diverse and international, the AAS Program offers the graduate certificate as a means to enrich academic, personal, and employment horizons.

**4 courses from the list below at the 300-level or above**

with no more than 6 credits at the 300-level

**COURSES**

Additional courses may be chosen in consultation with the program director.

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<td>Gender, Race and Sexuality: The Social Construction of Differences</td>
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<tr>
<td>AAS/FREN 312</td>
<td>Modernity in the Maghreb</td>
<td>4</td>
</tr>
<tr>
<td>AAS/SOC 313</td>
<td>Keep the Change: Social Movements in Society</td>
<td>4</td>
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<tr>
<td>AAS 003</td>
<td>Introduction to Africana Studies</td>
<td>4</td>
</tr>
<tr>
<td>AAS/COM 276</td>
<td>Media and Race</td>
<td>4</td>
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<tr>
<td>AAS/COMM 277</td>
<td>Race Representations &amp; News Media</td>
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<td>Residential Segregation: Policies and Practices</td>
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<td>Modernity in the Maghreb</td>
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<tr>
<td>AAS/SOC 313</td>
<td>Keep the Change: Social Movements in Society</td>
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</table>

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Courses

AAS 003 Introduction to Africana Studies 4 Credits
An interdisciplinary examination of the roots, culture, and politics of the modern black world through study of classic works in Africana Studies with emphasis on the continuities among African peoples worldwide and the social forces that have shaped contemporary black life in Africa and the Americas.
Attribute/Distribution: SS

AAS 005 (HIST 005) African Civilization 4 Credits
Sub-Saharan Africa through the millennia of the ancient world to the present. Human origins, state and non-state systems, the external slave trade; colonialism, resistance to European rule; independence movements; neocolonialism.
Attribute/Distribution: SS

AAS 025 (REL 025) Introduction to Black Religions and Hip-Hop 4 Credits
Rapper KRS ONE once stated that, “Rap is something you do and Hip-Hop is something you live.” This course thinks through the global evolution of Hip-Hop culture and the public and academic study of Black Religions as responses to structural and historical inequality and the search for meaning in culture by considering themes of resistance, constraint, power, the body, deviance, and morality over and against race, class, gender, and sexuality from a range of academic and cultural sources.
Attribute/Distribution: HU

AAS 038 (ENGL 038) Introduction to African Literature 3 Credits
Sub-Saharan African literary themes and styles, historical and social contexts, African folk tales, oral poetry, colonial protest literature, postcolonial writing, films on contemporary Africa.
Attribute/Distribution: HU

AAS 039 Special Topics in Africana Studies 4 Credits
Study of a subject or issue in Africana Studies not covered in other courses. May be repeated for credit as subtitle varies.
Repeat Status: Course may be repeated.

AAS 059 (THTR 059) West African Dance 2 Credits
Explore the dance movement and rhythms of West Africa, including African-based dance technique, characteristics, and the fundamental connection between the drums and the dance.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

AAS 062 (THTR 062) Black Theatre 4 Credits
Attribute/Distribution: HU

AAS 066 (THTR 066) Hip Hop Dance 2 Credits
Techniques, vocabulary, and history behind the various elements of the Hip Hop Movement. Focus upon the cultural influence of Hip Hop dance styles, and the overall social influence of the Hip Hop Movement.
Repeat Status: Course may be repeated.
Prerequisites: THTR 066 or AAS 066
Attribute/Distribution: HU

AAS 076 (THTR 076) Hip Hop Dance II 2 Credits
Students familiar with the music genres and basic dance tropes of the Hip Hop movement will explore, develop, and apply them in combinations that weave the various elements of Hip Hop culture into a high energy dance. Focus on Hip Hop dance as it influences the contemporary world view and global aesthetics.
Repeat Status: Course may be repeated.

AAS 095 1-4 Credits
Repeat Status: Course may be repeated.

AAS 102 (ENGL 102, JST 102, REL 102) Promised Lands: Jewish and African American Children’s Literature 4 Credits
In the Hebrew Bible, Psalm 137 asks, “How can we sing the Lord’s song in a strange land?” For Jews, blacks, and black Jews, this was and is a poignant question. This course examines how these two rich, often overlapping and interacting groups tell their stories in literature for children and young adults, with a particular focus on the mediation of traumatic pasts. What does it mean to imagine promised lands beyond such pasts—and can they be reached?
Attribute/Distribution: HU

AAS 103 (SOC 103) Race and Ethnicity in the Contemporary U.S. 4 Credits
Examines race and ethnicity from a sociological perspective. Focus on the role of the major racial and ethnic communities in modern American society. Explores the roles of race and ethnicity in identity, social relations, and social inequality. Topics include racial and ethnic communities, minority/majority groups, assimilation, prejudice/discrimination, identity and the social construction of the concept of “race.”
Attribute/Distribution: SS

AAS 106 (LAS 106, SOC 106) Race and Ethnicity in the Americas 4 Credits
How is it possible that someone who is officially considered black in the United States can embody different racial identities throughout current Latin America? Even more, how is it possible that people considered white nowadays were not officially so in early twentieth-century US (although they were viewed as white in the Latin American context at the same time period)? This course offers a historical comparative analysis of the nature and dynamics of race between the United States and Latin America.
Attribute/Distribution: SS
AAS 117 (PHIL 117) Race, Racism, and Philosophy 4 Credits
An introduction to the philosophy born of struggle against racism and white supremacy. We will read the work of philosophers, mostly European, who quietly made modern racism possible by inventing the category of race, but we will concentrate on the work of philosophers, mostly of African descent, who for 200 years have struggled to force a philosophical critique of the category of race and the practice of white supremacy.
Attribute/Distribution: HU

AAS 121 (ENGL 121) Topics in African-American Literature 4 Credits
Selected works of African American literature and/or the literatures of the African Diaspora. Must have completed six hours of first-year English. Cannot be taken pass/fail.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

AAS 124 (ART 124, GS 124) Arts of the Black World 16th-20th Centuries 4 Credits
This course covers artistic practices originating in Africa that subsequently influenced countless world cultures. The material covers artistic production and theory of arts of the enslaved populations in the Ante-Bellum South, early African American painting through the Harlem Renaissance, the religious arts of Haiti (Vodou) and Cuba (Santeria), and contemporary production from Black Brazilian, American and European artists. Students should be prepared to attend Museums/galleries during the semester.
Attribute/Distribution: HU

AAS 125 (ART 125, GS 125) Art and Architecture of Africa from Colonial to Contemporary Times 4 Credits
This course is structured around case studies of art and architecture from early traditions up through the present. The focus is on cultural production, religious art and architecture (local as well as Christian and Muslim traditions), craftsmanship, style, materials, trade, and international exhibition of art objects in Museums. The literature draws from art historical, anthropological, and historical analyses as well as museum studies. Students should be prepared to attend Museums/galleries during the semester.
Attribute/Distribution: HU

AAS 126 (HIST 126, WGSS 126) How Black Women Made Modern America 4 Credits
This course introduces students to the significant themes and events that have shaped the African American women’s historical experience from slavery to the present. We examine the social, political, and economic meaning of freedom for women of African descent.
Attribute/Distribution: HU

AAS 128 (MUS 128) Jazz History I 3 Credits
A study of the roots of jazz. Starting in West Africa, the course traces the synthesis of African and European elements to 1945. Musicians covered are Gottshalk, Bolden, Morton, Armstrong, Hawkins, Basie, Ellington, and others.
Attribute/Distribution: HU

AAS 129 (MUS 129) Jazz History II 3 Credits
A survey of modern jazz from 1945 to present. Musicians covered include Parker, Gillespie, Monk, Davis, Coltrane, Hancock, and Coleman. Can be taken independently of Jazz History I, but the first course would be helpful.
Attribute/Distribution: HU

AAS 130 (HIST 130) African American History 4 Credits
Blacks in America from the first importation of Africans to the implementation of civil rights laws. West African origins, slave trade, slavery, free blacks and emancipation and study of Reconstruction, segregation, urbanization, and the struggle for racial equality.
Attribute/Distribution: SS

AAS 132 (THTR 132) Hip Hop Theatre 4 Credits
Introduction to the creation and performance of Hip Hop Theatre. Exploration of the history and culture of Hip Hop through original written material, live performance, music, film, video and web based content. Public Performances. Must have audition. Consent given by instructor.
Attribute/Distribution: HU

AAS 133 (FREN 133, HIST 133, LAS 133, MLL 133, POLS 133) Lehigh in Martinique: Globalization and Local Identity 3-4 Credits
Overview of Martinique’s history and cultures from the 18th century to the present, examining diversity among various ethnic groups and covering such themes as religion, literature, art, music/dance, gender, family and anti-colonial movements. The course will also explore how slave castles/forts contributed to the transatlantic slave trade, Pan-Africanism and global tourism.
Attribute/Distribution: HU

AAS 134 (HIST 134) History and Cultures of Ghana 4 Credits
Survey of Ghana’s history and cultures from the 18th century to the present. Features writers from the Harlem Renaissance, the Black Arts Movement, and the post Black Power era.
Attribute/Distribution: HU

AAS 139 Special Topics in Africana Studies 4 Credits
Study of a subject or issue in Africana Studies not covered in other courses. May be repeated for credit as subtitle varies.
Repeat Status: Course may be repeated.

AAS 140 (THTR 140) African American Theatre 4 Credits
Attribute/Distribution: HU

AAS 144 (SOC 144) Global Hip Hop and Social Change 4 Credits
Hip Hop has become a global phenomenon. We will analyze how and why socially conscious Hip Hop, as a tool for social change, has expanded to Latin America, Africa, and the Middle East.
Attribute/Distribution: SS

AAS 145 (WGSS 145) African American Women Writers 4 Credits
Literature by African American women writers with a focus on the experiences and images of black women in the U.S. Explores the written portraits and voices of 20th century black female novelists and poets, including Hurston, Petry, Morrison, Angelou, and Walker.
Attribute/Distribution: HU

AAS 155 (LAS 155, SOC 155) Afro-Latino Social Movements in Latin America & the Caribbean 4 Credits
This focuses on Afro-Latinos who make up nearly 70% of the population of the Americas. Despite the large amount of people of African descent living in the Americas, Afro-Latinos are an understudied population who face significant amounts of racial discrimination in their countries. Who are Afro-Latinos? Where do they live? How are they challenging the racism that they face? These are questions we will tackle in this course.
Attribute/Distribution: SS

AAS 163 (SOC 163) Sociology of Hip Hop Culture 4 Credits
Hip Hop culture is a complex form of artistic practices reflecting and impacting the environments in which they were produced. Through readings, music and video, this class will uncover the origins of Hip Hop by examining the musical history of the Afro-diaspora in the 20th century. Further study will reveal how the young Bronx, NY underclass in the 1970s fused elements of past musical styles with their own personal and political expression that sparked a worldwide phenomenon and culture industry.
Attribute/Distribution: SS
AAS 166 (SOC 166) Wealth and Poverty in the United States 4 Credits
Examine the sociology of wealth and poverty affluence and disadvantage, “rags and riches” in American Society. Focus is a critical analysis of the wealth gap, its causes, consequences and social context. We will consider the roles of wealth and poverty in determining life chances and structuring opportunity, as well as their roles in the perpetuation of social inequality across generations. We will address contemporary debates surrounding public policy, tax laws, antipoverty programs and other reform efforts aimed at decreasing the gap between the “Haves” and the “Have-Not’s.”
Attribute/Distribution: SS

AAS 176 (GS 176, HIST 176, HMS 176) Keeping Africa and Africans Healthy: A History of Illness and Wellness 4 Credits
What are the myths about diseases in Africa and how does the world respond to health crises there? What are the African healing traditions? What is the history of global health in Africa and its implications for illness and wellness? This course explores health interventions and initiatives by Africans and non-Africans including missionaries, colonial officials, and NGOs. Students’ final papers will perform a “post-mortem” on Africa, critically tracing how efforts to control, manage and eradicate diseases have succeeded or failed.
Attribute/Distribution: SS

AAS 177 (LAS 177, SOC 177) Cuba: Race, Revolution and Culture 4 Credits
This course analyzes the role of race and “culture” in the Afro Cuban struggle for equality. By focusing on the arts: particularly music, film and literature, this course will analyze the development of race during Cuba’s colonial period; the Afro Cuban challenge to the “race blind” political and cultural movements of the Cuban Republic. We will then wrap up the semester by addressing the significance of contemporary cultural movements that challenge the social issues currently facing Afro Cubans.
Attribute/Distribution: SS

AAS 178 (GS 178, HIST 178) Globalization and Health in Ghana 3 Credits
This 4-week field-based course fosters global engagement by introducing students to the historical, social, cultural, and political factors at the forefront of globalization and health processes in Ghana.
Attribute/Distribution: SS

AAS 179 (HIST 179) Black Political Thought in America 4 Credits
Black leadership, organizations, and philosophy in America from Reconstruction to the Civil Rights Era; ideas and programs of Booker T. Washington, W.E.B. DuBois, Marcus Garvey, Malcolm X and Martin Luther King, Jr.
Attribute/Distribution: SS

AAS 183 (ANTH 183) Peoples and Cultures of Africa 4 Credits
Studies African modernity through a close reading of ethnographies, social stories, novels, and African feature films.
Attribute/Distribution: SS

AAS 205 (POLS 205) The Political Development of American Race Relations 4 Credits
This course examines the distinctive role race has played in shaping the political history of the United States.
Attribute/Distribution: SS

AAS 210 (POLS 210, WGSS 210) Revolution on Campus 4 Credits
Universities are often sites of political protest. Some of these protests are expressive but ineffective, others can spark revolutions and regime change. Why? What distinguishes universities as sites for resistance? What makes students prone to mobilization? The study of politics can seem like an abstract pursuit, one that is not relevant to our lives. This course takes the scholarly literature on social movements and applies it to the university. Students will engage in social activism as part of this course.
Attribute/Distribution: SS

AAS 211 (ART 221, GS 221) Global Contemporary Art 4 Credits
Course examines artworks from around the world c. 1980s to the present. Topics include revolutionary arts, globalism, EcoArt, postcolonial arts, phenomenological, experiential and new media arts. Global feminist projects, design/build production, graffiti and popular arts are covered regularly. International Art Biennials, exhibitions and the built environment are featured. Art Theory is explored through iconographic, formal and contextual (political, social, financial) analysis. Movements are situated in historical frameworks as well as in their international scope and value. Writing Intensive.
Attribute/Distribution: HU

AAS 230 (POLS 230) Social Movements From the 1960s to Present 4 Credits
The lessons of U.S. social and political movements from the 1960s and the post-2000 era. Students examine social movements through the lens of intersectionality, with a focus on civil rights, anti-war activism, women’s rights, global justice, and ecology movements, to assess their connection to democracy and citizens’ lives.
Attribute/Distribution: SS

AAS 239 Special Topics in Africana Studies 4 Credits
Study of a subject or issue in Africana Studies not covered in other courses. May be repeated for credit as subtitle varies.
Repeat Status: Course may be repeated.

AAS 263 Caribbean Artistic and Cultural Traditions 4 Credits
Representation of contemporary popular culture in the Caribbean in literature, music, painting and other artistic expressions. Major attention is devoted to the influences on tradition, folklore and religion in modern Caribbean life.
Attribute/Distribution: HU

AAS 276 (COMM 276) Media and Race 4 Credits
Considers the role of print, broadcast and new media representations upon social reality. Focuses upon making the connections between information and entertainment media that perpetuate stereotypes and how such stereotypes create dominant, contemporary understandings of various groups. This course is writing intensive.
Attribute/Distribution: SS

AAS 277 (COMM 277) Race Representations & News Media 4 Credits
This course examines the representation of racial and ethnic minorities in American media and media outlets globally. It begins with a comparative analysis of majority/minority representations. It further analyzes the impact of such portrayals upon public opinion, public policy, and interpersonal life within the U.S. and abroad. Class discussions and assignments will address the role of print, broadcast and online media in shaping the contemporary dominant understandings of various racial groups in a globalized world and social constructions of reality.
Attribute/Distribution: SS

AAS 278 (COMM 278) Race, Sports, Media and Social Activism 4 Credits
This course investigates the role and use of media in key efforts of social resistance among American athletes of color. Our analysis will include a look at the lives of athletes who engage in these actions; key acts of resistance; media coverage; and the public response both for and against the protests. Students will learn about media literacy, the power of representation, public sphere protest among celebrities and the role of news media in protest.
Attribute/Distribution: SS

AAS 305 (ES 305, POLS 305) Residential Segregation: Policies and Practices 4 Credits
This course is an introductory planning course, with an emphasis on housing and community development policy. It will examine historical and contemporary aspects of urban politics; the economic, demographic, and spatial evolution of American cities; and various urban problems, such as the spatial mismatch between people and jobs, housing quality and affordability, and residential segregation. Finally, the course will review how planners have addressed conditions in cities and regions over time.
Attribute/Distribution: SS
AAS 310 (SOC 310, WGSS 310) Gender, Race and Sexuality: The Social Construction of Differences 4 Credits
Students will engage with current debates about the meaning and use of racial and sexual classification systems in society. We will examine the historical and sociological contexts in which specific theories of racial and sexual differences emerged in the U.S. We will also explore the ways in which changes in the images have implications on the roles racial, gender, and sexual identity plays in our understanding of the relationship between difference and inequality.
Prerequisites: SOC 103 or SSP 103
Attribute/Distribution: SS

AAS 312 (FREN 312) Modernity in the Maghreb 4 Credits
Emergence of the modern self through a comparative study of textual as well as visual representations of postcolonial subjects by male and female writers and film makers. Study of the way the sociopolitical context of countries such as Morocco, Algeria and Tunisia informs the constitution of subjectivity within a multicultural and multilingual community. Issues such as patriarchy, nationalism, colonialism, post colonialism, identity, gender, and Islam in North African literature and film from Franco-Arab traditions.
Attribute/Distribution: HU

AAS 313 (SOC 313) Keep the Change: Social Movements in Society 4 Credits
Interested in how social change works? Or how to stop it? This seminar provides an introduction to the origins, dynamics, and consequences of historical and contemporary social movements, beginning with the American Civil Rights Movement. Students will discuss and develop their own ideas on these issues through examination of social movement theory and empirical case studies. They will also explore more general questions about the relationship between human agency, social structure, and historical change. More information is available at wordpress.lehigh.edu/zim2/soc313.
Attribute/Distribution: SS

AAS 314 (GS 314, HMS 314, SOC 314) Infections and Inequalities: HIV, TB and Malaria in the Global South 4 Credits
This course will explore the social, economic, and environmental causes of HIV, TB, and malaria in developing nations, with a particular focus on the characteristics and causes of these diseases in Sub-Saharan Africa. Students will engage theories and perspectives on development, globalization, and social inequality to explain trends in HIV, TB, and malaria and to understand why certain groups are more vulnerable to infection than others. Prerequisite: Junior/senior standing with declared major/minor in SOC, ANTH, SOAN, HMS, GS, or AAS.
Attribute/Distribution: SS

AAS 318 (ENGL 318) African-American Literature and Culture 3,4 Credits
Special Topics in African American culture and/or the cultures of the African diaspora. Topics may be focused by period, genre, thematic interest or interdisciplinary method including, for example, "Nineteenth-century African American Literature and Politics", "African-American Folklore", "Black Atlantic Literature", "The Harlem Renaissance", "African-American Women Writers".
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

AAS 324 (ANTH 324, GS 324) Globalization and Development in Africa 4 Credits
This course examines the challenges Africa presents to expectations of modernization and development. It poses these questions: How do African societies have been left behind by globalization, shut out from it, or do they merely reflect an unexpected side of globalization processes? What is Africa's place in the neoliberal world order? What role does "African culture" play in generating or blocking social change? And, how can anthropology illuminate prospects for change on what has long been regarded as the "dark continent"?
Attribute/Distribution: SS

AAS 326 (PSYC 326) The Doing and Undoing of Racism 4 Credits
This course will provide students with a critical understanding of historical, legal, and social psychological factors that lead to prejudice, discrimination, and racism within our society. It will survey the US constitution, policy, and social psychological theories that explain the causes and maintenance of prejudice, discrimination, and racism in their many forms. Students will learn how laws and various theoretical perspectives apply to people's psychological functioning and group behavior, and examine theoretically derived interventions to reduce prejudice, discrimination, and racism.
Prerequisites: PSYC 121 or AAS 003
Attribute/Distribution: SS

AAS 330 (HIST 330) Africans and the Atlantic World 4 Credits
This course chronicles the history of Africans and the Atlantic world from the fifteenth century. It explores cross-cultural interactions and exchanges between Africans and Europeans and covers major themes including trade, religion, slavery, abolition, identity, colonialism, gender, the “Back-to-Africa” movements and impact of Africans on Atlantic world history.
Attribute/Distribution: HU

AAS 331 (HIST 331) United States and Africa 3,4 Credits
Reciprocal relationships between North America and the African continent from the slave trade in the seventeenth century to the twentieth century Afrocentric movement; impact of Americans on shaping of modern Africa, Pan-African relations; influence of African Americans on U.S. policies toward Africa.
Attribute/Distribution: SS

AAS 332 (HIST 332) Slavery and the American South 3-4 Credits
The emergence and demise of the "peculiar institution" of African American slavery in British North America and the Old South. African background, colonial beginnings, 19th century slave community, the ruling race and proslavery ideology, the death of slavery and its aftermath, slavery and freedom in a comparative context.
Attribute/Distribution: SS

AAS 335 Special Topics in African History and/or Diaspora 3-4 Credits
Study of a subject or issue in Africana Studies not covered in other courses. May be repeated for credit as subtitle varies.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

AAS 339 Special Topics in Africana Studies 4 Credits
Study of a subject or issue in Africana Studies not covered in other courses. May be repeated for credit as subtitle varies.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

AAS 341 (GS 341, HIST 341) Global Africa: Aid, Volunteerism, NGO's and International Studies 3,4 Credits
This course traces the origins of Aid to Africa, explores various volunteer activities, and investigates the role of NGOs, missionaries, philanthropists, medical practitioners, and global education. It examines the ways that cross-cultural interactions and exchanges between Africans and foreigners shaped African societies both positively and negatively.
Attribute/Distribution: SS

AAS 343 (ASIA 343, GS 343, POLS 343) Global Politics of Race: Asia and Africa 4 Credits
An examination of the concept of "race" and its impact on domestic and international politics.
Attribute/Distribution: SS

AAS 345 (SOC 345) Colonialism and the Black Radical Tradition 4 Credits
Karl Marx was not the only figure who developed an influential theory of social revolution. A cadre of theorists from the Global South have extensively theorized about the issues facing their particular nations, and they have developed social theories that have challenged social and global inequality. This course is a theory based course that will focus on the anti-colonial and post-colonial thought of radical black intellectuals from the Black America, the Caribbean, and West Africa.
Attribute/Distribution: SS
AAS 371 Independent Study 1-4 Credits
Independent study in advanced areas of Africana Studies. Independent research with an individual faculty member in the Africana Studies program. Consent of director.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

AAS 375 (COMM 375) Global Media and Culture 4 Credits
Cultural Studies investigates dominant understandings; issues of identity and experience; and society. A Cultural Studies approach to understanding representations of difference in global media. Focus will center upon the role of media in shaping the contemporary dominant understandings of various groups in a globalized world; introductions to philosophies and theories that function as fundamental texts on the relationship between media, social life and human behavior; and the ways in which media socially construct a new, globalized reality.
Attribute/Distribution: SS

AAS 376 (COMM 376, WGSS 376) New Media, Race and Gender 4 Credits
This class explores the relationship among race, gender and new media. It examines depictions of racial minorities and women online; how users access and use new media across race and gender (including a look at the digital divide); and differences in use of social media websites across race and gender. The goal is for students to understand how existing racial and gender categorizations are/are not transmitted to the online community and do/do not become extensions of present social hierarchy.
Attribute/Distribution: SS

AAS 382 Seminar on a topic in Africana Studies 1-4 Credits
Attribute/Distribution: ND

AAS 390 Honors Thesis 1-4 Credits
Directed undergraduate research thesis required of Africana Studies majors who apply for and qualify for graduation with program honors. Students must complete a minimum of 4 Honors Thesis credits and attain a 3.5 grade point average in the major and a 3.2 grade point average overall. Permission of the program director required.
Repeat Status: Course may be repeated.

AAS 391 Special Topics in Africana Studies 3-4 Credits
A topic, genre, or approach in literature or writing not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

American Studies
Program Director: Vacant
Website: http://american.cas2.lehigh.edu

American Studies is an interdisciplinary study field that crosses the humanities and the social sciences, encouraging students to analyze America—broadly, transnationally considered—as a site of intellectual inquiry. Asking “What is America? What does it mean and what has it meant to be called ‘American’?” provokes a multitude of theoretical and pragmatic questions that are vital for developing intercultural knowledge and civic engagement among undergraduate students. Applying cultural and social thought to such matters as citizenship, democracy, community, religion, gender, poverty and prosperity, politics, popular culture, and identity in this region makes American Studies an intellectually sophisticated yet practical course of study, bringing theory and praxis together.

Professor. Seth Moglen, PHD (University of California, Berkeley)
Assistant Professor. Christopher Mark Driscoll, PHD (Rice University)

THE MINOR
Four courses from the approved list, at least two of which must be at the 100-level or above.

COURSES

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<tr>
<td>REL/JST/THTR 177</td>
<td>Jews and the Broadway Musical</td>
<td>4</td>
</tr>
<tr>
<td>SOC/AAS 103</td>
<td>Race and Ethnicity in the Contemporary U.S.</td>
<td>4</td>
</tr>
<tr>
<td>SOC/AAS/LAS 106</td>
<td>Race and Ethnicity in the Americas</td>
<td>4</td>
</tr>
<tr>
<td>SOC 115</td>
<td>A Nation of Immigrants: The American Experience</td>
<td>4</td>
</tr>
<tr>
<td>SOC 128</td>
<td>Race, Gender, and Work</td>
<td>4</td>
</tr>
<tr>
<td>SOC 130</td>
<td>Sociology of Sports</td>
<td>4</td>
</tr>
<tr>
<td>SOC 138</td>
<td>The Sociology of Reality TV</td>
<td>4</td>
</tr>
<tr>
<td>SOC 166</td>
<td>Wealth and Poverty in the United States</td>
<td>4</td>
</tr>
<tr>
<td>SOC/WGSS/AAS 310</td>
<td>Gender, Race, and Sexuality: The Social Construction of Differences</td>
<td>4</td>
</tr>
</tbody>
</table>
**THE GRADUATE PROGRAM IN AMERICAN STUDIES IS CURRENTLY ON HIATUS. NO STUDENTS ARE BEING ADMITTED. CERTIFICATE PROGRAMS MAY STILL BE PURSUED**

### M.A. IN AMERICAN STUDIES

A Master of Arts degree in American Studies is offered in the College of Arts and Sciences. Candidates for the master's degree must complete at least 30 credit hours, 18 of which must be at the 400 level.

**AMST 400** American Studies: Theory and Method

- **Methods Course**
- **AMST 490** Master's Thesis

- **Concentration/Track**
  - Environmental Policy Design (EPD)
  - Gender & Sexuality (WGSS)
  - Race & Ethnicity (AAS)
  - Culture & Ideas
  - Documentary Film
  - Customized Concentration

- **Free Electives**

1. Choose 1 or 2 methods courses in consultation with advisor/mentor and permission of course instructor needed. Possible courses include SOC 410 Statistics for Sociological Inquiry; SOC 411 Advanced Quantitative Research Methods; SOC 412 Advanced Qualitative Research Methods; POLS 402 Methods Of Policy Analysis; POLS 403 Creativity, Ideas, and Methods in Political Science; PSYC 421 Research Methods; PSYC 421 Statistical Analysis of Psychological Data; HIST 401 Historical Research HIST 438 Techniques in Public History; ENGL 481 Theory and Criticism; ENGL 483 Creative Writing and Literary Studies; EDUC 403 Research; EDUC 405 Qualitative Research Methods; EDUC 408 Introduction to Statistics

2. Traditional thesis is available but students may also fulfill this requirement through other final project forms such as: documentary film, journal article, internship/Community Fellows (https://community-fellows.cas2.lehigh.edu) placement, exhibit/installation, archive, report. There will be a written and presentation component to all thesis/other final projects.

3. Choose one in consultation with advisor/mentor. Individualized option is available but student must propose their track with a rationale that will be approved by their advisor and the director.

4. Graduate certificate available. (http://catalog.lehigh.edu/coursesprogramsandcurricula/interdisciplinarygraduatestudyandresearch/graduatecertificates)

5. EPD offers Graduate Certificates in Urban Environmental Policy and Planning, Sustainable Development, and Environmental Law and Policy. (http://catalog.lehigh.edu/coursesprogramsandcurricula/artsandsciences/environmentalinitiative#graduatetext)

6. Sample courses include HIST 448 Land Use, Growth Management, and the Politics of Sprawl; SOC 421 Information Ecology; ANTH 352 Environmental Archaeology; ES 431 Public Administration.

7. Sample courses include WGSS 458 Readings in Gender History; WGSS 450 Seminar in Feminist Theory; SOC 351 Gender and Social Change; WGSS 441 Women and Health.

8. Sample courses include HIST 332 Slavery and the American South; SOC 465 Inequalities at Work; HIST 367 Rise and Fall of the Old South; SOC 379 Race and Class in America.

9. Sample courses include SOC 402 Sociology of Cyberspace; ANTH 376 Culture and the Individual; HIST 328 American Intellectual History since 1900; POLS 435 Power, Persuasion and the American Presidency.

10. Sample courses include HIST 348 Techniques in Public History; HIST 305 Public History; HIST 337 History and Community Memory; AMST 425.

11. Free electives chosen in consultation with advisor from American Studies approved classes.

---

### GRADUATE CERTIFICATE IN AFRICANA STUDIES

A Graduate Certificate in Africana Studies is offered in the College of Arts and Sciences. Candidates for the certificate must complete 12 credit hours (4 courses) at the 300-level or above, with no more than 6 credits at the 300-level.

The Graduate Certificate in AAS is designed as a complement to a graduate program (e.g. English, History, Sociology, American Studies, Political Science) or as a standalone post-baccalaureate course of study. The Certificate is a small, flexible program that provides students with breadth and the challenge of working outside their home discipline in concentrated interdisciplinary study of Africana Studies.

In recognition of contemporary educational and employment contexts that are increasingly diverse and international, the AAS Program offers the graduate certificate as a means to enrich academic, personal, and employment horizons.

4 courses from the list below at the 300-level or above with no more than 6 credits at the 300-level

### COURSES

Additional courses may be chosen in consultation with the program director.

- **AAS/SOC/WGSS 310** Gender, Race and Sexuality: The Social Construction of Differences
- **AAS/FREN 312** Modernity in the Maghreb
- **AAS/SOC 313** Keep the Change: Social Movements in Society
- **AAS/HMS/SOC/GS 314** Infections and Inequalities: HIV, TB and Malaria in the Global South
- **AAS/ENGL 318** African-American Literature and Culture
- **AAS/ANTH/GS 324** Globalization and Development in Africa
- **AAS/HIST 330** Africans and the Atlantic World
- **AAS/HIST 331** United States and Africa
- **AAS/HIST 332** Slavery and the American South
- **AAS/HIST 335** Special Topics in African History and/or Diaspora
- **AAS 339** Special Topics in African Studies
- **AAS/GS/HIST 341** Global Africa: Aid, Volunteering, NGO’s and International Studies
- **AAS/ASIA/GS/POLS 343** Global Politics of Race: Asia and Africa
- **AAS/SOC 345** Colonialism and the Black Radical Tradition
- **AAS/COMM 375** Global Media and Culture
- **AAS/COMM/WGSS 376** New Media, Race and Gender
- **AAS 376/SOC 379** New Media, Race and Gender
- **AAS 382** Seminar on a topic in African Studies
- **AAS 391** Special Topics in Africana Studies
- **HIST 367** Rise and Fall of the Old South
- **POLS 430** Social Movements From the 1960s to Present
- **POLS 443** Global Politics of Race: Asia and Africa
- **SOC/WGSS 365/SOC 465/WGSS 465** Inequalities at Work
- **SOC 374** Social Stratification: Race, Class, Gender
- **SOC 443** Race, Ethnicity, and Health

### GRADUATE CERTIFICATE IN WOMEN, GENDER & SEXUALITY STUDIES

The Graduate Certificate in WGSS is designed as a complement to a disciplinary graduate program or as a standalone post-baccalaureate course of study. The Certificate is a small, flexible program that provides students with breadth and the challenge of working outside their home discipline in concentrated interdisciplinary study of women and gender.
In recognition of contemporary educational and employment contexts that are increasingly diverse and international, the WGSS Program offers the graduate certificate as a means to enrich academic, personal, and employment horizons. A certificate in WGSS will be especially beneficial to those who wish to incorporate a broader perspective into their teaching (either in secondary or higher education), and qualifies them for positions that require such expertise. Additionally, individuals interested in fields such as social policy, human resources, and business will also gain from understanding how gender operates at individual, organizational, and institutional levels. Students will work closely with outstanding faculty from diverse disciplinary backgrounds.

WGSS 450 Seminar in Feminist Theory 3
Select three additional courses \(^1\,^2\) 9
Total Credits 12

\(^1\) 2 courses outside home department (for matriculating students)
\(^2\) No more than 6 credits at the 300-level

Refer to Women, Gender and Sexuality catalog entry (http://catalog.lehigh.edu/coursesprogramsandcurricula/artsandsciences/womengenderandsexualitystudies/#courseinventory) for course listing.

**GRADUATE CERTIFICATE IN ENVIRONMENTAL LAW & POLICY AND PLANNING**

**Core Course**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES/SOC 404 Socio-cultural Foundations of Environmental Policy</td>
<td>3</td>
</tr>
</tbody>
</table>

**Elective Courses** \(^1\)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES/POLS 411 Environmental Valuation for Policy Design</td>
<td>1</td>
</tr>
<tr>
<td>ES/POLS 431 U.S. Environmental Law I: Pollution and Risk Abatement</td>
<td>1</td>
</tr>
<tr>
<td>ES 443 International Environmental Law &amp; Philosophical-Policy Design</td>
<td>1</td>
</tr>
<tr>
<td>ES 442 International Law &amp; Philosophical-Policy Design</td>
<td>1</td>
</tr>
<tr>
<td>ES 443 Comparative Environmental Law &amp; Philosophical-Policy Design</td>
<td>1</td>
</tr>
<tr>
<td>ES/POLS 455 Environmental Justice: From Theory to Practice</td>
<td>1</td>
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<tr>
<td>EES 446 Human-Climate Interactions</td>
<td>1</td>
</tr>
<tr>
<td>POLS 416 American Environmental Policy</td>
<td>1</td>
</tr>
<tr>
<td>POLS 418 Political Economy</td>
<td>1</td>
</tr>
</tbody>
</table>

Total Credits 12

\(^1\) Additional courses selected in consultation with the program adviser may fulfill program requirements. No more than 6 credits can be taken at the 300-level.

**GUARDATE CERTIFICATE IN SUSTAINABLE DEVELOPMENT**

**Core Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES/SOC 404 Socio-cultural Foundations of Environmental Policy</td>
<td>3</td>
</tr>
<tr>
<td>ES 410 Foundations of Sustainable Development Practice</td>
<td>3</td>
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</tbody>
</table>

**Elective Courses** \(^1\)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTH/GS/AAS 324 Globalization and Development in Africa</td>
<td>3</td>
</tr>
<tr>
<td>ECO 303 Economic Development</td>
<td>3</td>
</tr>
<tr>
<td>ES/POLS 414 Urban Agriculture Policy, Planning and Practice</td>
<td>3</td>
</tr>
<tr>
<td>EES 446 Human-Climate Interactions</td>
<td>3</td>
</tr>
<tr>
<td>POLS/ENTP 310 Social Entrepreneurship: How to Change the World</td>
<td>3</td>
</tr>
<tr>
<td>POLS/GS/WGSS 342 Gender and Third World Development</td>
<td>3</td>
</tr>
<tr>
<td>POLS 348 Land Use, Growth Management, and the Politics of Sprawl</td>
<td>3</td>
</tr>
<tr>
<td>SDEV/ENTP 307 International Social Entrepreneurship</td>
<td>3</td>
</tr>
<tr>
<td>SOC/GS/HMS 322 Global Health Issues</td>
<td>3</td>
</tr>
<tr>
<td>SOC/GS 319 The Political Economy of Globalization</td>
<td>3</td>
</tr>
<tr>
<td>SOC 419 Global Food Systems</td>
<td>3</td>
</tr>
<tr>
<td>SOC/WGSS 441 Gender and Health</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits 12

\(^1\) Additional courses selected in consultation with the program adviser may fulfill program requirements. No more than 6 credits can be taken at the 300-level.

**Courses**

**AMST 347 (PHIL 347, REL 347) American Religious Thinkers 3-4 Credits**

An examination of the writings of key figures in the history of American religious thought (such as Edwards, Emerson, Bushnell, Peirce, James, Royce, Dewey and the Niebuhrs). Attention will be directed both to the historical reception of these writings and to their contemporary significance.

**AMST 400 American Studies: Theory and Method 3 Credits**

An introduction to the theoretical orientations and methodological strategies of American Studies. Seminar involves extensive reading as well as application of theory and method to students’ research.

**AMST 401 Special Topics in American Studies 1-3 Credits**

Graduate seminar focused on one particular subject area in American Culture.

**AMST 402 Independent Study 3 Credits**

Individually supervised course in the area of American Culture. Consent of the program director required.

**AMST 433 (DOC 433) Documentary Film Production 3 Credits**

An independent study mode of course awarding credit for the production of a 30-minute documentary film that meets two standards: 1) high production value, and 2) scholarly content based on detailed research and driven by critical analysis.

**AMST 471 Special Topics 3 Credits**

**AMST 481 Independent Study 1-3 Credits**

**AMST 482 Independent Study 1-3 Credits**

**AMST 490 Master’s Thesis 1-6 Credits**

Independent work, with a faculty member, on a single master’s thesis or two thesis papers. Topic approved by individual faculty member. Typically taken in the last semester of course work.

**Repeat Status:** Course may be repeated.
Art, Architecture, and Design

The three primary disciplines of the Department of Art, Architecture and Design share a common focus on design, visual literacy, the creative process and the making of the built environment. The emphasis on design as a broad concept begins to shape aesthetic principles, and initiates the structuring of the individual’s creative process. To that end, the department offers undergraduate Bachelor of Arts degrees in four majors: art, architecture, design, and art history. Minor programs are available in studio art, architecture, graphic design, product design, history of the visual arts, history of architecture, and museum studies.

Many studio courses require department permission. The student interested in enrolling in any of the department’s courses should contact the program coordinator to schedule an appointment with an advisor well before preregistration so that he or she can be rostered at the appropriate time.

An art major centers on studio education wherein principal disciplines such as drawing, sculpture, painting and photography are explored. The student is required to engage in an intense concentration in studio work at Lehigh and when appropriate at other Lehigh Valley colleges that offer complementary courses. Studio work is enhanced by courses in history and theory, both within the department and throughout the university.

For the student interested in becoming a creative artist, the major provides a foundation for a life in art, or more immediately the potential path into a graduate degree program in fine art. A major in art may be combined with theater for those interested in costume design, or with architecture and theater for those who aspire to be set designers. A major in art combined with a minor in education is available for students interested in becoming primary, secondary or special education art teachers.

The architecture major is a pre-professional course of study focused on architectural design studios, complemented by art studios, history and theory courses, and introductory materials and building technology courses. The major results in a Bachelor of Arts degree.

The architecture major is a comprehensive undergraduate education that is the first step in a series of educational and apprenticeship requirements leading to professional registration. Architecture majors regularly go on to the most respected graduate schools of architecture, with Harvard, the University of Pennsylvania, University of Virginia, and Washington University in St. Louis, among scores of institutions, actively seeking Lehigh graduates for their programs.

Alternatively, many architecture majors choose to work in fields allied to the discipline, such as interior design, adaptive reuse building, historic preservation, construction management, real estate development, etc. Since for such paths professional architectural registration is not required, the Lehigh degree alone is the springboard to various careers that involve the making of the built environment.

(The Bachelor of Arts degree with a major in architecture should not be confused with the Bachelor of Architecture, a professional five-year degree. Those students who major in architecture and graduate with the Bachelor of Arts degree and wish to pursue a professional career in architecture will be required to obtain a Master of Architecture from an institution offering a graduate program in architecture.)

The Arts-Engineering program, a five-year, dual-degree course of study, allows students to link complementary disciplines of engineering and architecture. The result is two degrees from two different colleges within Lehigh, one a professional degree in engineering, one the pre-professional degree in architecture.

A design major engages students with new technologies, materials and media in developing the creative processes and critical thinking necessary for the modern designer. The major centers on studio wherein an emphasis on visual communication through digital media is complemented by the traditional focus on art making. Courses in art and design history and theory and in specific media techniques supplement the series of required studios.

A student may take a range of department courses in design or may choose a specific concentration in either graphic design or product design. The graphic design concentration introduces students to the tools and media related to print applications, web-based media, exhibition design, publishing and advertising. Product design concerns the creation of objects used in industrial applications, art objects, furniture, toys, exhibits and trade design, electronic products, household items and recreational equipment.

An art history major provides students with a comprehensive education in the history of art and architecture, and an opportunity to learn about the changing form and status of the visual arts and built environment in culture and society. Through introductory and advanced coursework, as well as museum and site visits, students learn how to examine, evaluate, and interpret works of art and architecture, and acquire a working knowledge of the methods, theories and research practices of art historical analysis.

The study of art and its history is a vital and fundamental part of a liberal arts education, and art history is unique among academic fields in the breadth and diversity of its objects of study: drawings, painting, sculpture, and printmaking; architecture, design, and urban planning; photography and film; material culture; as well as a variety of other cultural forms. Students majoring in art history go on to careers in architecture, art, design, curating, communications, imaging, advertising, education, and many other fields. The major also provides an important foundation for students who plan to pursue advanced graduate studies in the arts and humanities. Art history majors choose one of three areas of concentration: history of the visual arts, history of architecture, or museum studies.

All programs are philosophically cross-disciplinary, as students are encouraged to take advantage of the many learning environments that constitute a university. Significant resources for all disciplines in the department include the Lehigh University permanent art collection and archives as well as the numerous on-campus galleries and the Zoeller Art Center. Students are encouraged to make use of the collections and facilities to enhance and enrich studios and courses, and to help shape their own creative work.

The department offers minor programs in studio art, architecture, apparel design, graphic design, product design, history of the visual arts, history of architecture, museum studies that are available to all undergraduate students. The purpose of these minor programs is to enable students from any major to be introduced to the studio practices of art, architecture, and design, and to help form an understanding of the role that art plays in human history and culture.

DEPARTMENTAL HONORS

Exceptional students in art, architecture or design may apply for department honors at the end of their junior year or the beginning of their senior year. To be eligible, a student must have attained a 3.5 GPA in the major program and a minimum overall GPA of 3.0. Candidates should submit to the department chair a written proposal, prepared in consultation with a faculty member who will serve as honors sponsor. The project could result in a research paper, design project, or exhibition. Successful completion of the project will result in a “Department Honors” designation being affixed to the student’s transcript.

Professors. Berrisford W. Boote, MFA (Maryland Institute College of Art); Anna Chupa, MFA (University of Delaware); Lucy C. Gans, MFA (Pratt Institute); Anthony Viscardi, MARCH (Georgia Institute of Technology)

Associate Professors. Amy Forsyth, MARCH (Princeton University); Wesley Heiss, MARCH (Rice University); Marilyn Jones, MFA (Marywood University); Nik Nikolov, MARCH (Rice University); Nicholas Sawicki, PHD (University of Pennsylvania)

Assistant Professors. Eugene Han, PHD (Yale University); Susan E. Kart, PHD (Columbia University)

Professors Of Practice. William B. Crow, PHD (Columbia University); Peter Lusch, MA (Michigan State University); Jason E. Travers, MFA (University of Pennsylvania); Christine E. Ussler, MARCH (Columbia University)

Emeriti. Tom F. Peters, DSC (ETH Zurich); J. Bruce Thomas, PHD (University of California, Berkeley); Ricardo Viera, MFA (Rhode Island School of Design); Ivan Zaknic, MARCH (Princeton University)
### ART MAJOR
44 credit hours required

**Foundation**
- ART 001 Art and Architecture History: Ancient to Medieval
- ART 002 Art History: Renaissance to Present
- ART 003 Two-Dimensional Design
- ART 004 Three-Dimensional Design
- ART 011 Drawing I

**History**
- ART 220 20th Century Art
- OR
- ART 221 Global Contemporary: Recent Art Movements Around the World

**Studio - Two entry level discipline specific art studios**
- ART 007 Digital Photography I
- ART 011 Drawing I
- ART 013 Sculpture I
- ART 015 Figure I
- ART 034 Plein Air Painting
- ART 035 Painting I
- ART 052 Introduction to Video Recording and Editing

**Two ART 217 Studio Workshops**
- ART 217 Studio Workshop (Repeated twice for the major program)

**One Capstone**
- ART 317 Art Capstone

Total Credits 44

### ART HISTORY MAJOR
44 credit hours are required.

**Foundation**
- ART 001 Art and Architecture History: Ancient to Medieval
- ART 002 Art History: Renaissance to Present
- ART 003 Two-Dimensional Design
- ART 004 Three-Dimensional Design
- ART 016 Introduction to Museum Work

**Capstone - 1 course from the following List**
- ART 317 Departmental Capstone
- ART 389 Honors Project

**Electives - 5 courses from the following list**
- See footnote instructions
- ANTH 112 Doing Archaeology
- ANTH 172 North American Archaeology
- ANTH 174 Greek Archaeology
- ANTH 176 Roman Archaeology
- ANTH 178 Mesoamerican Archaeology
- ARCH 134 Architecture and Urbanism of New York City
- ARCH 209 Architecture and Ideas
- ART 069 Special Topics in Art History
- ART/WGSS 121 Women in Art
- ART 124/ AAS 124; GS 124 Arts of the Black World 16th-20th Centuries
- ART 125/ AAS 125; GS 125 Art and Architecture of Africa from Colonial to Contemporary Times
- ART 169 Special Topics in Art History
- ART 220 Modern Art of the 20th Century (WI)
- ART 221 Global Contemporary Art
- ART 223 Writing Your Way Into the Arts

### ARCHITECTURE MAJOR
62-64 credit hours are required.

**Foundation**
- ART 001 Art and Architecture History: Ancient to Medieval
- ARCH 002 Architectural History II
- ART 003 Two-Dimensional Design
- ART 004 Three-Dimensional Design
- ART 016 Introduction to Museum Work

**Architecture Studios**
- ARCH 043 Architectural Design I
- ARCH 143 Architectural Design II
- ARCH 243 Architectural Design III
- ARCH 343 Architectural Design IV

**Additional Studios**
- Select three of the following: 11-12
- ART 007 Digital Photography I
- ART 011 Drawing I
- ART 013 Sculpture I
- ART 015 Figure I
- ART 034 Plein Air Painting
- ART 035 Painting I
- ART 052 Introduction to Video Recording and Editing
- ART 111 Drawing II
- ART 113 Sculpture II
- ART 115 Figure II
- ART 135 Painting II
- DES 148 Furniture Design I
- DES 248 Furniture Design II
- ARCH 033 Architectural Design
- ARCH 123 Visualization and Fabrication in Architecture
- ARCH 211 Architectural Drawing/Analysis and Expressions

**History and Theory**
- ARCH 210 20th Century Architecture
- Select two of the following: 7-8
- ARCH 107 History of American Architecture
- ARCH 159 Modern History and Sustainable Architecture in Munich
- ARCH 174 Greek Archaeology
- MLL 100 Introduction to International Film
- PHIL 123 Art, Beauty, and Aesthetic Experience
- PHIL 223 Figures/Themes In Aesthetics
- THTR 129 History of Fashion and Style

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1. At least 3 of the 5 classes must be at the 200 level or above and at least 1 must be a Writing Intensive course. Additional courses taught in AAD or in other disciplines may be substituted for the classes listed here at the discretion of the student’s major advisor. Courses taken during study abroad must be pre-approved with the student’s advisor if they are intended to fulfill requirements for the major.
**ARCH 134**  Architecture and Urbanism of New York City
**ARCH 176**  Roman Archaeology
**ARCH 187**  Synthetic Space
**ARCH 209**  Architecture and Ideas
**ARCH 212**  The Architecture of Carlos Scarpa/ Theory and Practice
**ARCH 214**  Architecture and the City since WWII
**ARCH 342**  Theory of Form and Materials
**ARCH 335**  Issues in Contemporary Architecture
**PHIL 123**  Art, Beauty, and Aesthetic Experience
**HIST 334**  American City in the Twentieth Century
**DES 066**  Design History
**ART 124**  Arts of the Black World 16th-20th Centuries
**ART 125**  Art and Architecture of Africa from Colonial to Contemporary Times
**ART 221**  Global Contemporary: Recent Art Movements Around the World

### Materials and Technology

**ARCH 157**  Architectural Technology I  4
**ARCH 158**  Architectural Technology II  4

Total Credits: 62-64

For the Architecture Major, students must fulfill the mathematics and physical science requirements with the following:

### Mathematics Requirement

Select one of the following:

<table>
<thead>
<tr>
<th>Credits</th>
<th>Course</th>
<th>Description</th>
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<tbody>
<tr>
<td>5-8</td>
<td>MATH 021 &amp; MATH 022</td>
<td>Calculus I and Calculus II</td>
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<tr>
<td></td>
<td>MATH 051 &amp; MATH 052</td>
<td>Survey of Calculus I and Survey of Calculus II</td>
</tr>
<tr>
<td></td>
<td>MATH 075 &amp; MATH 076 &amp; MATH 022</td>
<td>Calculus I, Part A and Calculus I, Part B and Calculus II</td>
</tr>
<tr>
<td></td>
<td>MATH 075 &amp; MATH 076 &amp; MATH 052</td>
<td>Calculus I, Part A and Calculus I, Part B and Survey of Calculus II</td>
</tr>
</tbody>
</table>

### Physical Science Requirement

**PHY 012**  Introductory Physics Laboratory I  1

Select one of the following:

<table>
<thead>
<tr>
<th>Credits</th>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>PHY 010</td>
<td>General Physics I</td>
</tr>
<tr>
<td></td>
<td>or PHY 011</td>
<td>Introductory Physics I</td>
</tr>
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A typical first-year might consist of:

<table>
<thead>
<tr>
<th>Credits</th>
<th>Course</th>
<th>Description</th>
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<tr>
<td>4</td>
<td>ART 001</td>
<td>4</td>
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<tr>
<td>4</td>
<td>MATH 021 or MATH 051</td>
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<td>ENGL 001</td>
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<td>ART 003</td>
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<td>First-year seminar</td>
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<td>3</td>
<td>ENGL 002</td>
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<td></td>
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</tr>
</tbody>
</table>

Total Credits: 32

**DESIGN MAJOR**

48 credit hours required

### Foundation

<table>
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<tr>
<th>Credits</th>
<th>Course</th>
<th>Description</th>
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<tbody>
<tr>
<td>20</td>
<td>ART 001</td>
<td>Art and Architecture History: Ancient to Medieval</td>
</tr>
<tr>
<td></td>
<td>ART 002</td>
<td>Art History: Renaissance to Present</td>
</tr>
<tr>
<td></td>
<td>ART 003</td>
<td>Two-Dimensional Design</td>
</tr>
</tbody>
</table>

**ART 004**  Three-Dimensional Design
**ART 011**  Drawing I
**ART 220**  20th Century Art
**or ART 221**  Global Contemporary: Recent Art Movements Around the World

### Core Concentration

#### Graphic Design

**DES 053**  Introduction to Graphic Design
**DES 153**  Graphic Design: Word and Image
**DES 253**  Graphic Design: Brand Experience

Plus three elective studios from the following:

<table>
<thead>
<tr>
<th>Credits</th>
<th>Course</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>4</td>
<td>ART 007</td>
<td>Digital Photography I</td>
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<tr>
<td></td>
<td>ART 035</td>
<td>Painting I</td>
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<tr>
<td></td>
<td>DES 040</td>
<td>Product Design I: Form, Process and Concept</td>
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<td></td>
<td>DES 070</td>
<td>Web Design I</td>
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<tr>
<td></td>
<td>DES 170</td>
<td>Web Design II</td>
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<td>DES 385</td>
<td>Fusion: Design Practice</td>
</tr>
</tbody>
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### Product Design

**DES 040**  Product Design I: Form, Process and Concept
**DES 140**  Product Design II: Designing for Others
**DES 240**  Product Design III: Materials to Market

Plus three elective studios from the following:

<table>
<thead>
<tr>
<th>Credits</th>
<th>Course</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>4</td>
<td>ART 013</td>
<td>Sculpture I</td>
</tr>
<tr>
<td></td>
<td>DES 053</td>
<td>Introduction to Graphic Design</td>
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<tr>
<td></td>
<td>DES 070</td>
<td>Web Design I</td>
</tr>
<tr>
<td></td>
<td>DES 148</td>
<td>Furniture Design I</td>
</tr>
</tbody>
</table>

Total Credits: 48

### Architecture Courses

**ARCH 002**  Architectural History II  4 Credits

Survey of architecture from the Renaissance to the present, examined in the context of culture formation, design concepts, and the built environment.

**Attribute/Distribution**: HU

**ARCH 010 (CEE 010)**  Engineering/Architectural Graphics and Design  3 Credits

Graphical communication of civil engineering or architectural projects using manual techniques and commercial state-of-the-art computer software. Topics include visualization and sketching; orthographic, isometric and other drawings; points, lines and planes in descriptive geometry; site design; overview of geographical information systems and 3D applications. Teamwork on design projects with oral and graphical presentations. Open to a limited number of architecture, design arts or other students with project roles consistent with students’ background. Not available to students who have taken MECH 10.

**Attribute/Distribution**: ND

**ARCH 033**  Architectural Drawing 4 Credits

Introduction to architectural hand drawing including orthographic, paraline, and perspective drawing types. Studio course.

**Attribute/Distribution**: HU

**ARCH 034**  Digital Drawing and 3D Modeling 4 Credits

In our increasingly visual world we often need to present ideas in realistic, expressive, and engaging ways. This introductory course presents the basics of digital drawing and rendering through the lens of architecture, but is intended for students of all disciplines interested in visual communication. This project-based course focuses on the essentials of AutoCAD, SketchUp, and Revit supplemented with V-Ray and Photoshop for rendering.

**Attribute/Distribution**: HU
ARCH 035 Seoul: Everyday Life, Culture, and History 3 Credits
This course, a study abroad winter term program, deals with the physical and cultural environment of the city of Seoul. The capital of South Korea is known for its rich historical heritage and economic and technological developments. Students will have opportunities to discuss and experience cultural, technological, and political currents of the city, as well as its traditions. The class will visit places of significance in the city.
Attribute/Distribution: HU, SS

ARCH 043 Architectural Design I 4 Credits
Fundamental design studio for architecture majors. Composition, spatial concepts; precedent; materials and detail; light and color in architecture. Instruction in basic communication techniques.
Repeat Status: Course may be repeated.
Prerequisites: ART 004
Attribute/Distribution: HU

ARCH 071 Special Topics in Architecture 1-4 Credits
Directed projects for students in architecture. Student must initiate contact with sponsoring professor. Permission of Instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ARCH 107 History of American Architecture 4 Credits
Survey of American building from European colonization to the present.
Prerequisites: ART 001 and ARCH 002
Attribute/Distribution: HU

ARCH 123 Visualization and Fabrication in Architecture 4 Credits
This course concentrates on visualization and fabrication in architecture. Students are introduced to advanced architectural diagramming and model-making as well as conventional and digital representation skills. This course investigates architectural graphics as an active means of communication and as a generative element in organizing architectural space. Precedents and examples are extensively researched. All exercises are designed to enhance students' ability to imagine and visualize complex architectural forms and spaces. Various architectural materials are employed and tested.
Attribute/Distribution: HU

ARCH 126 (ART 126, THTR 126) History of Interior Design and Decor 4 Credits
Survey of architectural interiors and décor examining public and domestic spaces and their contents in terms of period and style. Exploration of major art and design movements through the lens of interior spaces and objects within the context of culture and society.
Attribute/Distribution: HU

ARCH 134 Architecture and Urbanism of New York City 4 Credits
This course deals with the architecture and urbanism of New York City. It focuses on the twentieth century and occasionally covers other historical periods as well. With the direction of the instructor, students visit and analyze, formally and historically, important structures and places of the city such as museums, transportation hubs, offices, parks and other landmarks of interest. Cultural and sociological as well as architectural readings are offered and discussed. There are six mandatory field trips to New York City led by the instructor. Consent of instructor required.
Attribute/Distribution: HU

ARCH 134 Architectural Design II 4 Credits
Studio format, introductory course in architectural design which introduces students to new ways of thinking about architecture and the perception of space, three-dimensional composition, drawing, and model-making. Previous or concurrent courses in studio art and/or architectural history are recommended.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ARCH 157 Architectural Technology I 4 Credits
The two-course sequence (ARCH 157 & ARCH 158) introduces the use of building materials, components and systems (slabs, walls, trusses, facade systems, etc.) while providing students with the knowledge to design and construct comfortable, technically sound and aesthetically pleasing buildings.
Attribute/Distribution: HU

ARCH 158 Architectural Technology II 4 Credits
The two-course sequence (ARCH 157 & ARCH 158) introduces the use of building materials, components and systems (slabs, walls, trusses, facade systems, etc.) while providing students with the knowledge to design and construct comfortable, technically sound and aesthetically pleasing buildings.
Attribute/Distribution: HU

ARCH 170 Modern History and Sustainable Architecture in Munich 3 Credits
This Lehigh faculty-led study abroad program allows students from an array of majors to earn three credits over winter break. The program will explore the history, culture, and architecture of Munich, a capital and center of the southern state of Germany, Bavaria. The program of study does not require German language skills.
Attribute/Distribution: HU, SS

ARCH 171 Special Topics in Architecture 1-4 Credits
Directed projects for students in architecture. Student must initiate contact with sponsoring professor. Must have major standing in department and/or consent of instructor.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ARCH 174 (ANTH 174, ART 174, CLSS 174) Greek Archaeology 4 Credits
Ancient Greek cultures from the neolithic to hellenistic periods. Reconstructions of Greek social dynamics from study of artifacts.
Attribute/Distribution: SS

ARCH 176 (ANTH 176, ART 176, CLSS 176) Roman Archaeology 4 Credits
Cultures of the Roman Empire. Reconstructions of social, political, and economic dynamics of the imperial system from study of artifacts.
Attribute/Distribution: SS

ARCH 177 Roman Architecture 4 Credits
This course addresses formal concerns in contemporary architecture. Synthetic space exists between the actual and the virtual, between the analogue and the digital. The course will be a pure exploration of the possibilities of space, through animation and creative model making and deployment of parametric modeling software, film sets and motion graphics. Software tutorials will be given as needed.
Attribute/Distribution: HU

ARCH 178 History of Ideas 4 Credits
Examination of philosophical, technological, and cultural forces shaping Western architecture and urbanism. Writing intensive.
Prerequisites: ART 001 and ARCH 002
Attribute/Distribution: HU

ARCH 210 20th Century Architecture 4 Credits
History and theories of modern and contemporary architecture. Analysis of buildings, architects, theories and manifestos from the early 20th century to the present.
Prerequisites: ART 001
Attribute/Distribution: HU

ARCH 211 Architectural Drawing/Analysis and Expressions 3 Credits
This studio course is part of the Lehigh in Italy summer program and will utilize several different architectural drawing techniques to study aspects of architecture from analysis of a piazza to architecture in detail. It will employ pencil sketching, charcoal drawing, and watercolor. These drawings will act as a way of seeing the Italian urban landscape and supplement the study and analysis of the Italian architects' contemporary work. Fulfills an art studio elective requirement.
Attribute/Distribution: HU

ARCH 212 The Architecture of Carlos Scarpa/Theory and Practice 3 Credits
This course which is part of the Lehigh in Italy summer program will survey several of the Venetian architect's most famous works. Meet with architects who worked with Scarpa and completed his unfinished projects. Explore thematic principles behind Scarpa's work, their origin and role in his unique process of design.
Attribute/Distribution: HU
ARCH 214 Architecture and the City since WWII 4 Credits
Architectural and urban theories and projects from 1945 to the present. Analysis of the relationship between architecture and the city.
Prerequisites: (ARCH 002 or ART 002)
Attribute/Distribution: HU

ARCH 243 Architectural Design III 4 Credits
Design principles of space and form and issues of “materiality,” “structure,” “modes of representation” and the “process of making.”
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ARCH 253 (GS 253, HIST 253) Paris: Plan of Metropolis 3 Credits
The splendor of modern Paris is due in large part to bold, large scale modernization and changes in the city’s patterns during the 19th century. This course, which is part of the Lehigh in Paris summer program, will cover a century of change and focus on the major accomplishments of its visionary planners.
Attribute/Distribution: HU

ARCH 342 Theory of Form and Materials 4 Credits
Study of the genesis of form, its representation and its interrelationship to related artistic disciplines. Formal notions will be studied, compared and manipulated through the role of time, scale, perceptual analysis and material transformation. Consent of instructor required.
Attribute/Distribution: HU

ART 002 Art History: Renaissance to Present 4 Credits
Survey of art and architecture from the Renaissance through the contemporary era. Examining developments in printing, sculpture, and built environment, as well as the rise of media such as printmaking and photography, the course explores the changing form and status of the visual arts in modern culture and society.
Attribute/Distribution: HU

ART 003 Two-Dimensional Design 4 Credits
This class will present the foundations necessary to understand, discuss and create in the two-dimensional visual world. Using variety of materials and techniques and digital media, students will explore the concepts of line, form, shape, value, texture, space and color. Required for all Architecture, Art, Art History and Design majors.
Attribute/Distribution: HU

ART 004 Three-Dimensional Design 4 Credits
An introduction to the basic elements and principles of design, involves use of various materials to solve 3D design problems in studio and computer lab. Problem solving in variety of materials for 3D design including assemblages, models, constructions, and conceptual forms. Required for all majors in department.
Attribute/Distribution: HU

ART 007 (FILM 007) Digital Photography 14 Credits
Intensive work in photography as fine art using digital input and output. Lectures, demonstratons, critiques.
Attribute/Distribution: HU

ARCH 311 Portfolio 1 Credit
The concept, layout, and preparation of a portfolio for graduate school application or employment search, including graphic techniques and reproduction method. Student must contact sponsoring professor.
Prerequisites: ARCH 243
Attribute/Distribution: HU

ARCH 335 Issues in Contemporary Architecture 4 Credits
Seminar on selective architectural topics from the 1960s to the present. Analysis of important architectural projects and theories. Interaction among architecture and social, economic, political and technological changes.
Prerequisites: ART 001 and ARCH 002
Attribute/Distribution: HU

ARCH 342 Theory of Form and Materials 4 Credits
Study of the genesis of form, its representation and its interrelationship to related artistic disciplines. Formal notions will be studied, compared and manipulated through the role of time, scale, perceptual analysis and material transformation. Consent of instructor required.
Attribute/Distribution: HU

ARCH 343 Architectural Design IV 4 Credits
The design of buildings and building groups, with the emphasis on urban design and the city.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ARCH 389 Honors Project 1-8 Credits
Repeat Status: Course may be repeated.

Art Courses
ART 001 Art and Architecture History: Ancient to Medieval 4 Credits
Survey of art and architecture around the globe, from the world’s earliest artistic and architectural production through the 14th century. European, Middle Eastern, African, Asian and Central and South American works are covered. The course also serves as an introduction to the vocabulary, concepts, and methods of art and architectural history.
Attribute/Distribution: HU
ART 052 (FILM 052) Introduction to Video Recording and Editing 4 Credits
We will consider the interaction of image, sequence, motion, time and audio with video to create associative, abstract, documentary and narrative videos. Workshops in camera use, editing, concept development, lighting, sound and DVD authoring.
Attribute/Distribution: HU

ART 068 Color Theory 4 Credits
Application of color in design. Color in graphics, product, digital imaging, and all related fields of design.
Attribute/Distribution: HU

ART 069 Special Topics in Art History 1-4 Credits
Directed projects for students in the history of art or architecture. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ART 073 Introductory Studio Practice 1-4 Credits
An introduction to the methods and techniques of studio art. Designed to acquaint the student with general studio practice, covering topics not covered in other specific studio course listings.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ART 077 The Laws of Light 3 Credits
In this course students will learn the laws of light and how to apply them to situations inside the studio and out. Course starts by exploring the physics of light through in class demonstrations. Then we will use different light sources and modifiers to experiment with a wide range of lighting scenarios. We will also focus on problem solving on set, as it is vital to understand what must be achieved in camera and what can be added in Photoshop.
Attribute/Distribution: HU

ART 111 Drawing II 4 Credits
Projects in creative drawing designed to build on concepts and practices initiated in basic drawing and life drawing.
Prerequisites: ART 011
Attribute/Distribution: HU

ART 113 Sculpture II 4 Credits
Development of principles and techniques in Sculpture I. Modeling, casting, fabrication and carving. Emphasizes an approach to sculptural form and an exploration of the evolution of modern sculpture.
Prerequisites: ART 013
Attribute/Distribution: HU

ART 115 Figure II 4 Credits
Projects in figure modeling and drawing from direct observation of the human figure, designed to build on concepts and practices initiated in Figure I. Students may elect to concentrate in one particular medium, although the primary investigation of form will always incorporate both two and three dimensional work.
Prerequisites: ART 015
Attribute/Distribution: HU

ART 121 (WGSS 121) Women in Art 4 Credits
A history of women artists from Renaissance to present day, with emphasis on artists of the 20th and 21st century from a global perspective. We explore attitudes toward women artists and their work as well as the changing role of women in art world. There may be required visits to museums and/or artists’ studios.
Attribute/Distribution: HU

ART 124 (AAS 124, GS 124) Arts of the Black World 16th-20th Centuries 4 Credits
This course covers artistic practices originating in Africa that subsequently influenced countless world cultures. The material covers artistic production and theory of arts of the enslaved populations in the Antebellum South, early African American painting through the Harlem Renaissance, the religious arts of Haiti (Vodou) and Cuba (Santería), and contemporary production from Black Brazilian, American and European artists. Students should be prepared to attend Museums/ galleries during the semester.
Attribute/Distribution: HU

ART 125 (AAS 125, GS 125) Art and Architecture of Africa from Colonial to Contemporary Times 4 Credits
This course is structured around case studies of art and architecture from early traditions up through the present. The focus is on cultural production, religious art and architecture (local as well as Christian and Muslim traditions), craftsmanship, style, materials, trade, and international exhibition of art objects in Museums. The literature draws from art historical, anthropological, and historical analyses as well as museum studies. Students should be prepared to attend Museums/ galleries during the semester.
Attribute/Distribution: HU

ART 126 (ARCH 126, THTR 126) History of Interior Design and Decor 4 Credits
Survey of architectural interiors and décor examining public and domestic spaces and their contents in terms of period and style. Exploration of major art and design movements through the lens of interior spaces and objects within the context of culture and society.
Attribute/Distribution: HU

ART 135 Painting II 4 Credits
A sustained exploration of paint media. Students concentrate on developing a body of related images using various media and approaches.
Prerequisites: ART 035
Attribute/Distribution: HU

ART 152 Experimental Animation and Video 4 Credits
An exploration of time, motion and interactivity in a series of conceptual and technical projects dealing with advanced digital imaging and nonlinear video editing. We will consider the interaction of image, sequence, motion, animation, and audio with video.
Prerequisites: ART 052
Attribute/Distribution: HU

ART 169 Special Topics in Art History 1-4 Credits
Directed projects for students in the history of art or architecture. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ART 173 Special Topics in Studio Practice 1-4 Credits
Directed projects in art. Permission of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ART 174 (ANTH 174, ARCH 174, CLSS 174) Greek Archaeology 4 Credits
Ancient Greek cultures from the neolithic to hellenistic periods. Reconstructions of Greek social dynamics from study of artifacts.
Attribute/Distribution: SS

ART 175 Introduction to Museum Work 4 Credits
Introduction to the world of museums, surveying theory and practice through readings and class discussions in all aspects of museums (A to Z), art galleries and art/historical management. The course combines in situ (LUAG/Museum Operation) instruction, conversations with museum professionals and hands-on experience. Students complete several interactive (PB & CL) exercises/projects.
Attribute/Distribution: HU

ART 176 (ANTH 176, ARCH 176, CLSS 176) Roman Archaeology 4 Credits
Cultures of the Roman Empire. Reconstructions of social, political, and economic dynamics of the imperial system from study of artifacts.
Attribute/Distribution: SS

ART 183 (GS 183, HIST 183) France from Medieval to Modern: Soc., Pol. & Art 3 Credits
France's artistic, cultural, social, artistic and political development from early kingship and dominance of the Church in the Middle Ages to the grandeur of Versailles in the Age of Absolutism; radical transformations of culture and society during the French Revolution and advent of the Modern Nation-State; to twentieth century developments including the two World Wars, imperialism and impact of post-war globalization. Offered in summer only through Lehigh Study Abroad Office as part of Lehigh in Paris program.
Attribute/Distribution: HU
ART 213 Sculpture Workshop 4 Credits
An advanced studio emphasizing sculpture within a contemporary context. Through the exploration of various concepts, material processes and rigorous critique, the student works toward developing their own unique vision and practice.
Repeat Status: Course may be repeated.
Prerequisites: ART 013 and (DES 004 or ART 004)
Attribute/Distribution: HU

ART 215 Figure III 4 Credits
Further exploration of the human figure as the subject of art. More advanced students may elect to concentrate in either two or three dimensional representations in any media. The emphasis will be on personal interpretation and independent work with the instructor.
Prerequisites: ART 115
Attribute/Distribution: HU

ART 217 Studio Workshop 4 Credits
Studio Workshop is available to any student who has completed a first level discipline specific art studio such as Drawing I, Figure I, Painting I, Digital Photography I or Sculpture I and is designed for intermediate to advanced work in a specified medium. Course may be repeated.
Repeat Status: Course may be repeated.
Prerequisites: ART 011 or ART 007 or ART 013 or ART 015 or ART 035 or ART 052
Attribute/Distribution: HU

ART 220 Modern Art of the 20th Century 4 Credits
What was modern art, and how do we make sense of it? Modern artists revolutionized the art world of the 20th century, exploding its boundaries and conventions in ways that still challenge us today. This course explores modern art’s origins and development. It offers a closer look at the leading artists, works, and debates of the period, and an introduction to the methods we use to understand and interpret them. Includes museum visits.
Attribute/Distribution: HU

ART 221 (AAS 221, GS 221) Global Contemporary Art 4 Credits
Course examines artworks from around the world c. 1980s to the present. Topics include revolutionary arts, globalization, EcoArt, postcolonial arts, phenomenological, experiential and new media arts. Global feminist projects, design/build production, graffiti and popular arts are covered regularly. International Art Biennials, exhibitions and the built environment are featured. Art Theory is explored through iconographic, formal and contextual (political, social, financial) analysis. Movements are situated in historical frameworks as well as in their international scope and value. Writing Intensive.
Attribute/Distribution: HU

ART 222 Seminar in Art History 4 Credits
In this seminar students undertake sustained and focused study of select themes and topics from the history of art. Particular attention is devoted to learning the methods, theories, and research practices that art historians use to interpret and understand art. Seminar topics change annually.
Repeat Status: Course may be repeated.
Prerequisites: ART 002 or ART 001
Attribute/Distribution: HU

ART 223 Writing Your Way Into the Arts 2,3 Credits
A seminar course designed to build proficiency in the writing of personal statements, application materials, and portfolio narratives for students who are considering careers, internships, and graduate studies in the visual, performing, and creative arts or related fields. Specifically useful for juniors and seniors preparing for future opportunities after graduation. Writing intensive.
Attribute/Distribution: HU

ART 227 (LAS 227) Latino Visual Arts and Culture in American Art 4 Credits
Because art has no country, but the artist does, is contemporary art a product of globalization? Is Latino and Latin American art, culture and art criticism a nationalistic platform of cultures. Who’s who in the current Latino and Latin American art world? Students will utilize works from the university (LUAG) collection and/or research and interview a contemporary artist at his or her studio (if possible) for essays or media projects.
Attribute/Distribution: HU

ART 228 (LAS 228) Photography as Contemporary Art 4 Credits
A history of photography in an in-situ class, at the LUAG Teaching Collection Visual Laboratories and Integrated Open Storage classroom. The course will explore the power of photographs as a dominant 21st Century universal visual art form, emphasizing Latino and Latin American photography. The students will progressively work their way through today’s explosive array of digital, one channel video, photobase and conceptual discourses of our remix culture through evolutionary image-making of the 20th and 19th Century, and the uses of photographic processes that have enriched our perceptions and our world. Readings, group discussions and individual research. The course will conclude with a final project/paper: a one figure or theme paper and a small group/team project (to be determined later). This will constitute the transformative approach to study the state of photography today.
Attribute/Distribution: HU

ART 269 Special Topics in Art History 1-4 Credits
ART 269. Special Topics in Art History (1-4) Directed projects for advanced students in the history of art or architecture. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ART 273 Special Topics in Studio Practice 1-4 Credits
Individually directed projects for advanced students capable of undertaking independent creative work in studio art. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ART 275 Museums: Research, Collections Management and Exhibition Planning 4 Credits
Theory and practice in contemporary museums and galleries through readings and class discussion. Practicum at the LUAG/Museum Operation dealing with care of museum collections, collection management, intellectual and practical tasks of preparing and communicating through exhibitions, and the professional responsibilities of the curator and curatorial staff. Students will complete a number of exercises and a research report or equivalent.
Repeat Status: Course may be repeated.
Prerequisites: ART 175
Attribute/Distribution: HU

ART 276 Museums: Education, Communication and Exhibition Design 4 Credits
Theory and practice in contemporary museums and galleries through readings and class discussions. Practicum in the LUAG/ Museum Operation dealing with design and installation of exhibitions; educational programming and the community; organization, principles of management and strategic planning; museum advocacy. Students complete a number of exercises and a research report or equivalent.
Prerequisites: ART 175
Attribute/Distribution: HU

ART 277 (FILM 277) Digital Photography II 4 Credits
An opportunity to produce a unified body of work and to explore digital photography on a deeper level with an emphasis on conceptually driven images. Experimental process encouraged.
Repeat Status: Course may be repeated.
Prerequisites: ART 007 or FILM 007
Attribute/Distribution: HU

ART 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.
ART 317 Departmental Capstone 4 Credits
Departmental Capstone is offered to seniors and qualified juniors and is taught collectively by the departmental faculty. Students focus on understanding and articulating their own interests and vision through research, written work, creation of new works of art, and critique. Instructor permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ART 350 Special Topics in Graphic Design and Theory Seminar 1-4 Credits
Current topics in graphic communication theory and practice will cover preparation, production, and formulation of individual portfolio. Selected readings and discussions in professional ethics as well as legal issues in the field will be covered.
Repeat Status: Course may be repeated.
Prerequisites: ART 253 or DES 253
Attribute/Distribution: ND

ART 356 Advanced Seminar in Art History 4 Credits
In this upper level seminar, students undertake advanced study of select themes and topics from the history of art. Special emphasis is accorded to the practical application of art historical methods, theories, and research practices. Students pursue advanced research projects related to the seminar topic, which changes annually.
Prerequisites: ART 001 and ART 002 and ART 220
Attribute/Distribution: HU

ART 370 Special Topics in Museum and Curatorial Studies 1-4 Credits
Special project and/or internship for graduate and advanced undergraduates.
Repeat Status: Course may be repeated.
Prerequisites: ART 275 or ART 276
Attribute/Distribution: HU

ART 373 Studio Art Internship 1-4 Credits
Practical field experience in an artist's studio or art-related apprenticeship opportunity. Requires approval a semester in advance by instructor and host organization.
Attribute/Distribution: ND

ART 375 Museum Internship 1-4 Credits
Internship under professional supervision in all areas of museums and/or related organizations, regionally, nationally or abroad in well established or accredited institutions. Students must initiate contact/application. A contractual agreement or letter of acceptance is required. Consent of department required.
Prerequisites: ART 276 or ART 275
Attribute/Distribution: ND

ART 389 Honors Project 1-8 Credits
Repeat Status: Course may be repeated.

Design Courses
DES 040 Product Design I: Form, Process and Concept 4 Credits
Introduction to the field of Industrial Design. Through research, analysis, drawing and prototyping, students will acquire an understanding of the various aesthetic, technological, and business issues a designer must consider when creating a product. Consent of department required.
Prerequisites: (ART 003 or ART 011) and ART 004
Attribute/Distribution: HU

DES 053 Introduction to Graphic Design 4 Credits
This course serves as an introduction to the graphic design process, with a primary focus on concept development and craft. Students examine how to identify and resolve visual problems and learn the basics of design and typography. Creative solutions will be encouraged for projects with practical applications. Topics include logo development and execution, professional typography, image basics and resolution, print production, studio skills and professional practices. Digital applications include Photoshop, Illustrator and In-design.
Prerequisites: ART 003
Attribute/Distribution: HU

DES 066 Design History 4 Credits
History of product design, graphic design and time-based media in artistic, cultural, technological, and business contexts.
Attribute/Distribution: HU

DES 070 Web Design I 4 Credits
Introduction to the design and fabrication of web pages. Students will learn how to create pages using HTML and web fabrication software, with an emphasis on aesthetic and structure.
Prerequisites: ART 003
Attribute/Distribution: HU

DES 072 (THTR 072) Digital Textile Design 4 Credits
Digital textile printing has brought about revolutionary changes in textile design. Digital Textile Design utilizes digital photography, scanning, drawing and image editing software to create botanical and geometric patterns for textiles.
Attribute/Distribution: HU

DES 073 Special Topics in Design 1-4 Credits
An introduction to methods and techniques of design studio. Designed to acquaint the student with general design elements, covering topics not covered in other specific studio course listings. Instructor permission required.
Repeat Status: Course may be repeated.

DES 079 (ASIA 079) Digital Bridges 2 Credits
Run as an independent study: research ancient Chinese bridges, gardens, and pavilions. Digitize images and website design. Create photographic documentation of the Bridge Project. Produce documentary from historical materials concerning history of Chinese students at Lehigh. Bridge Project students could continue project work in Shanghai and Beijing.
Repeat Status: Course may be repeated.

DES 087 (THTR 087) Performance Design 4 Credits
Introduction to the process of creating integrated designs in theatre production. The study and practice of the principles of visual representation, historical and conceptual research and the study of theatrical styles.
Attribute/Distribution: HU

DES 088 (THTR 088) Digital Rendering 4 Credits
Explore the use of modern technology to develop and communicate design ideas with speed, clarity, and visual punch. Strategies geared toward increasing the young designer’s confidence in presenting artistic concepts. Learn the basics of Photoshop and SketchUp and then apply those skills in creative execution of scenic, costume, and lighting renderings.
Attribute/Distribution: HU

DES 089 (THTR 089) Introduction to Fashion Design 4 Credits
An introduction to conceptual garment design. Research, devise, and develop collections of apparel and accessories. Basic elements of design, fashion theory, design processes, and rendering techniques.
Attribute/Distribution: HU

DES 111 (THTR 111) Sound Design 2 Credits
Introduction to the study of the techniques and equipment used for theatrical sound design. Elements include audio theory, script analysis, field recording and editing audio in digital audio workstations.
Attribute/Distribution: HU

DES 129 (THTR 129, WGSS 129) History of Fashion and Style 4 Credits
Dress and culture in the Western Hemisphere from prehistory to today. The evolution of silhouette, garment forms and technology. The relationship of fashion to politics, art and behavior. Cultural and environmental influences on human adornment.
Attribute/Distribution: HU

DES 138 Introduction to Metalworking 3 Credits
An introduction to welding and metal forming through a series of practical design projects. Exploration of metal as a medium in both art and design. Practical application of design process, presentation and craft. Acquired skills in stick arc welding, MIG welding, plasma torch and other metal bending and forming techniques.
Attribute/Distribution: HU
DES 140 Product Design II: Designing for Others 4 Credits
This course will expose students to client based projects and issues of branding relevant to the product designer. Special emphasis will be given to functionality from a user centered perspective. Projects will also include the use of 3D digital prototyping software and computer based fabrication techniques.
Prerequisites: DES 040
Attribute/Distribution: HU

DES 148 Furniture Design I 4 Credits
Design methodology, fabrication techniques, and methods of design presentation.
Attribute/Distribution: HU

DES 153 Graphic Design: Word and Image 4 Credits
This course explores techniques of image making in relation to analyzing and creating meaning in graphic and typographic messages. Students solve visual communication problems with visual, conceptual and social impact. Assignments may include book covers, posters, music packaging, and promotional materials. Students will work in both traditional and digital media. May be repeated for credit once under different instructor.
Repeat Status: Course may be repeated.
Prerequisites: ART 053 or DES 053

DES 154 (THTR 154) Scene Painting 4 Credits
Study and practice of basic and advanced methods of painting for the theatre. Includes basic elements and principles of design, color theory, the influence of light, atmosphere and aesthetics for the theatre.
Attribute/Distribution: HU

DES 155 (THTR 155) Model Building and Rendering 4 Credits
The art and practice of model building and rendering for the stage. Special techniques including scale furniture, soldering, acrylic painting and hand drafting.

DES 164 Ergonomics 4 Credits
Introduction to physical, emotional, and psychological ways design interacts with people. Analyze real design problems and create solutions.
Attribute/Distribution: HU

DES 170 Web Design II 4 Credits
Creation of dynamic content in web design. Various 2D animation software applications and simple scripting will be explored.
Prerequisites: DES 070
Attribute/Distribution: HU

DES 173 Special Topics in Design 1-4 Credits
Directed projects in design with selected readings as required. Student must initiate contact with sponsoring professor. Instructor permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

DES 186 (THTR 186) Lighting Design 4 Credits
An introduction to the art and practice of lighting design for the theatre. Script analysis, research, and the interplay of lighting technology and design. Students will develop a sense of the dramatic while creating a portfolio of lighting designs.
Attribute/Distribution: HU

DES 188 (THTR 188) Scenic Design 4 Credits
An introduction to the art and practice of scenic design for the theatre. Script analysis, research, drafting and modeling techniques. Students will develop a sense of the dramatic while creating a portfolio of scenic designs.
Attribute/Distribution: HU

DES 189 (THTR 189) Costume Design 4 Credits
An introduction to the art and practice of costume design for the theatre. Script analysis, research, and rendering techniques. Students will develop a sense of the dramatic while creating a portfolio of costume designs.
Attribute/Distribution: HU

DES 200 Graphic Design: Word and Image 4 Credits
This course will expose students to client based projects and issues of branding relevant to the product designer. Special emphasis will be given to functionality from a user centered perspective. Projects will also include the use of 3D digital prototyping software and computer based fabrication techniques.
Prerequisites: DES 040
Attribute/Distribution: HU

DES 240 Furniture Design II 4 Credits
Advanced fabrication. Contemporary art issues and furniture history.
Repeat Status: Course may be repeated.
Prerequisites: DES 148
Attribute/Distribution: HU

DES 253 Graphic Design: Brand Experience 4 Credits
Students examine the basic principles of corporate identity and develop a clear understanding of the process of creating brands. Projects will offer a framework for looking at business strategy as it relates to the creative process of design. Emphasis will be placed on creating visual elements that support a brand and the steps a designer takes to create a consistent brand. In addition, students will develop self-promotion materials and identity systems. May be repeated for credit once under different instructor.
Repeat Status: Course may be repeated.
Prerequisites: DES 053
Attribute/Distribution: HU

DES 260 Exhibit Design 4 Credits
Team projects in development of exhibits for museums, conferences, or educational centers. Project work is supplemented by lectures and demonstrations. Teams will produce real and virtual exhibit prototypes and will design and maintain an exhibit website.
Attribute/Distribution: HU

DES 266 History of Contemporary Design 4 Credits
History of modern design from mid 19th century to the present. Studies and discussion of contemporary issues and technology in Design Arts. Topics will include green design, digital technology, current legal and ethical principles, and other issues.
Attribute/Distribution: HU

DES 268 Advanced Design Projects 1-4 Credits
Advanced projects or studies applying Design Arts practices or theories. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

DES 300 Apprentice Teaching 1-4 Credits

DES 311 Design Portfolio 1-4 Credits
The concept, layout, and preparation of a portfolio for graduate school application or employment search, including graphic techniques and reproduction method. Student must contact sponsoring professor.
Repeat Status: Course may be repeated.
Prerequisites: DES 240 or DES 253
Attribute/Distribution: HU

DES 348 Furniture Design II 4 Credits
Advancement in furniture design. Emphasis will be placed on the development of individual style and identity for each designer. Students will work with advanced production techniques, develop ideas into prototypes, and produce a final portfolio that will allow them to pursue professional opportunities.
Prerequisites: DES 248
Attribute/Distribution: HU

DES 370 Special Topics in Design 1-4 Credits
Current topics in design, with selected readings, discussions, and studio work as required. Must have completed two 100-level Design courses. Consent of department required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

DES 375 Design Internship 1-4 Credits
Practical experience following apprenticeship model. Requires approval of instructor and host prior to beginning of the term, with a memorandum of understanding outlining student work responsibilities and educational objectives for the experience.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND
The major in Asian Studies requires a minimum of 35 credits. Students are required to demonstrate the intermediate language proficiency (Intermediate II) in an Asian language in addition to required course work as described below. The academic advisor is the director of the Asian Studies Program. Students may also request an advisor from among the Asian Studies faculty.

Core Requirements

Intermediate language proficiency

<table>
<thead>
<tr>
<th>Humanities and Social Science</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Six courses (minimum 24 credits) from the Humanities/Social Sciences course list or other courses approved by the Asian Studies program director, minimum one course must be at 200-level or above, one course may be an advanced Asian language course.</td>
<td>24</td>
</tr>
</tbody>
</table>

Study Abroad

| Capstone Project. Students are required to exhibit using primary source of materials under supervision of faculty member. | 3-4 |
| Pre-thesis (fall) | 4 |
| Senior thesis (spring) | 4 |
| Total Credits | 35-36 |

1 Other suitable courses at LVAIC or other approved institutions in the United States or courses in approved study abroad programs in Asia may be substituted with the Director's approval.

2 Courses in Chinese, Japanese or other Asian language may apply as program electives with approval of the Program Director.

3 If study abroad is difficult academically or financially, other arrangements can be made upon major advisor's approval.

MINOR IN ASIAN STUDIES

The minor in Asian Studies is intended to complement a student’s major field of study and it is flexible according to individual needs. Students are free to survey the field broadly or concentrate in a specific area such as Chinese or Japanese studies. The minor comprises a minimum of 4 courses (16 credits) in Asian studies, chosen from an approved list in consultation with the director of the Asian Studies Program.

While students minoring in Asian Studies are encouraged to study languages, only 8 credits of language study count towards the Asian Studies minor. Students interested only in language study are encouraged to minor in Chinese or Japanese language (see MLL (p. 198)).

HUMANITIES and SOCIAL SCIENCES COURSES

Each semester, a complete list of Asian Studies course offerings can be found on the web site or available in the Office of Interdisciplinary Programs, Williams Hall, Suite 101.

| ASIA/PHIL/REL 010 | Intro to Buddhism: Love Death and Freedom | 4 |
| ASIA/REL 012 | Mountains, Buddhists, Ancestors: Introduction to East Asian Religions | 4 |
| ASIA/WGSS/MLL 015 | Sex, War, Women, Art | 4 |
| ASIA/THTR 053 | Bollywood Dance | 2 |
| ASIA/THTR 055 | Indian Classical Dance | 2 |
| ASIA 057 | Globalization in Asia through Time and Space | 4 |
| ASIA/REL 060 | Religions of South Asia | 4 |
| ASIA/IR 061 | East Asian International Relations | 4 |
| ASIA/IR 063 | U.S.-China Relations | 4 |
| ASIA/IR 066 | Japan in a Changing World | 4 |
| ASIA/MLL 068 | Japanese Language: Past and Present | 4 |
| ASIA/MLL/HIST 071 | Understanding Hong Kong | 4 |
| ASIA/MLL 072 | Ghosts, Monsters, and J-Horror | 4 |
| ASIA/MLL/WGSS 073 | Film, Fiction, and Gender in Modern China | 4 |
| ASIA/MLL 074 | Chinese Cultural Program | 1-8 |
| ASIA/HIST/MLL 075 | Chinese Civilization | 4 |
| ASIA/HIST/MLL 076 | Understanding Contemporary China | 4 |
Asian Studies offers a limited number of study abroad travel grants.

Courses

ASIA 010 (PHIL 010, REL 010) Intro to Buddhism: Love Death and Freedom 4 Credits

This course will introduce students to Buddhist practices, philosophical systems, and cultural forms, from Buddhism's Indian origins to its spread in East Asia and Tibet. Students will explore how Buddhists have approached the problem of death, the possibility of freedom, and the forms of social and individual love and concern. Course materials include poetry, biographies, philosophical writings, art and film.

Attribute/Distribution: HU

ASIA 012 (REL 012) Mountains, Buddhists, Ancestors: Introduction to East Asian Religions 4 Credits

This course explores the principal religions of East Asia, including Buddhism, Daoism, Confucianism, Shinto, and Shamanic Traditions. What is each tradition's view of human potential? How is ultimate reality depicted and experienced? What do home altars, boisterous festivals, and silent meditation halls have in common? Several primary texts are read in translation.

Attribute/Distribution: HU

ASIA 015 (MLL 015, WGSS 015) Sex, War, Women, Art 4 Credits

Through the study of selected visual and literary works in their historical and social contexts, students will gain knowledge of cultures in Japan. This course examines various cultures from the perspectives of gender and sexuality as constitutive factors of Japanese society. Materials include a film depicting a romantic life of samurai, art works by contemporary artists, and writings on sex workers impacted by the Japanese empire. No prior knowledge of Japanese language is required. An introductory course taught in English.

Attribute/Distribution: HU

ASIA 053 (THTR 053) Bollywood Dance 2 Credits

Bollywood is a term compounded from "Bombay" (now Mumbai) and "Hollywood." Bollywood dance is the movement form used in Indian films - a unique and energetic style inspired by Indian folk dance and Indian classical dance. Middle Eastern, and modern dance. Explore how each of these unique styles combine to create modern Bollywood dance. Learn the fundamental movements, gestures, and expressions that create the Bollywood dance aesthetic, and how they are applied in choreographed sequences.

Repeat Status: Course may be repeated.

Attribute/Distribution: HU

ASIA 055 (THTR 055) Indian Classical Dance 2 Credits

Introduction to the history and practice of Bharatanatyam, a classical dance style of India. Understanding basic footwork, hand gestures, and body movements, and how they are combined to convey emotion, meaning, and imagery. Traditional repertoire, music, terminology, and the spectator's experience of the dance.

Repeat Status: Course may be repeated.

Attribute/Distribution: HU

ASIA 057 Globalization in Asia through Time and Space 4 Credits

Have you ever wondered about Asia? It covers a vast geographic territory; it is divided into East, South, and Southeast Asia and each sub-region contains numerous different ethnic groups, cultures and nations. The time span for these cultures is similarly vast going back to pre-historic and continuing through modern times. The topics we investigate range from popular culture to technology, music, gender, languages, and so on. Students will have a chance to participate in hands-on experience sessions on these topics.

Attribute/Distribution: HU

ASIA 060 (REL 060) Religions of South Asia 4 Credits

A thematic introduction to the foundational religious traditions of South Asia: Hinduism, Jainism, Buddhism, Sikhism and Islam. Students explore the social and spiritual dimensions of these religious worlds through scripture, ritual practices, narrative and teaching traditions, music and art.

Attribute/Distribution: HU
ASIA 061 (IR 061) East Asian International Relations 4 Credits
Introduction to East Asian international relations, with emphasis on post-1945 period: historical background of Asian international system; Cold War conflicts; China's rise and regional responses; Japan's changing international role; the two Koreas; ASEAN and Asian regionalism; U.S. and Russian policies; current and future issues.
Attribute/Distribution: SS

ASIA 063 (IR 063) U.S.-China Relations 4 Credits
Introduction and analysis of the historical context and key aspects of contemporary US-China relations: Cold War US containment, rapprochement and diplomatic normalization; American arms sale and the Taiwan controversy; conflict and cooperation in the Korean Peninsula; economic interdependence and friction; human rights and security relations; Asian regional disputes. Students may not receive credit for both IR/ASIA 063 and IR/ASIA 163.
Attribute/Distribution: SS

ASIA 066 (IR 066) Japan in a Changing World 4 Credits
This course explores Japanese foreign policy through its historical and international context; domestic determinants; foreign and security policymaking processes; policy toward major regional players; foreign economic policy; current grand strategic debates.
Attribute/Distribution: SS

ASIA 068 (MLL 068) Japanese Language: Past and Present 4 Credits
Historical and contemporary aspects of the Japanese language, including the origins of Japanese in relation to Korean, the influence of Chinese, syntactic features which reflect the hierarchical character of Japanese society, differences in female and male speech, and use of foreign loan words.
Prerequisites: (JPN 001) Attribute/Distribution: HU

ASIA 071 (HIST 071, MLL 071) Understanding Hong Kong 4 Credits
This course introduces Hong Kong, from its history as a vibrant British colony to its current status as a bustling territory mediating between China and the world. The learning objectives and outcomes consist not only of a knowledge of Hong Kong's significance for global commerce and culture but also of the ability to analyze primary and secondary sources as well as to conduct independent research. All course materials are available in English.
Attribute/Distribution: HU

ASIA 072 (MLL 072) Ghosts, Monsters, and J-Horror 4 Credits
What's behind our fascination with the ghost stories? What are some of the social issues that the horror stories examine? What makes us afraid? Examining Japan's long tradition of horror stories of ghosts and monsters, this course introduces students to various Japanese horror stories, ranging from the classical texts to "J-Horror," and explores how contemporary forms of popular culture such as anime, manga, and films draw on, or depart from, the traditional images of supernatural beings.
Attribute/Distribution: HU

ASIA 073 (MLL 073, WGSS 073) Film, Fiction, and Gender in Modern China 4 Credits
Study of the struggle for an individual "modern" identity out of traditionally defined roles for men and women as depicted by Chinese writers and filmmakers. Class, texts, and films in English. Students interested in setting up a corollary Chinese language component for credit as CHIN 371 or CHIN 251, may discuss this possibility with the professor.
Attribute/Distribution: HU

ASIA 074 (MLL 074) Chinese Cultural Program 1-8 Credits
A summer program in China, taught in English.
Attribute/Distribution: HU

ASIA 075 (HIST 075, MLL 075) Chinese Civilization 4 Credits
The development of traditional Chinese thought, beliefs, technology, and institutions from a historical perspective.
Attribute/Distribution: HU, SS

ASIA 076 (HIST 076, MLL 076) Understanding Contemporary China 4 Credits
An overview of recent history, politics, economy, religion, problems of modernization, popular culture, and attitudes. Contemporary Chinese society viewed against the backdrop of tradition and the tumultuous history of twentieth-century China.
Attribute/Distribution: SS

ASIA 077 (GS 077, REL 077) The Islamic Tradition 4 Credits
A thematic introduction to Islamic history, doctrine and practice. Topics include: Qur'an; prophecy and sacred history; ritual practices; community life; legal interpretation; art and aesthetics; mysticism; politics and polemics.
Attribute/Distribution: HU

ASIA 078 (MLL 078) Asian-American Studies 4 Credits
A survey of issues concerning Asians living in the United States from the perspectives of history, language, literature, and film.
Attribute/Distribution: HU

ASIA 079 (DES 079) Digital Bridges 2 Credits
Run as an independent study; research ancient Chinese bridges, gardens, and pavilions. Digitize images and website design. Create photographic documentation of the Bridge Project. Produce documentary from historical materials concerning history of Chinese students at Lehigh. Bridge Project students could continue project work in Shanghai and Beijing.
Repeat Status: Course may be repeated.

ASIA 091 Elementary Asian Language and Culture Abroad 1-8 Credits
Elementary language and culture abroad other than Chinese or Japanese.
Attribute/Distribution: HU

ASIA 110 (MLL 110, REL 110) Drinking and Immortality 4 Credits
This class explores modes of transcendence and their expression in literature and art, but most especially poetry. The primary focus is the role of drinking alcoholic beverages in traditional Chinese society and religion, but also on other modes and what is meant by the search for immortality - and the use of inner versus outer alchemy - will be examined.
Attribute/Distribution: HU

ASIA 114 (SOC 114) Social Issues in Contemporary China 4 Credits
Dramatic Economic, cultural and social changes are underway in China today and have aroused much debate among social scientists East and West. The following social issues are critical for understanding China's development trajectory: inequality and poverty; rapid demographic shifts; provision of health care services; provision of education services; and becoming an "information society." We will explore how these issues intersect with old hierarchies in China, urban-rural differences, and gender differences.
Attribute/Distribution: SS

ASIA 119 (GS 119, REL 119) The Podcast and the Lotus 4 Credits
Buddhism is increasingly a global phenomenon. Contemporary Buddhist teachers stay in touch with students via podcasts, WeChat, Twitter and Facebook. Buddhists from Singapore, Tibet, Japan, Mexico, Taiwan or Pennsylvania now meet via new technology. This class asks, how is Buddhism now a global religion? what effect has this had? How is Buddhism a "modern" religion? Students explore issues of conversion, modernity, globalization, new technology, migration and travel. Sources include autobiography, film, travel writing, political essays, interviews, social media, ethnography.
Attribute/Distribution: HU

ASIA 127 (MLL 127) ORIENTations: Approaches to Modern Asia 4 Credits
A survey of the rapid economic, political, and social changes occurring in East, South, and Southeast Asian countries. How do the contemporary societies and historical traditions of Asian countries differ from the West? What distinguishes our perspectives on politics, individual liberties, civic responsibility, religious faith, the "pursuit of happiness"? How are Asians represented (or misrepresented) in the West, and how will the ongoing process of globalization change, and be changed by, Asian cultures?
ASIA 130 (MLL 130, REL 130) Monkey Business 4 Credits
Read and discuss in English the premodern Chinese enlightenment odyssey, the Journey To The West, featuring the famous mischievous and magical martial arts master, the Monkey King. Familiarize yourself with a cultural icon that has entertained and inspired since the 16th century and continues to inspire spin-off dramas, comics, acrobatic and TV shows, movies, and video games.
Attribute/Distribution: HU

ASIA 140 (PHIL 140) Eastern Philosophy 4 Credits
Survey of selected texts and issues in the eastern philosophical traditions. Attention will be given to the development and interrelations of these traditions as well as a comparison of western and eastern treatments of selected issues. Areas of focus may include Confucianism, Taoism, and Zen Buddhism.
Attribute/Distribution: HU

ASIA 142 (PHIL 142) Zen and Art of the Everyday 4 Credits
The Japanese conception of beauty is strikingly different to our own: it is associated with impermanence, imperfection, and austerity. Moreover, attention to beauty pervades even everyday activities in Japan, such as wrapping purchases at the dollar store or putting out garbage. This course explores principles that guide the Japanese aesthetic sensibility with an eye to its expression in Japanese literature, film, and traditional arts, such as the tea ceremony and gardening.
Attribute/Distribution: HU

ASIA 145 (GS 145, REL 145) Islam and the Modern World 4 Credits
Examines how numerous Muslim thinkers-religious scholars, modernists, and Islamists-have responded to the challenges and challenges of the colonial and post-colonial eras. Special emphasis is placed on the public debates over Islamic authority and authenticity in contemporary South Asia.
Attribute/Distribution: HU

ASIA 147 (GS 147, REL 147) Pilgrims, Bandits, Traders, Nuns: Traveling Religious Identities in Asia 4 Credits
This course examines religious networks linking Chinese, Tibetan, Himalayan, and Inner Asian people, places, and institutions to Asia and the world. We explore examples of 19th, 20th century and present day transnational religious identities, emerging from trade, religious travel and pilgrimage, refugee migrations, labor migrations, and modern day leisure travel. We consider religious identity, nationalism, transnationalism, and globalization, using literary, historical, and ethnographic sources, and film, video, and popular media.
Attribute/Distribution: HU

ASIA 162 (REL 162) Zen Buddhism 4 Credits
Attribute/Distribution: HU

ASIA 163 (IR 163) U.S.-China Relations 4 Credits
Introduction and analysis of the historical context and key aspects of contemporary US-China relations: Cold War US containment, rapprochement and diplomatic normalization; American arms sale and the Taiwan controversy; conflict and cooperation in the Korean Peninsula; economic interdependence and friction; human rights and security relations; Asian regional disputes. This is an advanced course on US-China relations. Students may not receive credit for both IR/ASIA 063 and IR/ASIA 163.
Prerequisites: IR 010 or IR 061
Attribute/Distribution: SS

ASIA 164 (IR 164) Japan in a Changing World 4 Credits
This course explores Japanese foreign policy through its historical and international context; domestic determinants; foreign and security policymaking process; policy to major regional players; foreign economic policy; current grand strategic debates.
Prerequisites: IR 010 or IR 061
Attribute/Distribution: SS

ASIA 165 (MLL 165) Love and Revolution in Shanghai 4 Credits
This project-based course will examine human relationships and political-economic changes in Shanghai through the lens of literature, film, and a selection of other readings. Students will discuss the conflicts between and influences of pre-communist, communist, and capitalist systems as played out in the Shanghai urban arena.
Attribute/Distribution: HU

ASIA 166 (GS 166, REL 166) Religious Nationalism in South Asia 4 Credits
This course explores the conflation and conflict of religion and politics in one of the most complex, dynamic and volatile regions on the planet (South Asia). Through literature, film and scholarly writings, students will examine the history of cooperation and conflict between the Muslim and Hindu communities in South Asia from the movements for national independence to twenty-first century identity politics.
Attribute/Distribution: HU

ASIA 167 (REL 167) Engaged Buddhism 4 Credits
Examines a contemporary international movement that applies Buddhist teachings and practices to social, political, and environmental issues. Topics include: important thinkers, forms of engagement, and areas of controversy.
Attribute/Distribution: HU

ASIA 168 (REL 168) Buddhism in the Modern World 4 Credits
Explores contemporary Buddhism in Asia, America, and Europe. Topics include the plight of Tibet, Buddhist environmentalism, and the emergence of a socially engaged Buddhism. How are Westerners adapting this ancient tradition to address present day concerns.
Attribute/Distribution: HU

ASIA 170 (HIST 170) The Last Samurai 4 Credits
Explores the revolutionary character of the political upheaval in 1868 that led to the fall of the ruling shogun and the dissolution of the elite samurai class. Examines both the causes of these major political and social changes and their continuing impact upon Japanese culture and society.
Attribute/Distribution: HU

ASIA 172 (REL 172) Tibetan Buddhism and Society 4 Credits
This course examines the history, rituals, practices and art of the Tibetan Buddhist world, and the interaction of Tibetan Buddhism with the Tibetan Bon religion and Tibetan Islam. Students will explore film, autobiography, visual arts, and religious writings, asking, How has Tibetan Buddhism shaped Tibetan societies, as well as neighboring cultures in East Asia and Inner Asia? In what ways is Tibetan Buddhism now a global religion?
Attribute/Distribution: HU

ASIA 173 (REL 173, WGSS 173) Sex, Celibacy and Sainthood: Gender and Religion in East Asia 4 Credits
This course explores themes of sexuality, celibacy, gender, and sainthood in East Asian religions. We will pay special attention to the experiences of religious women from many walks of life and time periods, from traditions including Buddhism, Daoism, and shamanism. Through film, poetry, autobiography, philosophical writing, visual art, and descriptions of visionary experience, students will encounter Buddhist and Daoist nuns, lay women, mothers, shamanic healers, oracles, activists, and royalty, from Tibet, Korea, Japan, China, and the U.S.
Attribute/Distribution: HU

ASIA 177 (MLL 177) China Enters the Modern Age 4 Credits
The collapse of the imperial order and China's agonizing transformation into a modern nation-state over the past 150 years. The impact of imperialism, war, radical social change, and protracted revolution on Chinese traditions, values, and institutions.
Attribute/Distribution: HU, SS

ASIA 186 (SOC 186) Understanding China through Films 4 Credits
In this class, we will use films, both documentary and feature films, to demonstrate how Chinese people experience and interpret social, political, economic and cultural changes. Through sociological interpretation of film, we will focus on the following topics: education provision, migration, environmental concerns, gender relations, poverty, and changing cultural norms and values. We will explore how these social issues have been intensified with economic reform, and how they intersect with major historical hierarchies in China.
ASIA 187 (ANTH 187) Peoples and Cultures of Southeast Asia 4 Credits
Peoples and cultures of Burma, Laos, Cambodia, Thailand, Malaysia, Singapore, Indonesia, and the Philippines. World view, religion, economy, politics, and social organization. 
Attribute/Distribution: SS

ASIA 188 (ANTH 188) Southeast Asian Migrants and Refugees 4 Credits
Focus on migrants and refugees from Southeast Asia to the United States; examines cultures and practices while in Southeast Asia, the migration process, and the ways in the people and their cultural practices have changed in the United States. 
Attribute/Distribution: SS

ASIA 191 Intermediate Asian Language and Culture Abroad 1-8 Credits
Intermediate language and culture abroad other than Chinese and Japanese. 
Attribute/Distribution: HU

ASIA 192 (PHIL 192, REL 192) Lehigh in Japan: Kyoto I 3 Credits
This is one of 2 courses that will be part of an intensive international summer school course to take start Summer 2016 in Kyoto University. Students will study aspects of Western and Japanese philosophical thought in a small group led by local and international speakers. Participants in the class will also be local and international. Students will be expected to attend all classes for a number of hours over a period of two weeks. 
Attribute/Distribution: HU

ASIA 193 (PHIL 193, REL 193) Lehigh in Japan: Kyoto II 3 Credits
A second component of the Philosophy summer school in Kyoto will involve a series of excursions to galleries, museums, temples, shrines, stores, and restaurants. Students can expect to develop their understanding of both Japanese aesthetics and the way in which the philosophical systems present in Japan have influenced the Japanese aesthetic sensibility. Students will be required to submit a series of shorter pieces of writing and a final project. 
Attribute/Distribution: HU

ASIA 201 (GS 201, POLS 201) Democracy and Dictatorship in South Asia 4 Credits
Examines the politics of countries in South Asia (India, Pakistan, Bangladesh, Sri Lanka, Nepal, Bhutan, and the Maldives). Some of the key themes are 1) the lasting legacy of colonialism, 2) ways in which ethnic and religious diversity is managed, 3) distinctiveness of political institutions like parliament and constitutions in South Asia, and 4) how politics, economics, and culture relate to one another. The focus of the course changes each year in order to reflect current developments and student interest. 
Attribute/Distribution: SS

ASIA 220 (REL 220) Poet, Meditator, King: Classics of East Asian Religion 4 Credits
Classic texts of East Asia and an introduction to the traditions they represent. What do these texts teach about reality, humanity, divinity, virtue and society? How is the path of personal and social transformation presented? 
Attribute/Distribution: HU

ASIA 221 (REL 221) Topics in Asian Religions 4 Credits
Selected thematic and comparative issues in different Asian religious traditions. May include Buddhism and Christianity, religion and martial arts, Asian religions in America, Taoist meditation, Zen and Japanese business, Buddhist ethics. 
Repeat Status: Course may be repeated.

ASIA 240 (PHIL 240) Figures/Themes in Eastern Philosophy 4 Credits
This seminar course will involve in-depth focus upon a major figure in Eastern thought or upon the Eastern treatment of a particular theme or set of themes. Content varies. 
Repeat Status: Course may be repeated. 
Attribute/Distribution: HU

ASIA 247 (GS 247, REL 247) Islamic Mysticism 4 Credits
Sufism, the inner or ‘mystical’ dimension of Islam, has deep historical roots and diverse expressions throughout the Muslim world. Students examine Sufi doctrine and ritual, the master-disciple relationship, and the tradition’s impact on art and music, poetry and prose. 
Attribute/Distribution: HU

ASIA 254 (ES 254, ETH 254, REL 254) Buddhism and Ecology 4 Credits
Buddhism’s intellectual, ethical, and spiritual resources and reexamined in light of contemporary environmental problems. Is Buddhism the most green of the major world religions? What are the moral implications of actions that affect the environment? 
Attribute/Distribution: HU

ASIA 291 Advanced Asian Language and Culture Abroad 3 Credits
Advanced language and culture abroad other than Chinese and Japanese. 
Attribute/Distribution: HU

ASIA 298 1-4 Credits

ASIA 337 (ANTH 337, REL 337) Buddhism and Society 4 Credits
In this course we explore ways in which Buddhism is localized to become lived religions in Thailand, Tibet, Japan, and the United States. We examine how Buddhist practices are integrated into local traditions and how religious practices become part of the larger social, political, and value systems. Students will develop a comparative framework that includes Theravada, Tibetan, and Zen Buddhism. 
Attribute/Distribution: ND, SS

ASIA 339 (POLS 339) The Rise of the State in Modern East Asia 4 Credits
An examination of Asian nationalism in the construction of the modern state form in Asia. 
Attribute/Distribution: SS

ASIA 340 (HIST 340) Japanese Industrialization 3-4 Credits
Explores economic growth in the traditional economy, the rise of an entrepreneurial class, the importation of western technology, and the social, political and economic institutions which support industrial society since the early 19th century. 
Attribute/Distribution: SS

ASIA 343 (AAS 343, GS 343, POLS 343) Global Politics of Race: Asia and Africa 4 Credits
An examination of the concept of “race” and its impact on domestic and international politics. 
Attribute/Distribution: SS

ASIA 361 Internship in Asian Studies 1-4 Credits
Internship in public or private agency involved in some aspect of Asian studies. Individual faculty mentor. Written report required. Program permission required. 
Repeat Status: Course may be repeated. 
Attribute/Distribution: HU, SS

ASIA 364 (IR 364) Chinese Foreign Policy 4 Credits
Research-oriented seminar focusing on the sources of Chinese foreign policy preferences and goals, foreign policy decision-making processes; international implications of the rise of China, and the pressing regional and global issues that China is facing now and in the future. Consent of department required. 
Prerequisites: IR 010 or IR 061 or ASIA 061 or IR 062 or ASIA 062 or IR 063 or ASIA 063 or IR 161 or ASIA 161 or IR 163 or ASIA 163 
Attribute/Distribution: SS

ASIA 371 Advanced Readings in Asian Studies 1-4 Credits
Directed course of reading and writing in advanced topic not covered in regular Asian Studies course offerings. Program permission required. 
Repeat Status: Course may be repeated. 
Attribute/Distribution: HU, SS

ASIA 381 Special Topics in Asian Studies 1-4 Credits
Advanced study of aspects of Asian studies not covered in regular course offerings. Individual faculty supervision. Research paper required. Program permission required. 
Repeat Status: Course may be repeated. 
Attribute/Distribution: HU, SS
Astronomy and Astrophysics

Astronomy and Astrophysics are offered in the Department of Physics. Astrophysicists apply physics and mathematics to the study of planets, stars, galaxies, pulsars, black holes, quasars and the universe, among many other fascinating objects in order to understand their origin, evolution, and ultimate fate. Students who major in astronomy or astrophysics usually have very inquisitive minds and a good aptitude for physics and mathematics. The bachelor degree programs in astronomy and astrophysics provide the student with a solid background in laboratory and theoretical astrophysics as well as in the fundamentals of physics and mathematics. Research opportunities are available to supplement classroom instruction.

The bachelor of science degree in astrophysics is designed for students who wish to go on to graduate studies in astrophysics with the goal of becoming professional astronomers. Professional astronomers generally find positions at colleges, and universities, national labs, NASA or its contractors and in various space industries. This degree also prepares you for many jobs in related fields such as computer science, mathematics or physics.

The bachelor of arts degree in astronomy is intended for students who desire a broad background in astronomy, mathematics and physics but do not plan to do graduate work in astrophysics. With this broad background, the student is well prepared in many fields of endeavor, including planetarium and museum work, teaching astronomy at colleges and universities, secondary education, science writing, or in many professions in which the ability to learn is critical. Both of these degrees can be profitably combined with mathematics and other sciences producing excellent double majors or double degrees.

A minor program in astronomy is also available for students who wish to enlarge their potential for a career choice or who may be eager to learn more about astrophysics than an introductory course can provide.

ASTRONOMY AND ASTROPHYSICS DEGREE PROGRAMS

B.A. with Major in Astronomy Program Requirements

<table>
<thead>
<tr>
<th>Mathematics Courses</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 021 Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 022 Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 023 Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>MATH 205 Linear Methods</td>
<td>3</td>
</tr>
</tbody>
</table>

Basic and Intermediate-Level Science

<table>
<thead>
<tr>
<th>Courses</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTR 007 Introduction to Astronomy</td>
<td>4</td>
</tr>
<tr>
<td>&amp; ASTR 008 Introduction to Astronomy Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>PHY 010 General Physics I</td>
<td>4</td>
</tr>
<tr>
<td>or PHY 011 Introductory Physics I</td>
<td>4</td>
</tr>
<tr>
<td>PHY 013 General Physics II</td>
<td>3-4</td>
</tr>
</tbody>
</table>

Approved Electives

Select three courses from among the following seven:

<table>
<thead>
<tr>
<th>Courses</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ASTR 301 Modern Astrophysics I</td>
<td>3</td>
</tr>
<tr>
<td>ASTR 302 Modern Astrophysics II</td>
<td>3</td>
</tr>
</tbody>
</table>

Intermediate - Advanced Astronomy/Astrophysics

<table>
<thead>
<tr>
<th>Courses</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>PHY 220 Advanced Physics Laboratory I</td>
<td>3</td>
</tr>
<tr>
<td>PHY 221 Advanced Physics Laboratory II</td>
<td>2</td>
</tr>
<tr>
<td>ASTR 105 Introduction to Planetary Astronomy</td>
<td>3</td>
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</tbody>
</table>

Laboratory and Computing Courses

<table>
<thead>
<tr>
<th>Courses</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CSE 002 Fundamentals of Programming</td>
<td>2</td>
</tr>
<tr>
<td>PHY 220 Advanced Physics Laboratory I</td>
<td>3</td>
</tr>
<tr>
<td>PHY 221 Advanced Physics Laboratory II</td>
<td>2</td>
</tr>
</tbody>
</table>

Approved Elective Courses

Select three courses from among the following seven...
**ASTR/PHY 332** High-Energy Astrophysics 3
**ASTR/PHY 342** Relativity and Cosmology 3
**PHY 348** Plasma Physics 3
**PHY 352** Modern Optics 3
**PHY 364** Nuclear and Elementary Particle Physics 3
**PHY 369** Quantum Mechanics I 3
**PHY 380** Introduction to Computational Physics 3

... plus one additional course in an appropriate technical area in consultation with the adviser. Students planning graduate work in Astrophysics are advised to include ASTR 273 (Research) among their electives.

**Total Credits** 99-101

A total of 123 credit hours are required for the Bachelor of Science in Astrophysics.

### RECOMMENDED SEQUENCE OF COURSES FOR THE FIRST TWO YEARS

#### B.A. with Major in Astronomy

<table>
<thead>
<tr>
<th>Fall</th>
<th>CR</th>
<th>Spring</th>
<th>CR</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 001</td>
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<td>ENGL 002</td>
<td>3</td>
</tr>
<tr>
<td>ASTR 007</td>
<td>4</td>
<td>PHY 010 or 011</td>
<td>4</td>
</tr>
<tr>
<td>&amp; ASTR 008</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EES 021</td>
<td>3</td>
<td>PHY 012</td>
<td>1</td>
</tr>
<tr>
<td>EES 022</td>
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<td>MATH 022</td>
<td>4</td>
</tr>
<tr>
<td>MATH 021</td>
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<td>Col. Sem.</td>
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<table>
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<th>Spring</th>
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<tr>
<td>PHY 013 or 021</td>
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<td>PHY 031</td>
<td>3</td>
</tr>
<tr>
<td>PHY 022</td>
<td>1</td>
<td>MATH 205</td>
<td>3</td>
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<tr>
<td>MATH 023</td>
<td>4</td>
<td>ASTR 110</td>
<td>1</td>
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<tr>
<td>ASTR 105</td>
<td>3</td>
<td>Appr. Elec.</td>
<td>3</td>
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<tr>
<td>Dist req</td>
<td>3-4</td>
<td>Dist req</td>
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</table>

**Total Credits: 58-64**

#### B.S. Astrophysics

<table>
<thead>
<tr>
<th>Fall</th>
<th>CR</th>
<th>Spring</th>
<th>CR</th>
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<tbody>
<tr>
<td>ENGL 001</td>
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<td>ENGL 002</td>
<td>3</td>
</tr>
<tr>
<td>PHY 011 or 010</td>
<td>4</td>
<td>CHM 030</td>
<td>4</td>
</tr>
<tr>
<td>PHY 012</td>
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<td>MATH 022</td>
<td>4</td>
</tr>
<tr>
<td>MATH 021</td>
<td>4</td>
<td>Col. Sem. or Dist. Req.</td>
<td>3-4</td>
</tr>
<tr>
<td>Col. Sem. or Dist. Req.</td>
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<td></td>
<td>3-4</td>
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</table>

<table>
<thead>
<tr>
<th>Second Year</th>
<th>CR</th>
<th>Spring</th>
<th>CR</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHY 021 or 023</td>
<td>4</td>
<td>PHY 031</td>
<td>3</td>
</tr>
<tr>
<td>PHY 022</td>
<td>1</td>
<td>CSE 002**</td>
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<tr>
<td>MATH 023</td>
<td>4</td>
<td>MATH 205</td>
<td>3</td>
</tr>
<tr>
<td>ASTR 105</td>
<td>3</td>
<td>Dist. Req.</td>
<td>3-4</td>
</tr>
<tr>
<td>Elective or Dist. Req.</td>
<td>3-4</td>
<td>Elective or Dist. Req.</td>
<td>3-4</td>
</tr>
</tbody>
</table>

**Total Credits: 58-63**

* Students may choose to select ASTR 007 by deferring a distribution requirement (though it is not required for the BS in Astrophysics).

** Or an equivalent course in scientific computing.

### Departmental Honors in Astronomy or Astrophysics

Students receiving a BA in Astronomy or a BS in Astrophysics may earn Departmental Honors by satisfying the following requirements:

1. **Academic Performance:** Minimum grade point average of 3.50 in astronomy and physics courses used to satisfy the major degree requirements.
2. **Research or Project-Based/Creative Activity:** completion of approved special topics courses in astronomy that include written reports, or completion of 6 credits of ASTR 273 (research) or equivalent, or completion of a summer research project with written report and oral presentation.
3. **Additional Course Work:** Completion of at least one approved 300-level course in either physics or astronomy beyond those required in the student’s degree program. This course may not be selected from special topics or research courses such as ASTR 372.

** Specific approvals are granted by the Program Director.

### The Minor Program in Astronomy

The minor in astronomy consists of 15 credits of astronomy and physics courses, at least 9 credits of which must be astronomy courses at or above the 100-level. No more than one course required in a student’s major program may be included in the minor program. The minor program should be designed along a coherent intellectual theme in consultation with the Physics Department Chair. Examples of course sequences for the minor program can be found on the Physics Department Web Site.

### Courses

**ASTR 007 Introduction to Astronomy 3 Credits**

Introduction to planetary, stellar, galactic, and extragalactic astronomy. An examination of the surface characteristics, atmospheres, and motions of planets and other bodies in our solar system. Properties of the sun, stars, and galaxies, including the birth and death of stars, stellar explosions, and the formation of stellar remnants such as white dwarfs, neutron stars, pulsars, and black holes. Quasars, cosmology, and the evolution of the universe. May not be taken by students who have previously completed ASTR 105, PHY 105, ASTR 301, PHY 301, ASTR 302 OR PHY 302.

**Attribute/Distribution:** NS

**ASTR 008 Introduction to Astronomy Laboratory 1 Credit**

Laboratory to accompany ASTR 007. Must be enrolled concurrently in ASTR 007.

**Corequisites:** ASTR 007

**Attribute/Distribution:** NS

**ASTR 072 Special Topics In Astrophysics 1-4 Credits**

Selected topics not sufficiently covered in other courses.

**Repeat Status:** Course may be repeated.

**Attribute/Distribution:** NS

**ASTR 105 Introduction to Planetary Astronomy 3 Credits**

This course is an introduction to the solar system. Topics include observations of the sky, transition from the geocentric to the heliocentric paradigm, gravitational interactions, formation and evolution of the solar system, the structure of and energy production in the Sun, survey of the planets in the solar system, including their dynamics, interiors, atmospheres, composition, and moons, the nature of asteroids, comets, and the Kuiper belt, and the study of exoplanets. Instructor permission required in lieu of Phy 5/10/11.

**Prerequisites:** PHY 005 or PHY 010 or PHY 011

**Attribute/Distribution:** NS

**ASTR 110 Methods of Observational Astronomy 1 Credit**

Techniques of astronomical observation, data reduction, and analysis. Photometry, spectroscopy, CCD imaging, and interferometry. Computational analysis. Examination of ground-based and spacecraft instrumentation, and data transmission, reduction, and analysis.

**Attribute/Distribution:** NS

**ASTR 172 Special Topics In Astrophysics 1-4 Credits**

Selected topics not sufficiently covered in other courses.

**Repeat Status:** Course may be repeated.

**Attribute/Distribution:** NS
ASTR 272 Special Topics in Astronomy 1-4 Credits
Selected topics not sufficiently covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS

ASTR 273 Research 2-3 Credits
Participation in current research projects being carried out within the department.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS

ASTR 300 Apprentice Teaching 3 Credits

ASTR 301 Modern Astrophysics I 3 Credits
Prerequisites: (PHY 010 or PHY 011) and (PHY 013 or PHY 021 or PHY 023) and PHY 031 and (MATH 022 or MATH 032 or MATH 052)
Attribute/Distribution: NS

ASTR 302 Modern Astrophysics II 3 Credits
Prerequisites: (PHY 010 or PHY 011) and (PHY 013 or PHY 021 or PHY 023) and (MATH 022 or MATH 032 or MATH 052)
Attribute/Distribution: NS

ASTR 332 (PHY 332) High-Energy Astrophysics 3 Credits
Observation and theory of X-ray and gamma-ray sources, quasars, pulsars, radio galaxies, neutron stars, black holes. Results from ultraviolet, X-ray and gamma-ray satellites. Generally offered in the spring of odd-numbered years.
Prerequisites: (PHY 021 or PHY 023) and (MATH 023 or MATH 033) and PHY 031 and PHY 215
Can be taken Concurrently: MATH 023, MATH 033
Attribute/Distribution: NS

ASTR 342 (PHY 342) Relativity and Cosmology 3 Credits
Special and general relativity, Schwarzschild and Kerr black holes. Super massive stars. Relativistic theories of the origin and evolution of the universe. Generally offered in the spring of even-numbered years.
Prerequisites: (PHY 021 or PHY 023) and (MATH 023 or MATH 033) and PHY 031 and PHY 215
Can be taken Concurrently: MATH 023, MATH 033, PHY 215
Attribute/Distribution: NS

ASTR 372 Special Topics in Astronomy 1-4 Credits
Selected topics not sufficiently covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS

ASTR 389 Honors Project 1-6 Credits
Repeat Status: Course may be repeated.

ASTR 410 Stellar Atmospheres and Spectroscopy 3 Credits
The course will explore models of the thermodynamic structure of a star's outermost atmosphere to predict its emitted energy spectrum and spectral line production. Applications of spectroscopy to binary stars, exoplanet host stars, and other astrophysical systems will be presented.

ASTR 411 Stellar Structure and Evolution 3 Credits
The course discusses how to model the physical and thermodynamic structure of a star, from its core to the surface. Computational techniques of stellar modeling, including polynomials, are presented. Applications of stellar modeling to asteroseismology, magnetic fields, and rapidly rotating stars are presented.

ASTR 472 Special Topics in Astronomy 1-4 Credits
Selected topics not sufficiently covered in other courses.
Repeat Status: Course may be repeated.

Biochemistry

An interdepartmental B.S. biochemistry major is offered in the College of Arts and Sciences. The B.S. in biochemistry degree is managed by an interdepartmental committee composed of biochemists, bioorganic chemists, and molecular/cellular biologists. The committee administers the degree, monitors the academic program, provides research possibilities, and advises student majors. The director of the program is currently Linda J. Lowe-Krentz. Faculty in both Biological Sciences and Chemistry serve as advisors.

BACHELOR OF SCIENCE DEGREE IN BIOCHEMISTRY

College and University Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ENGL 001 Composition and Literature</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 002 Composition and Literature II</td>
<td>3</td>
</tr>
<tr>
<td>First Year Seminar</td>
<td>3</td>
</tr>
<tr>
<td>Non-science Electives</td>
<td>16</td>
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</tbody>
</table>

Collateral Science Requirements

Select one of the following options:

Option A

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>PHY 010 General Physics I</td>
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<tr>
<td>&amp; PHY 012 Introductory Physics Laboratory I</td>
<td></td>
</tr>
<tr>
<td>PHY 013 General Physics II</td>
<td></td>
</tr>
<tr>
<td>&amp; PHY 022 Introductory Physics Laboratory II</td>
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Option B

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>PHY 011 Introductory Physics I</td>
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</tr>
<tr>
<td>&amp; PHY 012 Introductory Physics Laboratory I</td>
<td></td>
</tr>
<tr>
<td>PHY 021 Introductory Physics II</td>
<td></td>
</tr>
<tr>
<td>&amp; PHY 022 Introductory Physics Laboratory II</td>
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</tbody>
</table>

Select one of the following options:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>MATH 051 Survey of Calculus I</td>
<td></td>
</tr>
<tr>
<td>MATH 052 Survey of Calculus II</td>
<td></td>
</tr>
<tr>
<td>MATH 043 Survey of Linear Algebra</td>
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</tr>
<tr>
<td>MATH 021 Calculus I</td>
<td></td>
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<tr>
<td>MATH 022 Calculus II</td>
<td></td>
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<tr>
<td>MATH 023 Calculus III</td>
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</table>

One statistics course

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSE 012 Survey of Computer Science</td>
<td>3</td>
</tr>
<tr>
<td>or ENGR 010 Applied Engineering Computer Methods</td>
<td>3</td>
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Required Chemistry Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CHM 040 Concepts, Models and Experiments I</td>
<td>3</td>
</tr>
<tr>
<td>CHM 041 Concepts, Models and Experiments II</td>
<td>3</td>
</tr>
<tr>
<td>CHM 110 Organic Chemistry I</td>
<td></td>
</tr>
<tr>
<td>&amp; CHM 111 Organic Chemistry Laboratory I</td>
<td></td>
</tr>
<tr>
<td>CHM 112 Organic Chemistry II</td>
<td></td>
</tr>
<tr>
<td>&amp; CHM 113 Organic Chemistry Laboratory II</td>
<td></td>
</tr>
<tr>
<td>CHM 194 Physical Chemistry for Biological Sciences</td>
<td>3</td>
</tr>
<tr>
<td>CHM 307 Advanced Inorganic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHM 332 Analytical Chemistry</td>
<td>3</td>
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Required Biological Sciences courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BIOS 041 Biology Core I: Cellular and Molecular Biology</td>
<td>4</td>
</tr>
<tr>
<td>&amp; BIOS 042 Biology Core I: Cellular and Molecular Lab</td>
<td></td>
</tr>
<tr>
<td>BIOS 115 Biology Core II: Genetics</td>
<td>3</td>
</tr>
<tr>
<td>BIOS 371 Elements of Biochemistry I</td>
<td>3</td>
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<tr>
<td>BIOS 372 Elements of Biochemistry II</td>
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<tr>
<td>BIOS 377 Biochemistry Laboratory</td>
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</tr>
<tr>
<td>Advanced Laboratory</td>
<td>4</td>
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</tbody>
</table>

Electives in Biological Sciences (3 hours minimum) | 3 |
Technical Writing (2 hours minimum) | 2 |

Total Credits 100-103

1 16 hours to be broadly distributed in fields of thought other than natural science and mathematics, including at least 8 hours each in humanities and social sciences.
2 Mathematics option and statistics course must be at least 12 hours combined.
The biological sciences include the study of living systems at levels ranging from the structure and function of molecules to the behavior and evolution of communities of organisms. The department offers four different routes to mastering skills and knowledge in this broad area. The B.A. and B.S. programs in biology provide a broad introduction to biology with opportunities for students to create a program of study suited to their specific interests. Programs of study focused on particular aspects of biology are the B.A. and B.S. degree in the areas of behavioral neuroscience and molecular biology. For programs in biochemistry and bioengineering, see those separate sections in the catalog.

The Department of Biological Sciences strongly supports the positions of both the American Association for the Advancement of Science and the National Academy of Sciences that intelligent design is not scientific and should not be presented as science in science classes.

The requirements for the B.A. and B.S. in biology, behavioral neuroscience, and molecular biology are listed below. Research interests of the faculty and instrumentation are described in the section on graduate education.

**Professors.** Michael J. Behe, PHD (University of Pennsylvania); R. Michael Burger, PHD (University of Texas at Austin); Lynne U. Cassimeris, PHD (University of North Carolina at Chapel Hill); David L. Cundall, PHD (University of Arkansas); Maria Joanne Donoghue Velleca; Matthias M. Falk, PHD (University of Heidelberg); Wonpil Im, PHD (Cornell University); M. Kathryn Iovine, PHD (Washington University); Murray Itzkowitz, PHD (University of Maryland); Linda J. Lowe-Krentz, PHD (Northwestern University); Jill E. Schneider, PHD (Wesleyan University); Neal G. Simon, PHD (Rutgers University); Robert V. Skibbens, PHD (University of North Carolina Chapel Hill); Jennifer Swann, PHD (Northwestern University); Vassie C. Ware, PHD (Yale University)

**Associate Professors.** Julie Haas, PHD (Boston University); Michael R. Kuchka, PHD (Carnegie Mellon University); Gregory I. Lang, PHD (Harvard University); Julie M. Miwa, PHD (Rockefeller University); Amber M. Rice, PHD (University of North Carolina at Chapel Hill)

**Assistant Professors.** Daniel Babcock, PHD (University Texas Houston); Michael J. Layden, PHD (University of Oregon); David C. Zappulla, PHD (State University of NY at Stony Brook)

**Professors Of Practice.** Ann E. Fink, PHD (University of Southern California); Santiago Herrera, PHD (Massachusetts Institute of Technology); Katie M. Hoffman, PHD (University of Montana)

**Emeriti.** Steven Krawiec, PHD (Yale University); John G. Nyby, PHD (University of Texas at Austin); Hayden N. Pritchard, PHD (Lehigh University); Jeffrey A. Sands, PHD (The Pennsylvania State University)

**B.A. WITH MAJOR IN BIOLOGY**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ENGL 001 Critical Reading and Composition</td>
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</tr>
<tr>
<td>ENGL 002 Research and Argument</td>
<td>3</td>
</tr>
<tr>
<td>First Year Seminar</td>
<td>3</td>
</tr>
<tr>
<td>Social Sciences</td>
<td>8</td>
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<tr>
<td>Humanities</td>
<td>8</td>
</tr>
<tr>
<td>Biology</td>
<td>20</td>
</tr>
<tr>
<td>BIOS 041 &amp; BIOS 042 Biology Core I: Cellular and Molecular and Biology Core I: Cellular and Molecular Lab</td>
<td>4</td>
</tr>
<tr>
<td>BIOS 115 &amp; BIOS 116 Biology Core II: Genetics and Biology Core II: Genetics Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>BIOS 121 &amp; BIOS 122 Biology Core III: Integrative &amp; Comparative Biology and Biology Core III: Integrative and Comparative Lab</td>
<td>4</td>
</tr>
</tbody>
</table>

**Mathematics**

Select one of the following: 18

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOS electives</td>
<td>18</td>
</tr>
</tbody>
</table>

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1. A statistics course from the MATH department could also fulfill the statistics requirement.
Choose one of the following:

**Biology Electives List A**

Choose one of the following:

- BIOS 234 Comparative Vertebrate Anatomy 4
- BIOS 235 Human Physiology 4
- BIOS 241 Vertebrate Natural History 4
- BIOS 276 Central Nervous System and Behavior 3
- BIOS 313 Vertebrate Histology 4
- BIOS 314 Vertebrate Development 4
- BIOS 315 Neuropharmacology 3
- BIOS 317 Evolution 3
- BIOS 323 Evolution of Development 3
- BIOS 326 Coevolution 3
- BIOS 329 Herpetology 3
- BIOS 334 Species and Speciation 3
- BIOS 335 Animal Behavior 3
- BIOS 337 Behavioral Ecology 3
- BIOS 365 Neurobiology of Sensory Systems 3
- BIOS 366 Diseases of the Nervous System 3
- BIOS 369 Comparative Physiology of Vertebrate Systems 3-4
- BIOS 374 Sex Determination and Differentiation 3
- BIOS 382 Endocrinology of Behavior 3
- BIOS 385 Synapses, Plasticity and Learning 3
- BIOS 386 Genes and the Brain 3

**Biology Electives List B**

Choose one of the following:

- BIOS 323 Evolution of Development 3
- BIOS 324 Microbiology 3
- BIOS 327 Development and Disease 3
- BIOS 328 Immunology 3
- BIOS 340 Molecular Basis of Disease 3
- BIOS 342 Cellular Basis of Human Disease 3
- BIOS 345 Molecular Genetics 3
- BIOS 347 Advanced Topics in Genetics 3
- BIOS 367 Cell Biology 3
- BIOS 371 Elements of Biochemistry I 3
- BIOS 372 Elements of Biochemistry II 3
- BIOS 376 Developmental Biology 3
- BIOS 381 Physical Biochemistry 3
- BIOS 384 Eukaryotic Signal Transduction 3

**THE B.S. IN BIOLOGY**

The Bachelor of Science in biology offers broad scientific preparation in biology to facilitate advanced work in the life sciences. Progression through the program is best served through early commitment.

**Requirements for the B.S. in Biology**

**College and university requirements for all majors**

- ENGL 001 Critical Reading and Composition 3
- ENGL 002 Research and Argument 3
- First Year Seminar 3
- Social Sciences 8
- Humanities 8

**Biology**

- BIOS 041 Biology Core I: Cellular and Molecular and Biology Core I: Cellular and Molecular Lab 4
- BIOS 115 & BIOS 116 Biology Core II: Genetics and Biology Core II: Genetics Laboratory 4
- BIOS 121 & BIOS 122 Biology Core III: Integrative & Comparative Biology and Biology Core III: Integrative and Comparative Lab 4
- BIOS 317 Evolution 3

**Total Credits** 74-75

1. Biology electives must include one course from list A (see below) and one course from list B (see below). These will be chosen in consultation with the major advisor. No more than 3 credits from the following courses: BIOS 161, BIOS 261, BIOS 262, BIOS 391, BIOS 393, College scholar project, not BIOS 130.

**Biology Electives List A**

Choose two of the following:

- BIOS 130 Developmental Biology 4
- BIOS 131 Development and Disease 4
- BIOS 132 Microbiology 4
- BIOS 133 Immunology 4
- BIOS 134 Molecular Genetics 4
- BIOS 135 Advanced Topics in Genetics 4
- BIOS 136 Cell Biology 4
- BIOS 137 Elements of Biochemistry I 4
- BIOS 138 Elements of Biochemistry II 4
- BIOS 139 Developmental Biology 4

**Total Credits** 7-8

**Mathematics**

- MATH 021 Calculus I 4
- MATH 022 Calculus II 4
- MATH 051 Survey of Calculus I 4
- MATH 052 Survey of Calculus II 4
- BIOS 130 Biostatistics 4

**Total Credits** 22

**Collateral Sciences**

Select one of the following:

- CHM 030 Introduction to Chemical Principles and Chemical Equilibria in Aqueous Systems 4
- CHM 040 Honors General Chemistry I and Honors General Chemistry II 4
- CHM 110 Organic Chemistry I and Organic Chemistry Laboratory I 4
- CHM 112 Organic Chemistry II and Organic Chemistry Laboratory II 4

**Total Credits** 8

1. Biology electives must include two courses from list A (see below), two courses from list B (see below) and at least four credits of laboratory experience (e.g., two 2 credit laboratory courses). These will be chosen in consultation with the major advisor.

**Biology Electives List B**

Choose two of the following:

- BIOS 234 Comparative Vertebrate Anatomy 4
- BIOS 235 Human Physiology 4
- BIOS 241 Vertebrate Natural History 4
- BIOS 276 Central Nervous System and Behavior 3
- BIOS 313 Vertebrate Histology 4
- BIOS 314 Vertebrate Development 4
- BIOS 315 Neuropharmacology 3
- BIOS 317 Evolution 3
- BIOS 323 Evolution of Development 3
- BIOS 326 Coevolution 3
- BIOS 329 Herpetology 3
- BIOS 334 Species and Speciation 3
- BIOS 335 Animal Behavior 3
- BIOS 337 Behavioral Ecology 3
- BIOS 365 Neurobiology of Sensory Systems 3
- BIOS 366 Diseases of the Nervous System 3
- BIOS 369 Comparative Physiology of Vertebrate Systems 3-4
- BIOS 374 Sex Determination and Differentiation 3
- BIOS 382 Endocrinology of Behavior 3
- BIOS 385 Synapses, Plasticity and Learning 3
- BIOS 386 Genes and the Brain 3

**Total Credits** 98-99
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>BIOS 315</td>
<td>Neuropharmacology</td>
<td>3</td>
</tr>
<tr>
<td>BIOS 323</td>
<td>Evolution of Development</td>
<td>3</td>
</tr>
<tr>
<td>BIOS 326</td>
<td>Coevolution</td>
<td>3</td>
</tr>
<tr>
<td>BIOS 329</td>
<td>Herpetology</td>
<td>3</td>
</tr>
<tr>
<td>BIOS 334</td>
<td>Species and Speciation</td>
<td>3</td>
</tr>
<tr>
<td>BIOS 335</td>
<td>Animal Behavior</td>
<td>3</td>
</tr>
<tr>
<td>BIOS 337</td>
<td>Behavioral Ecology</td>
<td>3</td>
</tr>
<tr>
<td>BIOS 365</td>
<td>Neurobiology of Sensory Systems</td>
<td>3</td>
</tr>
<tr>
<td>BIOS 366</td>
<td>Diseases of the Nervous System</td>
<td>3</td>
</tr>
<tr>
<td>BIOS 369</td>
<td>Comparative Physiology of Vertebrate Systems</td>
<td>3-4</td>
</tr>
<tr>
<td>BIOS 374</td>
<td>Sex Determination and Differentiation</td>
<td>3</td>
</tr>
<tr>
<td>BIOS 382</td>
<td>Endocrinology of Behavior</td>
<td>3</td>
</tr>
<tr>
<td>BIOS 385</td>
<td>Synapses, Plasticity and Learning</td>
<td>3</td>
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<tr>
<td>BIOS 386</td>
<td>Genes and the Brain</td>
<td>3</td>
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**Biology Electives List B**

Choose two of the following:

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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BIOS 323</td>
<td>Evolution of Development</td>
<td>3</td>
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<tr>
<td>BIOS 324</td>
<td>Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>BIOS 327</td>
<td>Development and Disease</td>
<td>3</td>
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<tr>
<td>BIOS 328</td>
<td>Immunology</td>
<td>3</td>
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<tr>
<td>BIOS 340</td>
<td>Molecular Basis of Disease</td>
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<tr>
<td>BIOS 342</td>
<td>Cellular Basis of Human Disease</td>
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<tr>
<td>BIOS 345</td>
<td>Molecular Genetics</td>
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<td>BIOS 347</td>
<td>Advanced Topics in Genetics</td>
<td>3</td>
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<tr>
<td>BIOS 367</td>
<td>Cell Biology</td>
<td>3</td>
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<tr>
<td>BIOS 371</td>
<td>Elements of Biochemistry I</td>
<td>3</td>
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<tr>
<td>BIOS 372</td>
<td>Elements of Biochemistry II</td>
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<tr>
<td>BIOS 376</td>
<td>Developmental Biology</td>
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<tr>
<td>BIOS 381</td>
<td>Physical Biochemistry</td>
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</tr>
<tr>
<td>BIOS 384</td>
<td>Eukaryotic Signal Transduction</td>
<td>3</td>
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**RECOMMENDED B.S. BIOLOGY SEQUENCE**

**First Year**

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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tr>
<td>BIOS 041</td>
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<tr>
<td>&amp; BIOS 042</td>
<td>Biology Core I: Cellular and Molecular Lab</td>
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<td>MATH 051</td>
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<td>4</td>
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<tr>
<td>MATH 052</td>
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<td>CHM 030</td>
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<td>CHM 031</td>
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**Second Year**

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<tr>
<td>BIOS 115</td>
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</tr>
<tr>
<td>&amp; BIOS 116</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>AND/OR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOS 121</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>&amp; BIOS 122</td>
<td></td>
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<tr>
<td>CHM 110</td>
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<tr>
<td>&amp; CHM 111</td>
<td></td>
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<td>BIOS 130</td>
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**Third Year**

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<td>4</td>
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<tr>
<td>&amp; BIOS 116</td>
<td></td>
<td>4</td>
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<tr>
<td>BIOS 121</td>
<td></td>
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<td>&amp; BIOS 122</td>
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<td>&amp; PHY 012</td>
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<td>PHY 013</td>
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<tr>
<td>&amp; PHY 022</td>
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**Approved biology electives including two from list A and two from list B**

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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BIOS 041</td>
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<td>4</td>
</tr>
<tr>
<td>&amp; BIOS 042</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOS 115</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>&amp; BIOS 116</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOS 121</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>&amp; BIOS 122</td>
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<td>CHM 110</td>
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**Fourth Year**

<table>
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<th>Credits</th>
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<tbody>
<tr>
<td>BIOS 317</td>
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<tr>
<td>Biology electives including at least 4 credits of laboratory</td>
<td>10-14</td>
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**Total Credits:** 70-77

**MINOR IN BIOLOGY**

A minor in biology may be achieved by completing the following requirements (17-18 credits):

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>BIOS 401</td>
<td>Biology Core I: Cellular and Molecular Lab</td>
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<td>&amp; BIOS 402</td>
<td>Biology Core I: Cellular and Molecular Lab</td>
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</tr>
<tr>
<td>BIOS 115</td>
<td>Biology Core II: Genetics and Laboratory</td>
<td></td>
</tr>
<tr>
<td>&amp; BIOS 116</td>
<td>Biology Core II: Genetics and Laboratory</td>
<td></td>
</tr>
<tr>
<td>BIOS 121</td>
<td>Biology Core III: Integrative &amp; Comparative Biology</td>
<td>3</td>
</tr>
<tr>
<td>CHM 110</td>
<td>Organic Chemistry I</td>
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</tbody>
</table>

**Total Credits:** 17-18

**B.A. WITH MAJOR IN BEHAVIORAL NEUROSCIENCE**

The B.A. in Behavioral Neuroscience is a natural science major for B.A. distribution purposes.

**Required Major Courses**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOS 041</td>
<td>Biology Core I: Cellular and Molecular Lab</td>
<td></td>
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</tr>
<tr>
<td>BIOS 121</td>
<td>Biology Core III: Integrative &amp; Comparative Biology</td>
<td>4</td>
</tr>
<tr>
<td>&amp; BIOS 122</td>
<td>Biology Core III: Integrative &amp; Comparative Biology</td>
<td>4</td>
</tr>
<tr>
<td>BIOS 130</td>
<td>Biostatistics</td>
<td>4</td>
</tr>
<tr>
<td>BIOS 276</td>
<td>Central Nervous System and Behavior</td>
<td>3</td>
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</table>

Select one of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOS 277</td>
<td>Experimental Neuroscience Laboratory</td>
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</tr>
<tr>
<td>BIOS 278</td>
<td>Neurophysiology Laboratory</td>
<td></td>
</tr>
<tr>
<td>BIOS 279</td>
<td>Experimental Molecular Neuroscience Laboratory</td>
<td></td>
</tr>
<tr>
<td>BIOS 382</td>
<td>Endocrinology of Behavior</td>
<td>3</td>
</tr>
</tbody>
</table>

Select one of the following:

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>BIOS 315</td>
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<td></td>
</tr>
<tr>
<td>BIOS 323</td>
<td>Evolution of Development</td>
<td></td>
</tr>
<tr>
<td>BIOS 326</td>
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</tr>
<tr>
<td>BIOS 365</td>
<td>Neurobiology of Sensory Systems</td>
<td></td>
</tr>
<tr>
<td>BIOS 366</td>
<td>Diseases of the Nervous System</td>
<td></td>
</tr>
<tr>
<td>BIOS 384</td>
<td>Eukaryotic Signal Transduction</td>
<td></td>
</tr>
<tr>
<td>BIOS 385</td>
<td>Synapses, Plasticity and Learning</td>
<td></td>
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<tr>
<td>BIOS 386</td>
<td>Genes and the Brain</td>
<td></td>
</tr>
<tr>
<td>BIOS 395</td>
<td>Miscellaneous</td>
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**Major Electives**

Select two of the following:

Any 300-level BIOS course not fulfilling another BNS requirement above

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<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>PSYC 117</td>
<td>Cognitive Psychology</td>
<td>4</td>
</tr>
<tr>
<td>PSYC 153</td>
<td>Personality</td>
<td>4</td>
</tr>
<tr>
<td>PSYC 176</td>
<td>Cognitive Neuroscience</td>
<td>4</td>
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</table>
### Math and Science Requirements for the B.A.

Select one of the following: 7-8

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
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<tbody>
<tr>
<td>MATH 021 &amp; MATH 022</td>
<td>Calculus I and Calculus II</td>
</tr>
<tr>
<td>MATH 051 &amp; MATH 052</td>
<td>Survey of Calculus I and Survey of Calculus II</td>
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Select one of the following: 4

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<tr>
<th>Course</th>
<th>Description</th>
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<tbody>
<tr>
<td>CHM 030 &amp; CHM 031</td>
<td>Introduction to Chemical Principles and Chemical Equilibria in Aqueous Systems</td>
</tr>
<tr>
<td>CHM 040 &amp; CHM 041</td>
<td>Honors General Chemistry I and Honors General Chemistry II</td>
</tr>
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<td>CHM 110 &amp; CHM 111</td>
<td>Organic Chemistry I and Organic Chemistry Laboratory I</td>
</tr>
<tr>
<td>CHM 112 &amp; CHM 113</td>
<td>Organic Chemistry II and Organic Chemistry Laboratory II</td>
</tr>
<tr>
<td>PSYC 001</td>
<td>Introduction to Psychology</td>
</tr>
</tbody>
</table>

Total Credits: 56-57

1. Except BIOS 320, BIOS 347, BIOS 383, BIOS 387, BIOS 388, BIOS 391, or BIOS 393.

### Other Options

The B.A. in Behavioral Neuroscience can be structured for a wide variety of possibilities (see listing of recommended elective courses). By using free electives to take additional science, the B.A. also can serve as a pre-professional degree for many graduate and professional schools. Students interested in a particular career based program should consult their advisor or the program director, Professor Michael Kuchka.

### B.S. IN BEHAVIORAL NEUROSCIENCE

An early commitment to the B.S. is desirable to meet all the requirements of this program.

### Required Major Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>BIOS 041 &amp; BIOS 042</td>
<td>Biology Core I: Cellular and Molecular and Biology Core I: Cellular and Molecular Lab</td>
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<td>BIOS 115 &amp; BIOS 116</td>
<td>Biology Core II: Genetics and Biology Core II: Genetics Laboratory</td>
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<tr>
<td>BIOS 121 &amp; BIOS 122</td>
<td>Biology Core III: Integrative &amp; Comparative Biology and Biology Core III: Integrative and Comparative Lab</td>
</tr>
<tr>
<td>BIOS 130</td>
<td>Biostatistics</td>
</tr>
<tr>
<td>BIOS 276</td>
<td>Central Nervous System and Behavior</td>
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Select one of the following: 4-5

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<tr>
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<th>Description</th>
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<tr>
<td>BIOS 277</td>
<td>Experimental Neuroscience Laboratory</td>
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<td>BIOS 279</td>
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<td>Endocrinology of Behavior</td>
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### Additional Biological Sciences Requirements for the B.S.

<table>
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<th>Course</th>
<th>Description</th>
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<tbody>
<tr>
<td>BIOS 371</td>
<td>Elements of Biochemistry I</td>
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<tr>
<td>BIOS 372</td>
<td>Elements of Biochemistry II</td>
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Select one of the following: 2-4

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<th>Description</th>
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<tbody>
<tr>
<td>BIOS 234</td>
<td>Comparative Vertebrate Anatomy</td>
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<tr>
<td>BIOS 368</td>
<td>Cell Biology Laboratory 1</td>
</tr>
<tr>
<td>BIOS 377</td>
<td>Biochemistry Laboratory</td>
</tr>
<tr>
<td>BIOS 277 or BIOS 278 or BIOS 279</td>
<td>(must be different than course chosen for Required Major Courses)</td>
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### Advanced BIOS Course Requirement

Select two of the following: 3-4

<table>
<thead>
<tr>
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<tr>
<td>BIOS 315</td>
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<td>Diseases of the Nervous System</td>
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### Math and Science Requirements for the B.S.

Select one of the following: 7-8

<table>
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<td>Survey of Calculus I and Survey of Calculus II</td>
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Select one of the following: 8

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<td>Organic Chemistry II and Organic Chemistry Laboratory II</td>
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<tr>
<td>PSYC 001</td>
<td>Introduction to Psychology</td>
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</table>

Total Credits: 75-80

1. If this course is elected, Cell Biology BIOS 367 must be taken as an elective.
2. Except BIOS 320, BIOS 347, BIOS 383, BIOS 387, BIOS 388, BIOS 391, or BIOS 393.

### B.A. WITH MAJOR IN MOLECULAR BIOLOGY

### College and university requirements for all majors

**ENGL 001** Critical Reading and Composition 3<br>**ENGL 002** Research and Argument 3<br>**First Year Seminar** 3<br>**Social Sciences** 8<br>**Humanities** 8

### Biology

<table>
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<tr>
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<tbody>
<tr>
<td>BIOS 041 &amp; BIOS 042</td>
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<tr>
<td>BIOS 384</td>
<td>Eukaryotic Signal Transduction</td>
</tr>
<tr>
<td>BIOS 385</td>
<td>Synapses, Plasticity and Learning</td>
</tr>
<tr>
<td>BIOS 386</td>
<td>Genes and the Brain</td>
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Select one of the following: 3-5

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<th>Course</th>
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<tr>
<td>PHY 010 &amp; PHY 012</td>
<td>General Physics I and Introductory Physics Laboratory I</td>
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<td>PHY 011 &amp; PHY 012</td>
<td>Introductory Physics I and Introductory Physics Laboratory I</td>
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<td>General Physics II and Introductory Physics Laboratory II</td>
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<tr>
<td>PSYC 001</td>
<td>Introduction to Psychology</td>
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Major Electives

Select two of the following: 6

- Any 300-level BIOS course not fulfilling another BNS requirement above.
- PSYC 117 Cognitive Psychology
- PSYC 153 Personality
- PSYC 176 Cognitive Neuroscience

Total Credits: 75-80

1. If this course is elected, Cell Biology BIOS 367 must be taken as an elective.
2. Except BIOS 320, BIOS 347, BIOS 383, BIOS 387, BIOS 388, BIOS 391, or BIOS 393.
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<td>BIOS 368</td>
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<td>BIOS 377</td>
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<td>BIOS 371</td>
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<td>BIOS 367</td>
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<td>MATH 051</td>
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<td>BIOS 328</td>
<td>Immunology</td>
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</tbody>
</table>

**THE B.S. IN MOLECULAR BIOLOGY**

**Requirements for the B.S. in Molecular Biology**

**Mathematics**

Select one of the following: 7-8

- MATH 021 Calculus I
  - MATH 022 and Calculus II

- MATH 051 Survey of Calculus I
  - MATH 052 and Survey of Calculus II

- BIOS 130 Biostatistics

**Chemistry**

Select one of the following: 4

- CHM 030 Introduction to Chemical Principles
- CHM 040 Honors General Chemistry I

Select one of the following: 4

- CHM 031 Chemical Equilibria in Aqueous Systems
- CHM 041 Honors General Chemistry II
- CHM 110 Organic Chemistry I
  - CHM 111 and Organic Chemistry Laboratory I
- CHM 112 Organic Chemistry II
  - CHM 113 and Organic Chemistry Laboratory II

**Physics**

Select one of the following: 5

- PHY 010 General Physics I
  - PHY 012 and Introductory Physics Laboratory I

- PHY 011 Introductory Physics I
  - PHY 012 and Introductory Physics Laboratory I

Select one of the following: 4-5

- PHY 013 General Physics II
  - PHY 022 and Introductory Physics Laboratory II
- PHY 021 Introductory Physics II
  - PHY 022 and Introductory Physics Laboratory II

**RECOMMENDED SEQUENCE FOR THE B.S. IN MOLECULAR BIOLOGY**

**First Year**

- BIOS 041
  - BIOS 042

- MATH 021
- MATH 022
- CHM 030
- CHM 031

**Second Year**

- BIOS 115
  - BIOS 116
- CHM 110
  - CHM 111
- CHM 112
  - CHM 113
- PHY 010
  - PHY 012
- PHY 013
  - PHY 022

**Third Year**

- BIOS 324 or 328
- BIOS 325, 368, or 377
- BIOS 345
  - BIOS 346

**Total Credits** 82-85
and an up-to-date understanding of the discipline. This will be assessed choosing the appropriate courses to provide a solid scientific foundation the student's progress towards the degree and to assist students in the graduate committee until they are admitted to candidacy. Members

Once students enter the department, their progress is monitored by

This work must be presented in a symposium at the end of the project.

Core requirements for each division are listed below. The graduate school requires students to register for at least 72-post baccalaureate credits to earn the Ph.D. In addition, all students must take BIOS 408 (0 credits) Responsible Conduct of Science within their first year of graduate study. All students must also attend departmental seminars and enroll in BIOS 406 (1 credit) Biological Sciences Seminar at least twice in the first four semesters. A minimum of 24 course credits may be chosen from upper level courses in biochemistry, molecular biology, cell biology, behavioral biology, and neuroscience. At least 12 of these credits must be at the 400 level.

Biochemistry
In the biochemistry program, research areas include DNA structure and function, regulation of protein synthesis, and signal transduction. Students admitted to graduate study in biochemistry will typically have an undergraduate degree in chemistry or biochemistry. Students with an undergraduate degree in a related discipline will be expected to have the following undergraduate preparation for graduate study beyond introductory chemistry and a year of organic chemistry: at least one semester of analytical chemistry and one semester of physical chemistry thermodynamics and kinetics, with appropriate math. Students without that background will be expected to take courses to fulfill those requirements as part of their graduate study.

Required courses

The qualifying exam generally should be taken after the third semester and no later than the fourth semester of course work. It will be prepared, administered and graded by the faculty associated with the specific graduate program in which the student is enrolled. It consists of a two-day written exam and an oral examination. The exam can be repeated once. Admission to candidacy is granted after successful completion of the qualifying exam and the thesis proposal. The proposal is a written description of an original research project developed under the guidance of a faculty member chosen by the student to be his/her advisor. The proposal will be presented orally to the thesis committee, typically after the fifth semester. Following the presentation of the proposal, an oral examination will take place in which the thesis committee will question the student about general science related to the project. This will constitute the general examination.

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### MOLECULAR BIOLOGY MINOR

#### Minor Program

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<tr>
<th>Code</th>
<th>Course Name</th>
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<tr>
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<td>BIOS 042</td>
<td>Biology Core II: Genetics and Biology Core II: Genetics Laboratory</td>
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<td>BIOS 115</td>
<td>Molecular Genetics and Molecular Genetics Laboratory</td>
<td>5</td>
</tr>
<tr>
<td>BIOS 345</td>
<td>BIOS 346</td>
<td>BIOS coursework at the 200 or 300 level (minimum 4 additional credits)</td>
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#### Collateral coursework

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<tr>
<td>CHM 110</td>
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<td>3</td>
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</table>

**Total Credits: 79**

#### DEPARTMENTAL HONORS

A student may apply for admission to the departmental honors program through a potential thesis advisor. Requirements for Departmental Honors include a major GPA of 3.25 and at least 2 semesters of 300-level research for a minimum of 6 cr. The student must write a research proposal for their project and a thesis at the conclusion of their research. This work must be presented in a symposium at the end of the project. Students must meet regularly with their advisor and research group to discuss their research progress and also must complete the year-long, 2-course sequence for BIOS honors students (BIOS 387 and BIOS 388).

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Students may apply for admission to an accelerated B.A.-Doctor of Medicine program and a B.A.-Doctor of Dental Medicine program. A seven-year B.A.M.D. program is offered in conjunction with Drexel University College of Medicine, and a seven-year B.A.D.M.D. program is offered in conjunction with the University of Pennsylvania School of Dental Medicine. Students in these programs receive a B.A. from Lehigh and a graduate degree from the designated professional school within a seven-year period. For details concerning admission to these programs, see Health Professions (p. 53).

#### GRADUATE STUDY IN THE BIOLOGICAL SCIENCES

Rigorous, research-oriented graduate programs leading to a Doctor of Philosophy are offered in three divisions of the Department of Biological Sciences: biochemistry, integrative biology and neuroscience, and cell and molecular biology. To complete the program students must successfully complete core courses, pass a qualifying exam, prepare, submit, and successfully defend a written research proposal, complete the research described in the proposal, and submit a written dissertation and defend the completed research to the department.

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### MOLECULAR BIOLOGY MINOR

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<td>Elements of Biochemistry II</td>
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<tr>
<td>BIOS 406</td>
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One of the following:

- BIOS 421 | Molecular Cell Biology I | 3       |
- BIOS 422 | Molecular Cell Biology II | 3       |
- BIOS 471 | Eukaryotic Signal Transduction (OR) | 3       |

One of the following:

- BIOS 345 | Molecular Genetics | 3       |
- BIOS 411 | Advanced Cell Biology | 3       |

One of the following:

- CHM 423 | Chemical Biology | 3       |
- 400-level bioinformatics course (through CSE or BIOS) | 3       |

#### Elective courses

- Additional courses to reach 24 course credits (12 at the 400-level). May be chosen from the upper level courses in Biochemistry, Molecular Biology, and Bio-Organic Chemistry.

#### Integrative Biology and Neuroscience

The graduate program in integrative biology and neuroscience is designed to train students in advanced organismal biology with the emphasis on behavioral ecology, evolution, functional morphology, endocrinology, and neurobiology of animals. The mission of the program is to create students who are broadly trained and uniquely capable of asking questions and solving problems at the interface of these traditionally defined fields. Students admitted to the program should have a basic knowledge of evolution, anatomy, physiology, behavioral neuroscience, and/or behavioral ecology. Students will begin by taking core courses providing a broad foundation in integrative biology at the graduate level and work toward a Ph.D. with a concentration in either behavioral neuroscience or behavioral and evolutionary biology.
Regardless of concentration, all students in the program develop an appreciation for the fact that all aspects of biology, whether cellular, physiological, anatomical, behavioral, evolutionary, or social, are inextricably linked and cannot be fully understood as separate, parallel systems of knowledge. The integrative program consists of two tracks: (I) Animal Behavior and Evolution, and (II) Neuroscience.

**GRADUATE STUDY IN BIOLOGY**
A rigorous, research-oriented graduate program leading to a Doctor of Philosophy in Biology with concentrations in biochemistry: molecular and cell biology; neuroscience; and evolution and behavior is offered in the Department of Biological Sciences. To complete the program students must successfully complete core courses, pass a qualifying exam, prepare, submit, and successfully defend a written research proposal, complete the research described in the proposal, and submit a written dissertation and defend the completed research to the department. Once students enter the department, their progress is monitored by the graduate committee until they are admitted to candidacy. Members of the committee meet with the student each semester to assess the student's progress towards the degree and to assist students in choosing the appropriate courses to provide a solid scientific foundation and an up-to-date understanding of the discipline. This will be assessed by the qualifying exam.

The qualifying exam generally should be taken after the third semester and no later than the fourth semester of course work. It will be prepared, administered and graded by the faculty associated with the specific concentration in which the student is enrolled. It consists of a two-day written exam and an oral examination. The exam can be repeated once. Admission to candidacy is granted after successful completion of the qualifying exam and the thesis proposal. The proposal is a written description of an original research project developed under the guidance of a faculty member chosen by the student to be his/her advisor. The proposal will be presented orally to the thesis committee, typically after the fifth semester. Following the presentation of the proposal, an oral examination will take place in which the thesis committee will question the student about general science related to the project. This will constitute the general examination.

Core requirements for each concentration are listed below. The graduate school requires students to register for at least 72-post baccalaureate credits to earn the Ph.D. In addition, all students must take BIOS 408 (http://catalog.lehigh.edu/search/?P=BIOS%20408) (0 credits) Responsible Conduct of Science within their first year of graduate study. All students must also attend departmental seminars and enroll in BIOS 406 (http://catalog.lehigh.edu/search/?P=BIOS%20406) (1 credit) Biological Sciences Seminar at least twice in the first four semesters. A minimum of 24 course credits may be chosen from upper level courses in biochemistry, molecular biology, cell biology, behavioral biology and evolutionary biology, and neuroscience. At least 12 of these credits must be at the 400 level.

**Biochemistry concentration**
In the biochemistry program, research areas include DNA structure and function, regulation of protein synthesis, and signal transduction. Students admitted to graduate study in biochemistry will typically have an undergraduate degree in chemistry or biochemistry. Students with an undergraduate degree in a related discipline will be expected to have the following undergraduate preparation for graduate study beyond introductory chemistry and a year of organic chemistry: at least one semester of analytical chemistry and one semester of physical chemistry thermodynamics and kinetics, with appropriate math. Students without that background will be expected to take courses to fulfill those requirements as part of their graduate study.

- **Required courses**
  - BIOS 371 Elements of Biochemistry I
  - BIOS 372 Elements of Biochemistry II
  - CHM 423 Chemical Biology
  - BIOS 345 Molecular Genetics

- **Seminar course**
  - BIOS 406 Biological Sciences Seminar
  - or CHM 400 First Year Graduate Student Seminar

**Neuroscience concentration**
The graduate program in neuroscience is designed to train students in advanced topics in neuroscience with emphases on the behavioral, synaptic, cellular, endocrinology, and physiological aspects of neurobiology. The mission of the program is to create students who are broadly trained and uniquely capable of asking questions and solving problems at the interface of these traditionally defined fields. Students admitted to the program should have a basic knowledge of anatomy, physiology, behavioral and cellular neuroscience. Students will begin by taking core courses providing a broad, integrative foundation in neuroscience at the graduate level and work toward a Ph.D. with a concentration in neuroscience. Regardless of concentration, all students develop an appreciation for the fact that all aspects of biology, whether cellular, physiological, anatomical, behavioral, evolutionary, or social, are inextricably linked and cannot be fully understood as separate, parallel systems of knowledge.

**NEUROSCIENCE CONCENTRATION**
Depending on the student's background, additional courses may be required.

- **Required Courses**
  - Take one (1) of the following:
    - BIOS 453 General Neuroanatomy
    - BIOS 457 Advanced Behavioral Neuroendocrinology
  - Take one (1) of the following:
    - BIOS 415 Synapses, Plasticity and Learning
    - BIOS 424 Advanced Neurobiology of Sensory Systems
  - Take one (1) of the following:
    - BIOS 471 Eukaryotic Signal Transduction
    - BIOS 486 Genes and the Brain
  - Take one (1) course from EITHER the 400-level Cell and Molecular offerings (see Catalog entry) OR the 400-level Animal Behavior and Evolution offerings (see above)

**ANIMAL BEHAVIOR AND EVOLUTION CONCENTRATION**
The graduate program in evolution and behavior is designed to train students in advanced organismal biology with emphases on behavioral ecology, evolution, and/or functional morphology. The mission of the program is to create students who are broadly trained and uniquely capable of asking questions and solving problems at the interface of these traditionally defined fields. Students admitted to the program should have a basic knowledge of evolution, anatomy, physiology and/or behavioral ecology. Students will begin by taking core courses providing a broad, integrative foundation in evolution and behavior at the graduate level and work toward a Ph.D. with a concentration in evolution and behavior. Regardless of concentration, all students develop an appreciation for the fact that all aspects of biology, whether cellular, physiological, anatomical, behavioral, evolutionary, or social, are inextricably linked and cannot be fully understood as separate, parallel systems of knowledge.

- **ANIMAL BEHAVIOR AND EVOLUTION CONCENTRATION**
  - **Required Courses**
    - Take three (3) of the following:
      - BIOS 423 Evolution of Development
      - BIOS 426 Coevolution
      - BIOS 428 Molecular Evolution
      - BIOS 434 Speciation
      - BIOS 439 Advanced Behavioral Ecology
  - Take one (1) course from EITHER the 400-level Cell and Molecular offerings (see Catalog entry) OR the 400-level Neuroscience offerings (see below)

- **Additional Requirements**
  - BIOS 401 Professional Skills for Biological Sciences Graduate Students (strongly recommended to be taken in first two years)
**CELL AND MOLECULAR BIOLOGY CONCENTRATION**

In the cell and molecular biology program, research areas include microbial evolution and genetics, plant and animal molecular genetics, eukaryotic cell biology, and regulation of gene expression.

**BIOS 345** Molecular Genetics 3
**BIOS 371** Elements of Biochemistry I 3
**BIOS 372** Elements of Biochemistry II 3
**BIOS 411** Advanced Cell Biology 3
**BIOS 421** Molecular Cell Biology I 3
**BIOS 422** Molecular Cell Biology II 3

**Additional Requirements**
- BIOS 406 Biological Sciences Seminar 1
- Upper level electives in molecular biology, cell biology, and biochemistry 6

**Total Credits** 25

Facilities available for research in the biological sciences include core facilities with equipment (for example, for DNA synthesis, confocal microscopy, digital imaging, chromatography, cell culture, confitagation, controlled environments, gamma and scintillation counting, flow cytometry, and rodent surgery). Individual research laboratories and advanced teaching laboratories contain a variety of additional equipment. Ongoing interactions with a variety of private companies contribute additional opportunities for student experiences.

**Cell and Molecular Biology**

In the cell and molecular biology program, research areas include microbial evolution and genetics, plant and animal molecular genetics, eukaryotic cell biology, and regulation of gene expression.

**BIOS 345** Molecular Genetics 3
**BIOS 371** Elements of Biochemistry I 3
**BIOS 372** Elements of Biochemistry II 3
**BIOS 411** Advanced Cell Biology 3
**BIOS 421** Molecular Cell Biology I 3
**BIOS 422** Molecular Cell Biology II 3

**Additional Requirements**
- BIOS 406 Biological Sciences Seminar (2 semesters) 1
- Upper level electives in molecular biology, cell biology, and biochemistry 6

**Total Credits** 25

Facilities available for research in the biological sciences include core facilities with equipment (for example, for DNA synthesis, confocal microscopy, digital imaging, chromatography, cell culture, centrifugation, controlled environments, gamma and scintillation counting, flow cytometry, and rodent surgery). Individual research laboratories and advanced teaching laboratories contain a variety of additional equipment. Ongoing interactions with a variety of private companies contribute additional opportunities for student experiences.

**Courses**

**BIOS 010 Bioscience in the 21st Century 3 Credits**

A multidisciplinary survey of advances in bioscience. Exploration of themebased topics (e.g., infectious diseases, cancer, genomics, medicine, engineering biomedical systems) coupled with social/ethical considerations. Three lectures per week. Participation in online multidisciplinary discussion, writing assignments, field trips, and/or other activities.

**Attribute/Distribution:** NS

**BIOS 032 (EES 032) Oceanography 3 Credits**

An introduction to the structure, composition, and processes of the earth from a marine perspective. Topics include earth structure, plate tectonics, continental margins, coastal processes, seawater chemistry, ocean circulation, wave dynamics, primary productivity, plankton and plants, marine organisms and communities. May be combined with EES 022 or EES 004 for 4 credits.

**Attribute/Distribution:** NS

**BIOS 041 Biology Core I: Cellular and Molecular 3 Credits**

Basic building blocks and highorder structures required for cellular processes. Topics include the character of membranes, the molecular/cellular basis of energy production, cell cycle progression, DNA replication, gene expression, signal transduction, and cell division.

**Prerequisites:** CHM 075 or CHM 025 or CHM 030 or CHM 040

**Can be taken Concurrently:** CHM 075, CHM 025, CHM 030, CHM 040

**Attribute/Distribution:** NS

**BIOS 042 Biology Core I: Cellular and Molecular Lab 1 Credit**

Techniques and experiments related to the principal topics covered in BIOS 041; emphasis on experimental design and scientific communication.

**Prerequisites:** BIOS 041

**Can be taken Concurrently:** BIOS 041

**Attribute/Distribution:** NS

**BIOS 043 Phage Hunting Laboratory 2 Credits**

The first laboratory research course in a two-semester series (as part of the Howard Hughes Medical Institute’s SEA-PHAGES Program) that focuses on the isolation (from local soil), as well as the physical and genomic characterization of novel bacteriophages that infect mycobacteria. Course will substitute for BIOS 42. Application and acceptance into Lehigh’s SEA program required (see www.lehigh.edu/~sea); freshman status in the spring semester or permission of the instructor. Co-requisite: BIOS 41 or instructor permission.

**Prerequisites:** BIOS 041

**Can be taken Concurrently:** BIOS 041

**Attribute/Distribution:** NS

**BIOS 115 Biology Core II: Genetics 3 Credits**


**Prerequisites:** BIOS 041

**Attribute/Distribution:** NS

**BIOS 116 Biology Core II: Genetics Laboratory 1 Credit**

Introduction to model organisms; techniques used in molecular genetics; experimental design and scientific communication.

**Prerequisites:** BIOS 115

**Can be taken Concurrently:** BIOS 115

**Attribute/Distribution:** NS

**BIOS 118 Phage Genetics Laboratory 2 Credits**

Part of a 2-semester series focusing on genetic analysis of novel bacteriophage genomes to determine gene function using recombineering strategies. Phage genome annotation using bioinformatics for previously sequenced phage genomes. Additional genetics, molecular biology, and/or biochemical research on previously isolated bacteriophages may also be included.

**Prerequisites:** BIOS 115

**Can be taken Concurrently:** BIOS 115

**Corequisites:** BIOS 115

**Attribute/Distribution:** NS

**BIOS 121 Biology Core III: Integrative & Comparative Biology 3 Credits**

Experimental and historical approaches to the analysis of structural and functional properties in organisms. Use of scientific method to study species diversity. Introduction to the analysis of organismal attributes that explain behavioral repertoire and ecological relationships.

**Prerequisites:** BIOS 41 and (BIOS 42 or BIOS 43)

**Attribute/Distribution:** NS
BIOS 122 Biology Core III: Integrative and Comparative Lab 1 Credit
Experiments and discussions related to the topics covered in BIOS 121; emphasis on experimental design and scientific communication.
Prerequisites: BIOS 121
Can be taken Concurrently: BIOS 121
Attribute/Distribution: NS

BIOS 130 (MATH 130) Biostatistics 4 Credits
Elements of statistics and probability theory with emphasis on biological applications. Statistical analysis of experimental and observational data.
Prerequisites: BIOS 041 and MATH 052 or MATH 022
Attribute/Distribution: ND

BIOS 161 Supervised Research 1-3 Credits
Apprenticeship in ongoing faculty research program. Literature review, experimental design, data collection and analysis, and professional writing under faculty sponsor supervision. Only 3 credits can be counted toward any life science major. Consent of instructor required.
Repeat Status: Course may be repeated.
Prerequisites: BIOS 041
Attribute/Distribution: NS

BIOS 102 Biomedical Externship 1-3 Credits
Analysis of individualized experiences at external biomedical clinical or research sites. Limited enrollment. May not be taken for pass/fail grading. May not be used to satisfy any life science major or minor requirement. Consent of department chair required.
Attribute/Distribution: NS

BIOS 234 Comparative Vertebrate Anatomy 4 Credits
A course in vertebrate zoology with emphasis on the study of homologous body structures in the various vertebrate classes and their relationship to the functional demands of habit and environment in each class. Detailed dissections of representative vertebrates are made in the laboratory. Two lectures and two laboratory periods.
Prerequisites: BIOS 121 or BIOS 122
Attribute/Distribution: NS

BIOS 235 Human Physiology 3 Credits
The goal of this course is to provide students with a thorough understanding of the major systems of the human body. Students will examine many of the major body systems including Nervous, Muscular, Cardiac, Respiratory, and Digestive systems. These systems will be analyzed by their components at both the cellular and molecular level. Students will also examine how each system functions as a whole and how it interacts with other systems at the organismal level.
Prerequisites: BIOS 115
Attribute/Distribution: NS

BIOS 237 Introductory Biomolecular Modeling and Simulation 3 Credits
Key concepts, methods, and tools used in biomolecular modeling and simulation. A hybrid lecture/hands-on practice course using the lectures and tools in CHARMM-GUI (http://www.charmm-gui.org/lecture). Topics include (but not limited to) UNIX operating system, text editors, Python programming, scientific programming using Python, PDB (Protein Data Bank), molecular mechanics, minimization, molecular dynamics, Monte Carlo simulation. The understanding of these concepts and algorithms as well as their applications to well-defined practical examples involving currently important biological problems will be emphasized.
Prerequisites: CHM 030 or CHM 040
Attribute/Distribution: NS

BIOS 238 Epigenetics, Health, and Environment 3 Credits
Foundational concepts in environmental epigenetics. Course will be centered around presentations and discussions of studies that address current issues, such as the mechanisms behind heritable health effects of acute malnourishment in human populations across multiple generations, or the potential for extremely fast evolutionary adaptation in species threatened by environmental change. This course may be listed as a Writing Intensive course.
Prerequisites: BIOS 115
Attribute/Distribution: NS

BIOS 241 Vertebrate Natural History 4 Credits
An introduction to the ecology, behavior, distribution and evolution of vertebrates, with emphasis on the North American fauna. Two lectures, one tutorial and one laboratory and field trip. This course may be used to fulfill junior writing requirements with the permission of the instructor.
Prerequisites: BIOS 115 or BIOS 116 or BIOS 121 or BIOS 122
Attribute/Distribution: NS

BIOS 245 Writing and Biological Sciences 3 Credits
A course designed to acquaint students with some of the intellectual foundations of science, with attention to the distinctiveness of the biological sciences. Format includes readings, intensive writing, extemporaneous speaking, and discussion. May not be used to fulfill Biology B.A. elective requirements.
Attribute/Distribution: NS

BIOS 261 Special Topics in Biological Sciences 1-3 Credits
Research, conferences and reports on selected topics not covered in the general undergraduate offerings. Consent of instructor required.
Repeat Status: Course may be repeated.
Prerequisites: BIOS 121 and BIOS 122
Attribute/Distribution: NS

BIOS 276 Central Nervous System and Behavior 3 Credits
Neuronanatomy and neurophysiology of animal and human behavior. Feeding, thirst, sleep, emotions, learning, and psychopathology.
Prerequisites: BIOS 121 and BIOS 122
Can be taken Concurrently: BIOS 276
Attribute/Distribution: NS

BIOS 277 Experimental Neuroscience Laboratory 2 Credits
Structure and function of the mammalian brain with special attention to cellular morphology and organization. Widely used histological and behavioral techniques to determine how the shape and function of the nervous system regulates behavior. Experimental design, hypothesis testing, statistical analysis, reading and writing of scientific papers, basic histology and imaging.
Prerequisites: BIOS 276
Can be taken Concurrently: BIOS 276
Attribute/Distribution: NS

BIOS 279 Experimental Molecular Neuroscience Laboratory 2 Credits
The functional electrical underpinnings of the nervous system explored through direct recordings and thorough data analyses. Experimental design, hypothesis testing, numerical analysis, reading and writing of primary science.
Prerequisites: BIOS 276
Can be taken Concurrently: BIOS 276
Attribute/Distribution: NS

BIOS 297 Experimental Molecular Neuroscience Laboratory 2 Credits
Inquiry-based lab course emphasizing molecular and cellular neuroscience approaches to understanding the nervous system. Opportunity for making real research discoveries on the genetic and cellular underpinnings of brain function. Molecular genetic, bioinformatic, and neurochemical techniques. Can be taken more than once with instructor approval.
Repeat Status: Course may be repeated.
Prerequisites: BIOS 276
Can be taken Concurrently: BIOS 276
Attribute/Distribution: NS

BIOS 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.
Prerequisites: BIOS 115 and BIOS 116 and BIOS 121 and BIOS 122
Attribute/Distribution: ND, NS

BIOS 313 Vertebrate Histology 4 Credits
Microstructural and ultrastructural properties of vertebrate cells and tissues. Techniques of tissue preparation. Two lectures and two labs.
Prerequisites: BIOS 115 and BIOS 116 and BIOS 121 and BIOS 122
Attribute/Distribution: NS
BIOS 314 Vertebrate Development 4 Credits
Germ cell formation, fertilization, early development, and the origin of the principal organ systems. Location, structure, and regulation of information from molecular to organismal levels of organization. 
Prerequisites: BIOS 115 and BIOS 116 and (BIOS 120 or (BIOS 121 and BIOS 122), )
Attribute/Distribution: NS

BIOS 315 Neuropharmacology 3 Credits
Prerequisites: BIOS 276
Attribute/Distribution: NS

BIOS 317 Evolution 3 Credits
Prerequisites: BIOS 115
Attribute/Distribution: NS

BIOS 318 Advanced Phage Research Laboratory 1-3 Credits
Apprentice-based laboratory research in phage biology in collaboration with faculty who direct Lehigh's SEA Phages Program (sponsored by the Howard Hughes Medical Institute). Research will focus on discoveries uncovered in SEA Phage courses and may include genetic, molecular, and biochemical analyses of novel bacteriophage genes, genomes, and novel gene functions. Additional research may include phage genome annotation using computational biology tools.
Repeat Status: Course may be repeated.
Prerequisites: BIOS 115 and BIOS 118
Attribute/Distribution: NS

BIOS 320 (ENTP 320) The Business of Life Science 3 Credits
An examination of business process in startup, early stage and developing bioscience companies. Technology assessment, business plan and proposal preparation, financial strategies, resource management, intellectual property, and legal as well as regulatory issues. Cannot be used to fulfill major or minor requirements in Biological Sciences.
Prerequisites: BIOS 121
Attribute/Distribution: NS

BIOS 323 Evolution of Development 3 Credits
This course examines how changes in the blueprint that describes the development of a multicellular animal from a single fertilized egg lead to the evolution of new species or new forms within a species.
Prerequisites: BIOS 317 or BIOS 376 or BIOS 327
Can be taken Concurrently: BIOS 317, BIOS 376, BIOS 327

BIOS 324 Microbiology 3 Credits
An examination of microbial life, including archaea, bacteria, fungi, protists and viruses. Emphasis on microbial molecular genetics and its relationship to the origin of life, human health/medicine, and the environment.
Prerequisites: CHM 110 and BIOS 115
Attribute/Distribution: NS

BIOS 325 Microbiology Laboratory 2 Credits
Laboratory studies of microorganisms, focusing on bacteria and fungi. Techniques for isolating, culturing, and identifying microorganisms. Experiments in microbial molecular genetics, phylogenetics, and evolution using traditional and modern techniques, as well as other topics covered in BIOS 324.
Prerequisites: BIOS 324
Attribute/Distribution: NS

BIOS 326 Coevolution 3 Credits
Discussion-based seminar course covering readings from the primary literature. Course will examine evolutionary consequences of species interactions, interactions between the sexes, and genetic interactions. Topics will include predator-prey interactions, host-parasite interactions, sexual conflict, genomic conflict, mutualism, and more. Consequences of coevolution for biodiversity and human health will also be examined.
Prerequisites: BIOS 317
Attribute/Distribution: NS

BIOS 327 Development and Disease 3 Credits
Development of organs from precursor cells; diseases that impact organ function. Focus on understanding how mutations or other causes influence organ development and function. Combination lecture and primary literature.
Prerequisites: BIOS 376
Attribute/Distribution: NS

BIOS 328 Immunology 3 Credits
Distinction of "self" and "nonself" through humoral and cellular mechanisms. Antigens; biochemical structures, cellular mechanisms, genetic control and processing, phylogenetic distribution, diseased states.
Prerequisites: BIOS 115
Attribute/Distribution: NS

BIOS 329 Herpetology 3 Credits
Biology of amphibians and reptiles. Two lectures, one laboratory or field trip per week.
Prerequisites: BIOS 115 and BIOS 116 and (BIOS 120 or (BIOS 121 and BIOS 122), )
Attribute/Distribution: ND

BIOS 330 Molecular Evolution 3 Credits
This course will focus on evolution at the level of individual genes, proteins, and genomes, alternating between lecture and discussion of papers from the recent primary literature. Topics include pathways for adaptive evolution, directionality in evolution, epistasis, evolvability, genome rearrangements and speciation, gene duplication, and evolutionary dynamics. We will draw on examples of molecular evolution in nature, laboratory model systems, and human pathogens.
Prerequisites: BIOS 317 or BIOS 345
Can be taken Concurrently: BIOS 317, BIOS 345
Attribute/Distribution: NS

BIOS 332 Behavioral Neuroanatomy 3 Credits
The study of neuroanatomy that underlies social and motivated behaviors and the techniques that support this study. Students learn by researching and reporting on original research, and ultimately designing and describing an original study on the topic.
Prerequisites: BIOS 276
Attribute/Distribution: NS

BIOS 334 Species and Speciation 3 Credits
Consideration of the origin of species. Discussion of a variety of "species" definitions and exploration of the evolutionary mechanisms by which new species arise. Alternation between lecture and discussion, drawing on the textbook and on current and classical literature.
Prerequisites: BIOS 317

BIOS 335 (PSYC 335) Animal Behavior 3 Credits
Discussion of the behavior of invertebrates and vertebrates and analysis of the physiological mechanisms responsible for behavioral stimuli, and adaptive value of specific behavior patterns.
Prerequisites: BIOS 121 and BIOS 122
Attribute/Distribution: NS

BIOS 336 Animal Behavior Laboratory 2 Credits
Experiments and field observations illustrating principles discussed in BIOS 335. Emphasis on observing animals, performing experiments, collecting and analyzing data, and individual research. Six hours of laboratory per week.
Prerequisites: BIOS 335 or BIOS 337
Can be taken Concurrently: BIOS 335, BIOS 337
Attribute/Distribution: NS

BIOS 337 Behavioral Ecology 3 Credits
Social systems of vertebrate and invertebrate groups. Emphasis on ecological and evolutionary factors that influence social behavior.
Prerequisites: BIOS 121 and BIOS 122
Attribute/Distribution: NS
BIOS 338 Neurodegenerative Diseases in Model Organisms 3 Credits
Discussion-based seminar course on the use of model systems to investigate neurodegenerative diseases. The primary focus will be on invertebrate model systems, including Drosophila. Critical reading of primary scientific literature and student discussion is required.
Prerequisites: BIOS 115

BIOS 340 Molecular Basis of Disease 3 Credits
Lectures and student projects on molecular mechanisms of human disease. Physiology of disease, molecular mechanisms, therapeutic approaches, ongoing research. Topics include: neurodegenerative diseases, cancer, autoimmune diseases, infectious diseases.
Prerequisites: BIOS 115
Attribute/Distribution: NS

BIOS 342 Cellular Basis of Human Disease 3 Credits
Cell and molecular biological advanced topics relevant to human disease and/or health. Critical reading of the primary literature, discussion and student discussion required.
Prerequisites: BIOS 367 or BIOS 411
Attribute/Distribution: NS

BIOS 345 Molecular Genetics 3 Credits
The organization and replication of genetic material; mutagenesis; mechanisms of regulation; mechanisms of gene transmission involving prokaryotes and eukaryotes and their viruses; techniques for intervention into genetic organization and expression.
Prerequisites: BIOS 115

BIOS 346 Molecular Genetics Laboratory 2 Credits
Laboratory experiments related to the topics covered in BIOS 345. Emphasis is on molecular characterization of DNA and the principles of gene isolation and transfer.
Prerequisites: BIOS 345
Can be taken Concurrently: BIOS 345
Attribute/Distribution: NS

BIOS 347 Advanced Topics in Genetics 3 Credits
Lectures and student projects on selected aspects of genetics such as the genetics and evolution of particular organisms, regulation of gene expression and transmission, human genetics, gene therapy, etc. Consent of department chair.
Prerequisites: BIOS 115 and BIOS 116
Attribute/Distribution: NS

BIOS 348 Developmental Biology 3 Credits
An examination of the primary scientific literature on how sex is conferred to a zygote. Hormonal and non-hormonal mechanisms of sexual differentiation. Neural correlates of sex, gender, and sexual orientation.
Prerequisites: BIOS 367 or BIOS 382
Can be taken Concurrently: BIOS 382
Attribute/Distribution: NS

BIOS 349 Cell Biology Laboratory 2 Credits
Opportunity to carry out an independent research project. Techniques include histology and microscopy (both white and fluorescent light), tissue culture and sterile procedures, cellular fractionation, nuclear import assays, and immunological probing. Consent of department required.
Prerequisites: BIOS 367
Can be taken Concurrently: BIOS 367
Attribute/Distribution: NS

BIOS 350 Comparative Physiology of Vertebrate Systems 3-4 Credits
Functional analysis of energy balance in vertebrate animal models. Digestion, respiration, circulation, and excretion, across aquatic and terrestrial vertebrates. Homeostatic mechanisms of salt, water, and gas exchange. Ionotropic and metabotropic signal transduction. Hormonal and electrical cellular communication among muscles, glands, and neurons. Sensory systems, movement and reproduction. Physiological adaptations to extreme environments. When offered for 4 credits, the course includes one laboratory meeting per week.
Prerequisites: BIOS 121 and BIOS 122
Attribute/Distribution: NS

BIOS 351 (CHM 371) Elements of Biochemistry I 3 Credits
A general study of carbohydrates, proteins, lipids, nucleic acids and other biological substances and their importance in life processes. Protein and enzyme chemistry are emphasized. Must have completed one year of organic chemistry.
Prerequisites: CHM 112
Attribute/Distribution: NS

BIOS 352 (CHM 372) Elements of Biochemistry II 3 Credits
Dynamic aspects of biochemistry; enzyme reactions including energetics, kinetics and mechanisms; metabolism of carbohydrates, lipids, proteins and nucleic acids; photosynthesis, electron transport mechanisms, coupled reactions, phosphorylations, and the synthesis of biological macromolecules.
Prerequisites: (BIOS 371 or CHM 371) and (BIOS 041)
Attribute/Distribution: NS

BIOS 353 Sex Determination and Differentiation 3 Credits
An examination of the primary scientific literature on how sex is conferred to a zygote. Hormonal and non-hormonal mechanisms of sexual differentiation. Neural correlates of sex, gender, and sexual orientation.
Prerequisites: BIOS 367 or BIOS 382
Can be taken Concurrently: BIOS 382
Attribute/Distribution: NS

BIOS 354 Methods in Developmental Biology Lab 2 Credits
Detection of gene expression and protein expression in vivo or in vitro. Mutants and/or transgenics examined. Students address research questions of instructor.
Prerequisites: BIOS 115 and BIOS 116
Attribute/Distribution: NS

BIOS 355 Developmental Biology 3 Credits
Differentiation of multicellular organisms from a single cell. Axis determination; gradients; induction and pattern formation viewed through modern analysis of regulated gene expression. Lecture topics on organ formation paired with discussions on birth defects and human diseases.
Prerequisites: BIOS 115 and BIOS 116
Attribute/Distribution: NS

BIOS 356 Cell Biology Laboratory 3 Credits
Laboratory studies of the properties of chemicals of biological origin and the influence of chemical and physical factors on these properties. Laboratory techniques used for the isolation and identification of biochemicals.
Prerequisites: (BIOS 371 or CHM 371) and (BIOS 041)
Can be taken Concurrently: BIOS 371, CHM 371
Attribute/Distribution: ND

BIOS 357 (CHM 377) Biochemistry Laboratory 3 Credits
A laboratory course involving the preparation or isolation, purification and identification of chemicals of biological origin.
Prerequisites: (BIOS 377 or CHM 377) and (BIOS 372 or CHM 372)
Attribute/Distribution: ND
BIOS 380 (BIOE 380) Molecular and Cellular Biophysics 3-4 Credits
Physical principles of biomolecular and cellular organization. Biomedical interaction and recognition, molecular motors, physical organization and functioning of cellular membranes, electrical signaling in live cells. Modern techniques in biophysics: X-ray analysis, molecular spectroscopy, molecular modeling, fluorescence imaging, electrophysiology, electron microscopy.
Prerequisites: (BIOS 115) and (PHY 013 or PHY 021)

BIOS 381 Physical Biochemistry 3 Credits
Topics include: thermodynamics of biological systems; Forces acting on and between biological molecules: Principles of macromolecular structure; Physical methods used to characterize biomolecules; and other topics to be determined.
Prerequisites: (BIOS 371 or CHM 371) and (BIOS 041)
Attribute/Distribution: NS

BIOS 382 (PSYC 382) Endocrinology of Behavior 3 Credits
Hormonal effects upon animal and human behavior. Emphasis on neuroendocrinology of steroid hormone involvement in reproductive behaviors.
Prerequisites: BIOS 121
Attribute/Distribution: NS

BIOS 383 Biological Sciences Colloquia 1 Credit
Analysis of weekly colloquia in the biological sciences.
Repeat Status: Course may be repeated.
Prerequisites: BIOS 121
Attribute/Distribution: NS

BIOS 384 Eukaryotic Signal Transduction 3 Credits
Signal transduction between cells of multicellular eukaryotic organisms examined in the context of specialized functions that include: nutrition, hormones and neurotransmitters, vision, muscle contraction, adhesion, and the immune system. The evolution of cancer based on mutations in these signaling systems.
Prerequisites: BIOS 367 or BIOS 372 or CHM 372 or BIOS 382 or BIOS 365

BIOS 385 Synapses, Plasticity and Learning 3 Credits
Communication between neurons. Physiology of synaptic transmission; varying forms of neuronal plasticity; acquisition, encoding, and retrieval of memory.
Prerequisites: BIOS 276
Attribute/Distribution: NS

BIOS 386 Genes and the Brain 3 Credits
Modern molecular genetics techniques applied to complex brain processes. Emphasis on DNA and RNA manipulation strategies to elucidate mechanisms of complex behaviors. Animal models of learning, behavioral plasticity, and neuropsychiatric diseases.
Prerequisites: BIOS 276
Attribute/Distribution: NS

BIOS 387 Biological Sciences Honors Seminar 1 Credit
Development, presentation and implementation of research proposals, and discussions of research. Required for senior biology, molecular biology, biochemistry, and behavioral neuroscience majors pursuing departmental honors. Departmental permission required.
Attribute/Distribution: ND

BIOS 388 Biological Sciences Honors Seminar 1 Credit
Continuation and extension of BIOS 387. Departmental permission required.
Attribute/Distribution: ND

BIOS 389 Honors Project 1-6 Credits
Repeat Status: Course may be repeated.

BIOS 391 Undergraduate Research 1-3 Credits
Laboratory research under tutorial with a faculty member. Must have junior standing. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

BIOS 393 Thesis 3 Credits
Literature review and design of project in selected area, execution of the project, final report and presentation. Consent of department required. Intended for senior majors in BIOS only. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

BIOS 401 Professional Skills for Biological Sciences Graduate Students 3 Credits
Students learn expectations and fundamental skills related to success in the biological sciences. The course is designed to help students make the most out of their graduate education. Students learn the principles underlying fundable, publishable research, and how these general principles can be applied to their specific research area. They learn to write and review manuscripts and grant proposals by serving on a mock editorial board and scientific review panel. They gain experience in giving oral presentations. Readings are from texts on scientific writing and research styles, and from original journal articles and grant proposals written by the faculty. Required of all Integrative Biology graduate students.

BIOS 404 (PSYC 404) Behavioral Neuroscience 3 Credits
Theoretical and empirical issues in biopsychology. Must have graduate standing.

BIOS 405 Special Topics in Molecular Biology 1-3 Credits
Research, conferences, and reports on selected topics not covered in the general graduate offerings.
Repeat Status: Course may be repeated.

BIOS 406 Biological Sciences Seminar 1 Credit
An advanced seminar in current developments including departmental research. Required for candidates for graduate degrees in molecular biology.
Repeat Status: Course may be repeated.

BIOS 407 Research in Biological Science 1-9 Credits
Laboratory investigations in one of the department’s research areas.

BIOS 408 Responsible Conduct of Science 0 Credits
Responsible practice in research. Training in general laboratory methods; human subjects concerns; radiation safety; chemical hazards; aseptic technique; physical, mechanical, biological, and fire hazards; animal welfare. Occupational and workplace considerations. Recombinant DNA guidelines; patent and proprietary rights; controversies over applications of science. Appropriate aspects required of investigators in all departmental research projects.

BIOS 409 Evolutionary and Functional Morphology 3 Credits
Readings in the current literature, demonstrations and laboratory exercises exploring the applications of comparative methods to the analysis of evolutionary patterns at a range of morphological levels (molecular and macroscopic). Students will also learn experimental approaches to testing relationships between form and function in vertebrates. Emphasis will be on the musculoskeletal and nervous systems.

BIOS 410 Special Topics in Behavioral and Evolutionary Bioscience 1-3 Credits
Readings and discussions on selected topics not covered in the general graduate offerings.

BIOS 411 Advanced Cell Biology 3 Credits
Cell structure and biochemistry, as related to specialized cell functions.

BIOS 412 Metabolic Influences on Behavior 3 Credits
Sensory systems that detect metabolic energy availability and affect the behavior of humans and other animals: food intake and body weight regulation, sexual and parental behavior, aggression, learning, and body temperature regulation.

BIOS 414 Sexual Differentiation 3 Credits
Genetic and hormonal events mediating the development and expression of sexual dimorphisms in physiology and behavior. Current theoretical models; emphasis on biochemical, neuroanatomical and molecular biological considerations.
BIOS 415 Synapses, Plasticity and Learning 3 Credits
Communication between neurons. Physiology of synaptic transmission; varying forms of neuronal plasticity; acquisition, encoding and retrieval of memory.

BIOS 420 Pheromonal Communication 3 Credits
Mechanisms of pheromone synthesis, biochemistry, sensory transduction, neuroanatomy/neuroendocrinology, and adaptive significance.

BIOS 421 Molecular Cell Biology I 3 Credits
Molecular aspects of cell structure, cell motility, intracellular transport; and biomembrane dynamics.
Prerequisites: BIOS 411

BIOS 422 Molecular Cell Biology II 3 Credits
Molecular aspects of gene expression, including genome structure and replication, RNA synthesis/processing, and protein synthesis.
Prerequisites: BIOS 345

BIOS 423 Evolution of Development 3 Credits
This course examines how changes in the blueprint that describes the development of a multicellular animal from a single fertilized egg lead to the evolution of new species or new forms within a species.
Prerequisites: BIOS 317 or BIOS 376 or BIOS 327
Can be taken Concurrently: BIOS 317, BIOS 376, BIOS 327

BIOS 424 Advanced Neurobiology of Sensory Systems 3 Credits
This course is designed to provide an overview of core principles of neuroscience through exploration of sensory systems. The course will provide an intensive review of fundamental neural signaling followed by a broad introduction to the major sensory pathways. Focus will be on major organizing principles of neural systems, and information processing. Student discussions and presentations will incorporate current literature and concepts.

BIOS 426 Coevolution 3 Credits
Discussion-based seminar course covering readings from the primary literature. Course will examine evolutionary consequences of species interactions, interactions between the sexes, and genetic interactions. Topics will include predator-prey interactions, host-parasite interactions, sexual conflict, genomic conflict, mutualism, and more. Consequences of coevolution for biodiversity and human health will also be examined.

BIOS 427 Techniques in Cell and Molecular Biology 1-3 Credits
Laboratory experiences in three or more cell and molecular biological techniques: gel electrophoresis of nucleic acids/proteins; polymerase chain reaction; DNA/RNA sequencing; molecular hybridization techniques; fluorescence microscopy; confocal microscopy; flow cytometry; electron microscopy tissue preparation; immunological detection methods; molecular cloning techniques; oocyte microinjection techniques; tissue culture methods; and autoradiography.

BIOS 428 Molecular Evolution 3 Credits
Evolution at the level of individual genes, proteins, and genomes. Lectures and discussion of papers from the recent primary literature. Topics include pathways for adaptive evolution, directionality in evolution, epistasis, evolvability, genome rearrangements and speciation, gene duplication, and evolutionary dynamics. Examples of molecular evolution in nature, laboratory model systems, and human pathogens.
Prerequisites: BIOS 317 or BIOS 345
Can be taken Concurrently: BIOS 317, BIOS 345

BIOS 429 Advances in Herpetology 3 Credits
Lectures and readings from the primary literature on current research in amphibian and reptilian biology. Two lectures, one discussion session and one laboratory or field trip. Not open to students who have received credit for BIOS 329.

BIOS 431 Advanced Topics in Cell Biology 3 Credits
Current research problems in cell biology.
Repeat Status: Course may be repeated.
Prerequisites: BIOS 367 or BIOS 367 or BIOS 411

BIOS 432 Advanced Topics in Molecular Genetics 3 Credits
Current research in molecular genetics.
Repeat Status: Course may be repeated.

BIOS 433 Advanced Topics in Developmental Biology 3 Credits
Current research problems in developmental biology.
Repeat Status: Course may be repeated.
Prerequisites: BIOS 345 or BIOS 345

BIOS 434 Speciation 3 Credits
Discussion-based seminar course covering readings from classical and current literature, including both theoretical and empirical contributions. Topics will include species concepts, reproductive isolation, mechanisms and modes of speciation, and current approaches to studying speciation.

BIOS 435 Epigenetics 3 Credits
Foundational concepts in environmental epigenetics. Course will be centered around presentations and discussions of studies that address current issues, such as the mechanisms behind heritable health effects of acute malnourishment in human populations across multiple generations, or the potential for extremely fast evolutionary adaptation in species threatened by environmental change.

BIOS 437 (CHM 437) Pathophysiological Chemistry 3 Credits
Biochemical basis of human diseases involving abnormal metabolism of proteins, nucleic acids, carbohydrates, and lipids. Emphasis on the correlation of the clinical presentation of disease processes seen as physiological dysfunctions with clinical laboratory methods. Lectures, student presentations, and clinical case discussions. Consent of department required.

BIOS 438 Neurodegenerative Diseases in Model Organisms 3 Credits
Discussion-based seminar course on the use of model systems to investigate neurodegenerative diseases. The primary focus will be on invertebrate model systems, including Drosophila. Critical reading of primary scientific literature and student discussion is required.
Prerequisites: BIOS 115

BIOS 439 Advanced Behavioral Ecology 3 Credits
Critical evaluation of the theoretical foundation in sociobiology. Emphasis placed on kinship, altruism, mate choice, parental investment, parent-offspring conflict, etc. Lectures and seminars. Not open to students who have taken BIOS 337.
Prerequisites: BIOS 317 or BIOS 317

BIOS 442 Cellular Basis of Human Disease 3 Credits
Cell and molecular biological advanced topics relevant to human disease and/or health. Critical reading of the primary literature, discussion and student discussion required.
Prerequisites: BIOS 367 or BIOS 411

BIOS 445 Systematics and Evolution 3 Credits
Theoretical, philosophical and methodological foundations of the classification of eukaryotic organisms and the manner in which systematic theory and method relate to evolutionary theory. Two lectures and one lab/recitation/discussion session.

BIOS 450 Developmental Neurobiology 3 Credits
Fundamental mechanisms underlying neural development. Early events leading to the induction of the neuroectoderm and the reorganization of the vertebrate central nervous system during adulthood and aging. Major developmental events such as phenotype commitment, cell migration, differentiation and growth cone guidance. Emphasis on the interplay between concepts emerging from organismal and molecular levels of analyses.

BIOS 453 General Neuroanatomy 3 Credits
Graduate level study of the neuroanatomy and neurochemistry of systems that underlie behavior in vertebrates. Emphasis will be on the traditional and novel methodologies used to reveal neuroanatomical pathways as well as the function of these pathways. Consent of department required.

BIOS 457 Advanced Behavioral Neuroendocrinology 3 Credits
A seminar course that covers current primary literature on the hormone-nervous system interactions that underlie physiology and behavior. The course covers the neuroendocrinology of reproduction, sex behavior, parental behavior, social behavior, agonistic and territorial behavior, learning and memory, homeostasis (caloric, nutritional, water and salt balance, temperature regulation), circadian rhythms and seasonality in a variety of vertebrates.
BIOS 464 Molecular Biology of Eukaryotic Organisms 3 Credits
Comparative analysis of several eukaryotes as model systems in cell biology, developmental biology, genetics, and molecular biology.

BIOS 466 Structure and Function of RNAs and Ribonucleoprotein Complexes 3 Credits
Biochemistry and function of small nuclear RNPs, RNAse P, ribosomes, self-splicing introns, signal recognition particle, RNA viruses. Functions of RNA in DNA replication, in regulation, as an enzyme, and as a repressor.

BIOS 467 (CHM 467) Principles of Nucleic Acid Structure 3 Credits
An examination of the principles underlying nucleic acid structure including stereochemistry, electrostatics, hydration, torsional constraints, sequence specific effects, and interaction with nucleic proteins. Special emphasis will be placed on DNA structure. Must have completed one year of biochemistry and one year of physical chemistry or consent of department required.

BIOS 468 (CHM 468) Principles of Protein Structure 3 Credits
An examination of the principles underlying protein structure including stereochemistry, preferred tertiary structures, protein homology, excluded volume effects, time dependent structural fluctuations, and prediction of protein structure from sequence information. Must have completed one year of biochemistry and one year of physical chemistry or consent of department required.

BIOS 469 (CHM 469) Biochemical Problem Solving I 1 Credit
Applications of material covered in BIOS 371 or CHM 371 including techniques used in research.

BIOS 470 (CHM 470) Biochemical Problem Solving II 1 Credit
Applications of concepts covered in BIOS 372 or CHM 372 including techniques used in research.

BIOS 471 Eukaryotic Signal Transduction 3 Credits
Signal transduction between and within cells of multicellular organisms examined in the context of specialized functions that include intracellular hormones and neurotransmitters, vision, muscle contraction, adhesion and the immune system. The evolution of cancer based on mutations in these signaling systems. Lecture, discussion, and student presentations.

Prerequisites: (BIOS 372 or CHM 372 or BIOS 411)

BIOS 472 (CHM 472) Lipids and Membranes 3 Credits
The study of lipids and lipid membranes similar to those found in mammalian cells including methods of synthesis, surface activity, bilayer and micellar structures, lipid mixing, fluidity, permeability and membrane stability. Special emphasis will be given to the current evidence for and against the lipid raft hypothesis.

Prerequisites: BIOS 372 or CHM 372

BIOS 473 (CHM 473) Principles of Biochemistry I 3 Credits
Study of proteins, carbohydrates, lipids, nucleic acids and other biological substances. Protein and enzyme chemistry are emphasized. Must have completed one year each of general chemistry and organic chemistry.

BIOS 477 (CHM 477) Topics in Biochemistry 1-3 Credits
Selected areas of biochemistry, such as mechanisms of enzyme action, new developments in the chemistry of lipids, nucleic acids, carbohydrates and proteins.

Repeat Status: Course may be repeated.

BIOS 479 (CHM 479) Biochemical Techniques 3 Credits
Laboratory studies of the techniques and principles involved in the isolation, identification, and biochemical transformation of carbohydrates, lipids, nucleic acids and proteins.

Prerequisites: (BIOS 371)
Can be taken Concurrently: BIOS 371

BIOS 480 (CHM 480) Advanced Biochemical Preparations 1-3 Credits
An advanced laboratory course in the preparation, isolation, purification, and identification of biochemically produced materials. Emphasis is placed on materials and procedures of current interest in biochemistry. Consent of department required.

BIOS 483 Special Topics in Behavioral Neuroscience 3 Credits
Examination of the biological substrates of behavior. Topics may include animal communication, sociobiology, behavioral endocrinology, or behavior genetics.

Repeat Status: Course may be repeated.

BIOS 486 Genes and the Brain 3 Credits
Modern molecular genetics techniques applied to complex brain processes. Emphasis on DNA and RNA manipulation strategies to elucidate mechanisms of complex behaviors. Animal models of learning, behavioral plasticity, and neuropsychiatric diseases.

Attribute/Distribution: NS

BIOS 488 Seminar in Neuroscience, Behavior, and Evolution 1 Credit
Advanced seminar in current research developments.

BIOS 490 Thesis 1-6 Credits
Repeat Status: Course may be repeated.

BIOS 499 Dissertation 1-15 Credits

Biology

Biology, life science, and related courses at Lehigh University are offered in a variety of settings that reflect the various levels of organization in life science and different orientations relating to areas of application. The College of Arts and Sciences offers degree programs in Behavioral Neuroscience, Biochemistry, Biology, Earth and Environmental Science, and Molecular Biology. The P. C. Rossin College of Engineering and Applied Science offers a degree program in Bioengineering. Refer to the catalog entries below for complete descriptions.

Major and Minor Programs

<table>
<thead>
<tr>
<th>Courses</th>
<th>Catalog Entry</th>
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<tbody>
<tr>
<td>Behavioral Neuroscience (BA or BS)</td>
<td>Biological Sciences</td>
</tr>
<tr>
<td>Biochemistry</td>
<td>Biochemistry (BS only)</td>
</tr>
<tr>
<td>Bioengineering</td>
<td>Bioengineering</td>
</tr>
<tr>
<td>Biology (BA or BS)</td>
<td>Biological Sciences</td>
</tr>
<tr>
<td>Earth and Environmental Science</td>
<td>Earth and Environmental Sciences</td>
</tr>
<tr>
<td>Molecular Biology (BA or BS)</td>
<td>Biological Sciences</td>
</tr>
</tbody>
</table>

Courses related to life science interest can be found under the catalog entries above as well as in other departments, including Chemical Engineering, Chemistry, Mathematics, Physics, Psychology, and Sociology and Anthropology.

Professors.

- Michael J. Behe, PHD (University of Pennsylvania); R. Michael Burger, PHD (University of Texas at Austin); Lynne U. Cassimeris, PHD (University of North Carolina at Chapel Hill); David L. Cundall, PHD (University of Arkansas); Maria Joanne Donoghue Velleca; Matthias M. Falk, PHD (University of Heidelberg); Wonpil Im, PHD (Cornell University); M. Kathryn Iovine, PHD (Washington University); Murray Itzkowitz, PHD (University of Maryland); Linda J. Lowe-Krentz, PHD (Northwestern University); Jill E. Schneider, PHD (Wesleyan University); Neal G. Simon, PHD (Rutgers University); Robert V. Skibbens, PHD (University of North Carolina Chapel Hill); Jennifer Swann, PHD (Northwestern University); Vassie C. Ware, PHD (Yale University)

Associate Professors.

- Julie Haas, PHD (Boston University); Michael R. Kuchka, PHD (Carnegie Mellon University); Gregory I. Lang, PHD (Harvard University); Julie M. Miwa, PHD (Rockefeller University); Amber M. Rice, PHD (University of North Carolina at Chapel Hill)

Assistant Professors.

- Daniel Babcock, PHD (University Texas Houston); Michael J. Layden, PHD (University of Oregon); David C. Zappulla, PHD (State University of NY at Stony Brook)

Professors Of Practice.

- Ann E. Fink, PHD (University of Southern California); Santiago Herrera, PHD (Massachusetts Institute of Technology); Katie M. Hoffman, PHD (University of Montana)

Emeriti.

- Steven Krawiec, PHD (Yale University); John G. Nyby, PHD (University of Texas at Austin); Hayden N. Pritchard, PHD (Lehigh University); Jeffrey A. Sands, PHD (The Pennsylvania State University)
Chemistry

Chemistry is a versatile subject area and the pursuit of a career in chemistry can be a most intellectually satisfying experience. No other basic science touches and shapes as many aspects of modern society as does chemistry. The study of chemistry has provided solutions to complex problems and has improved the quality of all phases of human life from soft contact lenses and synthetic blood to longer-lasting paint and alternative fuels. A particular strength of this department is in surface and interface chemistry, which bridges many areas of modern science and technology.

Chemists at all levels of education find a market for their skills and knowledge in many employment areas. Chemists provide the technical backbone for the manufacturing industries (pharmaceuticals, plastics, paper, semiconductor electronics technology, and agriculture), for service industries (clinical and forensic laboratories, academe, environmental protection, and information science) and for governmental positions in regulatory agencies and in science policy analyses. Many chemists are employed in nontraditional areas, such as patent law, insurance underwriting, sales, product management, journalism, and even banking.

The alluring challenge of chemistry inspires many bachelor degree recipients to study for advanced degrees within the discipline of chemistry and in other areas, as well. Chemistry or biochemistry is the strongest preparation for graduate studies or for professional school in the health-related disciplines (medicine, pharmacology, and biochemistry), and for other science programs (materials science, polymers, biotechnology, environmental studies, and mineralogy).

The study of chemistry opens doors to satisfying careers, to a stimulating view of the world, and to a professional life in which one’s natural tendency to ask “Why?” can lead to personally rewarding endeavors. The undergraduate curriculum in chemistry contains many of the prerequisites for biology, earth and environmental sciences, materials science, molecular biology, physics, and chemical engineering. This allows students to transfer credits among these majors through the sophomore year.

Chemistry students have the opportunity to design their undergraduate curricula for specialization in a variety of fields through the ChemFlex curriculum.

THE CHEMFLEX CURRICULUM

The Department of Chemistry offers degrees in both the College of Arts and Sciences and the College of Engineering and Applied Sciences. Students in the College of Arts and Sciences have three options: the B. S. in Chemistry, the B. A. in Chemistry, and the B. S. in Pharmaceutical Chemistry. In addition we offer an interdepartmental B. S. in Biochemistry in collaboration with the Department of Biological Sciences. For students in the College of Engineering and Applied Sciences we offer the B. S. in Chemistry.

In the College of Arts and Sciences, the traditional degree certified by the American Chemical Society is offered; the B. S. degree in the College of Engineering is the ACS certified degree and is identical in terms of degree program requirements. All B. S. programs have a Common Chemistry Core and similar collateral science requirements. These programs are pre-professional in nature, and students planning to attend graduate school in chemistry or an allied science should elect the B. S. program in the college to which they have been admitted. The traditional B. A. Program in the College of Arts and Sciences is not a pre-professional program and may be elected by students who do not plan to do graduate work in chemistry or allied sciences but who desire a stronger background in chemistry than is provided by a chemistry minor.

In addition to the traditional certified B. S degree and B. A. degree, the B. A. and B. S. Chemistry programs in the College of Arts and Sciences feature an alternative flexible curriculum, called ChemFlex, which enables a student to concentrate in a specific area. The concentrations possible for the B. S. are Physical/Analytical, Polymers, and Materials. The B. A. has two areas of concentration: Business and the Health Professions. All concentrations in ChemFlex share a Common Chemistry Core; all students complete the core and then follow one of two paths for collateral courses (Path A or Path B for math, physics, and programming) as outlined in the following lists.

Students may transfer from a B. S. program to a B. A. program easily, but the reverse is more difficult. Students in a B. A. program who make the decision to attend graduate school in chemistry or allied sciences can achieve a minimum preparation for this transition by electing 307 Advanced Inorganic Chemistry.

DEPARTMENT MODERN LANGUAGE AND LITERATURE REQUIREMENT

The modern foreign language requirement is met by one of three options:

1. Completion of the second semester of a modern foreign language;
2. Certification of language equivalent to this level taken in high school;
3. Substitution of six credits of science electives. If science electives are chosen, the non-science distribution requirement must still be met.

Professors. Gregory S. Ferguson, PHD (Cornell University); Robert A. Flowers, II, PHD (Lehigh University); Kai Manfred Martin Landskron, PHD (University of Munich); Steven L. Regen, PHD (Massachusetts Institute of Technology); John D. Simon, PHD (Harvard University); David A. Vici, PHD (University of Rochester)

Associate Professors. Kerney Jubbrel Glover, PHD (University of California, San Diego); Marcos Pires, PHD (Purdue University); James E. Roberts, PHD (Northwestern University); Damien ThZvenin, PHD (University of Delaware); Dmitri Veenenov, PHD (Harvard University)

Assistant Professors. Mark S. Chen, PHD (Harvard University); Oriana S. Fisher, PHD (Yale University); Lisa A. Fredin, PHD (Northwestern University); Nathan Wittenberg, PHD (The Pennsylvania State University); Xiaoji Xu, PHD (University of British Columbia); Elizabeth Young, PHD (Massachusetts Institute of Technology)

Professors Of Practice. Andy W. Ho, PHD (Harvard University); Yang Yang, PHD (University of Wisconsin)

Emeriti. Jack A. Alhadef, PHD (Oregon Health Science University); Natalie M. Foster, PHD (Lehigh University); Ned D. Heindel, PHD (University of Delaware); Kamil Klier, PHD (Academy of Sciences of the Czech Republic); John W. Larsen, PHD (Purdue University Calumet); Joseph R. Merkel, PHD (University of Maryland, College Park); Fortunato J. Micate, PHD (Lehigh University); Keith J. Schray, PHD (The Pennsylvania State University); Gary W. Simmons, PHD (University of Virginia); James E. Sturm, PHD (University of Notre Dame); Daniel Zeroka, PHD (University of Pennsylvania)

DEGREES IN THE COLLEGE OF ARTS AND SCIENCES

In the College of Arts and Sciences the Chemistry Department offers three degrees: a B.S. in Chemistry, a B.A. in Chemistry and a B.S. in Pharmaceutical Chemistry with an interdepartmental B.S. in Biochemistry degree with the Department of Biological Sciences. The ChemFlex Curriculum allows the flexibility for a student to develop a concentration in a specific area if he/she wishes to do so. The specific concentrations are noted in the following Table.

<table>
<thead>
<tr>
<th>Table: ChemFlex Curriculum Overview</th>
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<tbody>
<tr>
<td><strong>Specialization Requirements</strong></td>
</tr>
<tr>
<td>B.S. Chemistry (ACS)</td>
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<tr>
<td>B.S. Chemistry Analytical/Physical</td>
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<tr>
<td>B.S. Chemistry Polymers</td>
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<tr>
<td>B.S. Chemistry Materials</td>
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<tr>
<td>B.A. Chemistry</td>
</tr>
<tr>
<td>B.A. Chemistry Business</td>
</tr>
<tr>
<td>B.A. Chemistry Health Professions</td>
</tr>
<tr>
<td>B.S. Pharmaceutical Chemistry</td>
</tr>
<tr>
<td>B.S. Biochemistry (interdepartmental degree)</td>
</tr>
<tr>
<td>1. Common Chemistry Core</td>
</tr>
<tr>
<td>2. Courses required for specific concentration</td>
</tr>
<tr>
<td>3. Path A (see below)</td>
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<tr>
<td>4. Path B (see below)</td>
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</tbody>
</table>

With regard to the B.S. in Pharmaceutical Chemistry, the pharmaceutical industry is focused on exploring the biochemistry of disease and
designing or finding drugs to cure or ameliorate disease. Biochemists, organic chemists, biologists, and chemical engineers collaborate to achieve this end. The majority of chemists hired today go into the pharmaceutical industry. The B.S. in Pharmaceutical Chemistry is a chemistry degree option which focuses on core chemistry, biochemistry, and molecular biology to prepare students for careers in this field. Since it is a highly interdisciplinary field it requires the breadth of knowledge offered by this degree program.

Freshman chemistry courses
Common Chemistry Core

Select one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CHM 040 &amp; CHM 041</td>
<td>8</td>
</tr>
<tr>
<td>Honors General Chemistry I and Honors General Chemistry II</td>
<td></td>
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<tr>
<td>or</td>
<td></td>
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<tr>
<td>CHM 030 &amp; CHM 031</td>
<td></td>
</tr>
<tr>
<td>Introduction to Chemical Principles and Chemical Equilibria in Aqueous Systems</td>
<td></td>
</tr>
<tr>
<td>CHM 110 &amp; CHM 111</td>
<td>4</td>
</tr>
<tr>
<td>Organic Chemistry I and Organic Chemistry Laboratory I</td>
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<tr>
<td>CHM 112 &amp; CHM 113</td>
<td>4</td>
</tr>
<tr>
<td>Organic Chemistry II and Organic Chemistry Laboratory II</td>
<td></td>
</tr>
<tr>
<td>CHM 332</td>
<td>3</td>
</tr>
<tr>
<td>Analytical Chemistry</td>
<td></td>
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<tr>
<td>Concentrations (see below)</td>
<td>3-8</td>
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<tr>
<td>CHM 307</td>
<td>3</td>
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<tr>
<td>Advanced Inorganic Chemistry</td>
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<tr>
<td>CHM 351</td>
<td>2</td>
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<tr>
<td>Professional Development Seminar</td>
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</tr>
</tbody>
</table>

Total Credits: 27-32

Collateral requirements

Path A

MATH 021 Calculus I 4
MATH 022 Calculus II 4
MATH 023 Calculus III 4
MATH 205 Linear Methods 3
PHY 011 Introductory Physics I 5
& PHY 012 and Introductory Physics Laboratory I 5
PHY 021 Introductory Physics II 5
& PHY 022 and Introductory Physics Laboratory II 5
ENGR 010 Applied Engineering Computer Methods 2

or CSE 002 Fundamentals of Programming

Total Credits: 27

Path B

MATH 051 Survey of Calculus I 4
MATH 052 Survey of Calculus II 3
MATH 043 Survey of Linear Algebra 3
PHY 010 General Physics I 5
& PHY 012 and Introductory Physics Laboratory I 5
PHY 013 General Physics II 4
& PHY 022 and Introductory Physics Laboratory II 4

Total Credits: 19

SPECIALIZATIONS

B.S. Chemistry (ACS certified Degree)

Common Core

Select one of the following:

<table>
<thead>
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<td>CHM 040 &amp; CHM 041</td>
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</tr>
<tr>
<td>Honors General Chemistry I and Honors General Chemistry II</td>
<td></td>
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<tr>
<td>CHM 030 &amp; CHM 031</td>
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<tr>
<td>Organic Chemistry I and Organic Chemistry Laboratory I</td>
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<td>CHM 112 &amp; CHM 113</td>
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<tr>
<td>CHM 332</td>
<td>3</td>
</tr>
<tr>
<td>Analytical Chemistry</td>
<td></td>
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</tbody>
</table>

Collateral Requirement - Path A

MATH 021 Calculus I 4
MATH 022 Calculus II 4
MATH 023 Calculus III 4
MATH 205 Linear Methods 3
PHY 011 Introductory Physics I 5
& PHY 012 and Introductory Physics Laboratory I 5
PHY 021 Introductory Physics II 5
& PHY 022 and Introductory Physics Laboratory II 5
ENGR 010 Applied Engineering Computer Methods 2

or CSE 002 Fundamentals of Programming

Specialization Courses

CHM 334 Advanced Chemistry Laboratory I 3
CHM 335 Advanced Chemistry Laboratory II 3
CHM 341 Molecular Structure, Bonding and Dynamics 3
CHM 342 Thermodynamics & Kinetics 3
CHM 343 Physical Chemistry Laboratory 2
CHM 371 Elements of Biochemistry I 3
CHM 375 Research Chemistry Laboratory 2

Advanced Chemistry Elective Requirement

Select one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CHM 305</td>
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<tr>
<td>Organometallic Chemistry</td>
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<tr>
<td>CHM 323</td>
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<tr>
<td>Chemical Biology</td>
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<tr>
<td>CHM 336</td>
<td></td>
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<tr>
<td>Clinical Chemistry</td>
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<td>CHM 337</td>
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<tr>
<td>Crystallography and Diffraction</td>
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<tr>
<td>CHM 340</td>
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<tr>
<td>Solid-State Chemistry</td>
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<tr>
<td>CHM 350</td>
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<tr>
<td>Special Topics</td>
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<td>CHM 356</td>
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<td>Physical Polymer Science</td>
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<td>CHM 394</td>
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<td>Organic Polymer Science I</td>
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<td>PHY 363</td>
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<td>Physics of Solids</td>
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Total Credits: 73

B.S. Chemistry- Analytical/Physical Concentration

Common Core

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<td>CHM 332</td>
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CHM 307 Advanced Inorganic Chemistry 3
CHM 351 Professional Development Seminar 2
B.S. Chemistry- Polymers Concentration

**Common Core**

Select one of the following: 8

- CHM 040 & CHM 041: Honors General Chemistry I and Honors General Chemistry II
- CHM 030 & CHM 031: Introduction to Chemical Principles and Chemical Equilibria in Aqueous Systems

**Collateral Requirement- Path A**

MATH 021: Calculus I 4
MATH 022: Calculus II 4
MATH 023: Calculus III 4
MATH 205: Linear Methods 3
PHY 011 & PHY 012: Introductory Physics I and Introductory Physics Laboratory I 5
PHY 021 & PHY 022: Introductory Physics II and Introductory Physics Laboratory II 5
ENGR 010: Applied Engineering Computer Methods 2
or CSE 002: Fundamentals of Programming

**Specialization Courses**

CHM 334: Advanced Chemistry Laboratory I 3
CHM 335: Advanced Chemistry Laboratory II 3
CHM 341: Molecular Structure, Bonding and Dynamics 3
CHM 342: Thermodynamics & Kinetics 3
CHM 343: Physical Chemistry Laboratory 2

Total Credits 65

B.S. Chemistry- Materials Concentration

**Common Core**

Select one of the following: 8

- CHM 040 & CHM 041: Honors General Chemistry I and Honors General Chemistry II
- CHM 030 & CHM 031: Introduction to Chemical Principles and Chemical Equilibria in Aqueous Systems

**Collateral Requirement- Path A**

MATH 021: Calculus I 4
MATH 022: Calculus II 4
MATH 023: Calculus III 4
MATH 205: Linear Methods 3
PHY 011 & PHY 012: Introductory Physics I and Introductory Physics Laboratory I 5
PHY 021 & PHY 022: Introductory Physics II and Introductory Physics Laboratory II 5
ENGR 010: Applied Engineering Computer Methods 2
or CSE 002: Fundamentals of Programming

**Specialization Courses**

CHM 334: Advanced Chemistry Laboratory I 3
CHM 335: Advanced Chemistry Laboratory II 3
CHM 341: Molecular Structure, Bonding and Dynamics 3
CHM 342: Thermodynamics & Kinetics 3
CHM 343: Physical Chemistry Laboratory 2
MAT 033: Engineering Materials and Processes 3

Total Credits 68

B.A. Chemistry

**Common Core**

Select one of the following: 8

- CHM 040 & CHM 041: Honors General Chemistry I and Honors General Chemistry II
- CHM 030 & CHM 031: Introduction to Chemical Principles and Chemical Equilibria in Aqueous Systems

**Collateral Requirement- Path A**

MATH 021: Calculus I 4
MATH 022: Calculus II 4
MATH 023: Calculus III 4
MATH 205: Linear Methods 3
PHY 011 & PHY 012: Introductory Physics I and Introductory Physics Laboratory I 5
PHY 021 & PHY 022: Introductory Physics II and Introductory Physics Laboratory II 5
ENGR 010: Applied Engineering Computer Methods 2
or CSE 002: Fundamentals of Programming

**Specialization Courses**

CHM 341: Molecular Structure, Bonding and Dynamics 3
CHM 342: Thermodynamics & Kinetics 3
CHM 343: Physical Chemistry Laboratory 2
CHM 388: Polymer Synthesis and Characterization Laboratory 3
CHM 393: Physical Polymer Science 3
CHM 394: Organic Polymer Science I 3

Total Credits 68
ENGR 010  Applied Engineering Computer Methods
or CSE 002  Fundamentals of Programming

Path B
MATH 051  Survey of Calculus I
MATH 052  Survey of Calculus II
MATH 043  Survey of Linear Algebra
PHY 010  General Physics I
& PHY 012  and Introductory Physics Laboratory I
PHY 013  General Physics II
& PHY 022  and Introductory Physics Laboratory II

Specialization Courses
CHM 343  Physical Chemistry Laboratory
Select one of the following: 3
CHM 341  Molecular Structure, Bonding and Dynamics
CHM 342  Thermodynamics & Kinetics
CHM 194  Physical Chemistry for Biological Sciences

Advanced CHM elective (300 Level) 3
Select one of the following:
CHM 305  Organometallic Chemistry
CHM 323  Chemical Biology
CHM 334  Advanced Chemistry Laboratory I
CHM 335  Advanced Chemistry Laboratory II
CHM 336  Clinical Chemistry
CHM 337  Crystallography and Diffraction
CHM 340  Solid-State Chemistry
CHM 350  Special Topics
CHM 356  Spectral Analysis
CHM 357  Organic Reaction Mechanisms
CHM 358  Advanced Organic Chemistry
CHM 362  Molecular Biophysics
CHM 365  Protein Separation & Biophysical Analysis
CHM 371  Elements of Biochemistry I
CHM 372  Elements of Biochemistry II
CHM 373  Lipids and Membranes
CHM 375  Research Chemistry Laboratory
CHM 376  Advanced Research Chemistry Laboratory
CHM 377  Biochemistry Laboratory
CHM 388  Polymer Synthesis and Characterization Laboratory
CHM 391  Colloid and Surface Chemistry
CHE 392  Introduction to Polymer Science
CHM 393  Physical Polymer Science
CHM 394  Organic Polymer Science I

Total Credits 51-59

1 MATH 021 may substitute for MATH 051
2 MATH 022 may substitute for MATH 052
3 MATH 023 may substitute for MATH 043
4 PHY 011 may substitute for PHY 010
5 PHY 021 may substitute for PHY 013

B.A. Chemistry - Business Concentration

Common Core
Select one of the following: 8
CHM 040  Honors General Chemistry I
& CHM 041  and Honors General Chemistry II
CHM 030  Introduction to Chemical Principles and Chemical Equilibria in Aqueous Systems

CHM 110  Organic Chemistry I
& CHM 111  and Organic Chemistry Laboratory I
CHM 112  Organic Chemistry II
& CHM 113  and Organic Chemistry Laboratory II
CHM 332  Analytical Chemistry
CHM 307  Advanced Inorganic Chemistry
CHM 351  Professional Development Seminar

Collateral Requirement
Select Path A or Path B 19-27

Path A
MATH 021  Calculus I
MATH 022  Calculus II
MATH 023  Calculus III
MATH 205  Linear Methods
PHY 011  Introductory Physics I
& PHY 012  and Introductory Physics Laboratory I
PHY 021  Introductory Physics II
& PHY 022  and Introductory Physics Laboratory II
ENGR 010  Applied Engineering Computer Methods
or CSE 002  Fundamentals of Programming

Path B
MATH 051  Survey of Calculus I
MATH 052  Survey of Calculus II
MATH 043  Survey of Linear Algebra
PHY 010  General Physics I
& PHY 012  and Introductory Physics Laboratory I
PHY 013  General Physics II
& PHY 022  and Introductory Physics Laboratory II

Specialization Courses
CHM 343  Physical Chemistry Laboratory
Select one of the following: 3
CHM 194  Physical Chemistry for Biological Sciences
CHM 341  Molecular Structure, Bonding and Dynamics
CHM 342  Thermodynamics & Kinetics

Advanced CHM elective (300 Level) 3
Select one of the following:
CHM 305  Organometallic Chemistry
CHM 323  Chemical Biology
CHM 334  Advanced Chemistry Laboratory I
CHM 335  Advanced Chemistry Laboratory II
CHM 336  Clinical Chemistry
CHM 337  Crystallography and Diffraction
CHM 340  Solid-State Chemistry
CHM 350  Special Topics
CHM 356  Spectral Analysis
CHM 357  Organic Reaction Mechanisms
CHM 358  Advanced Organic Chemistry
CHM 362  Molecular Biophysics
CHM 365  Protein Separation & Biophysical Analysis
CHM 371  Elements of Biochemistry I
CHM 372  Elements of Biochemistry II
CHM 373  Lipids and Membranes
CHM 375  Research Chemistry Laboratory
CHM 376  Advanced Research Chemistry Laboratory
CHM 377  Biochemistry Laboratory
CHM 388  Polymer Synthesis and Characterization Laboratory

1 MATH 021 may substitute for MATH 051
2 MATH 022 may substitute for MATH 052
3 MATH 205 may substitute for MATH 043
4 PHY 011 may substitute for PHY 010
5 PHY 021 may substitute for PHY 013
CHM 391 Colloid and Surface Chemistry
CHE 392 Introduction to Polymer Science
CHM 393 Physical Polymer Science
CHM 394 Organic Polymer Science I
ECO 001 Principles of Economics
BUS 125 Behavioral Skills Workshop
BUS 126 Developing, Producing, and Marketing Products and Services I
BUS 127 Developing, Producing, and Marketing Products and Services II
BUS 225 Information Analysis and Financial Decision Making I
BUS 226 Information Analysis and Financial Decision Making II
BUS 326 Business Strategy
MATH 012 Basic Statistics

Total Credits: 73-81

1. MATH 021 may substitute for MATH 051
2. MATH 022 may substitute for MATH 052
3. MATH 205 may substitute for MATH 043
4. PHY 011 may substitute for PHY 010
5. PHY 021 may substitute for PHY 013
6. MATH 012 may be substituted by any statistics course

B.A. Chemistry - Health Professions Concentration

Common Core

Select one of the following: 8

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<td>Advanced Inorganic Chemistry</td>
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<td>CHM 351</td>
<td>Professional Development Seminar</td>
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Collateral Requirement

Select Path A or Path B 19-27

Path A

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<tr>
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<tbody>
<tr>
<td>MATH 021</td>
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<td>MATH 205</td>
<td>Linear Methods</td>
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<td>Introductory Physics I and Introductory Physics Laboratory I</td>
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Path B

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<td>PHY 010 &amp; PHY 012</td>
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Specialization Courses

CHM 343 Physical Chemistry Laboratory

Select one of the following: 3

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<td>Physical Chemistry for Biological Sciences</td>
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<tr>
<td>CHM 341</td>
<td>Molecular Structure, Bonding and Dynamics</td>
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<tr>
<td>CHM 342</td>
<td>Thermodynamics &amp; Kinetics</td>
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Advanced CHM elective (300 Level) 3

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<td>Organometallic Chemistry</td>
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<td>Chemical Biology</td>
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<td>CHM 337</td>
<td>Crystallography and Diffraction</td>
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<td>CHM 350</td>
<td>Special Topics</td>
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<td>Elements of Biochemistry I</td>
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<tr>
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Additional courses in BioS are recommended.

Total Credits: 63-71

1. MATH 021 may substitute for MATH 051
2. MATH 022 may substitute for MATH 052
3. MATH 205 may substitute for MATH 043
4. PHY 011 may substitute for PHY 010
5. PHY 021 may substitute for PHY 013
6. MATH 012 may be substituted by any statistics course

B.S. Pharmaceutical Chemistry

Common Core

Select one of the following: 8

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Collateral Requirement

Select Path A or Path B 19-27

Path A

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Path B

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Specialization Courses

CHM 343 Physical Chemistry Laboratory

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Advanced CHM elective (300 Level) 3

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Total Credits: 63-71

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5. PHY 021 may substitute for PHY 013
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<td>PHY 021</td>
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<td>or CSE 002</td>
<td>Fundamentals of Programming</td>
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**Path B**

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<td>PHY 013</td>
<td>General Physics II</td>
<td></td>
</tr>
<tr>
<td>&amp; PHY 022</td>
<td>and Introductory Physics Laboratory II</td>
<td></td>
</tr>
</tbody>
</table>

**Specialization Courses**

Select one of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM 194</td>
<td>Physical Chemistry for Biological Sciences</td>
<td>3</td>
</tr>
<tr>
<td>CHM 341</td>
<td>Molecular Structure, Bonding and Dynamics</td>
<td></td>
</tr>
<tr>
<td>CHM 342</td>
<td>Thermodynamics &amp; Kinetics</td>
<td></td>
</tr>
<tr>
<td>CHM 358</td>
<td>Advanced Organic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHM 371</td>
<td>Elements of Biochemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHM 372</td>
<td>Elements of Biochemistry II</td>
<td>3</td>
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</table>

**Advanced CHM Elective (300 Level)**

Select one of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CHM 305</td>
<td>Organometallic Chemistry</td>
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<tr>
<td>CHM 334</td>
<td>Advanced Chemistry Laboratory I</td>
<td></td>
</tr>
<tr>
<td>CHM 335</td>
<td>Advanced Chemistry Laboratory II</td>
<td></td>
</tr>
<tr>
<td>CHM 354</td>
<td>Spectral Analysis</td>
<td></td>
</tr>
<tr>
<td>CHM 357</td>
<td>Organic Reaction Mechanisms</td>
<td></td>
</tr>
<tr>
<td>CHM 362</td>
<td>Molecular Biophysics</td>
<td></td>
</tr>
<tr>
<td>CHM 365</td>
<td>Protein Separation &amp; Biophysical Analysis</td>
<td></td>
</tr>
<tr>
<td>CHM 336</td>
<td>Clinical Chemistry</td>
<td></td>
</tr>
<tr>
<td>CHM 337</td>
<td>Crystallography and Diffraction</td>
<td></td>
</tr>
<tr>
<td>CHM 335</td>
<td>Special Topics</td>
<td></td>
</tr>
<tr>
<td>CHM 373</td>
<td>Lipids and Membranes</td>
<td></td>
</tr>
<tr>
<td>CHM 375</td>
<td>Research Chemistry Laboratory</td>
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<tr>
<td>CHM 376</td>
<td>Advanced Research Chemistry Laboratory</td>
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</tr>
<tr>
<td>CHM 377</td>
<td>Biochemistry Laboratory</td>
<td></td>
</tr>
<tr>
<td>CHM 388</td>
<td>Polymer Synthesis and Characterization Laboratory</td>
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</tr>
<tr>
<td>CHM 391</td>
<td>Colloid and Surface Chemistry</td>
<td></td>
</tr>
<tr>
<td>CHE 392</td>
<td>Introduction to Polymer Science</td>
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<tr>
<td>CHM 393</td>
<td>Physical Polymer Science</td>
<td></td>
</tr>
<tr>
<td>CHM 394</td>
<td>Organic Polymer Science I</td>
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</tr>
<tr>
<td>BIOS 041</td>
<td>Biology Core I: Cellular and Molecular Biology</td>
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<tr>
<td>&amp; BIOS 042</td>
<td>Core I: Cellular and Molecular Lab</td>
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<tr>
<td>BIOS 115</td>
<td>Biology Core II: Genetics</td>
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<tr>
<td>MATH 012</td>
<td>Basic Statistics 6</td>
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**Total Credits: 70-79**

1. MATH 021 may substitute for MATH 051
2. MATH 022 may substitute for MATH 051
3. MATH 205 may substitute for MATH 043
4. PHY 011 may substitute for PHY 010
5. PHY 021 may substitute for PHY 013
6. MATH 012 may be substituted by any statistics course

**MODEL ROSTER WHEN PATH A IS FOLLOWED**

<table>
<thead>
<tr>
<th>Year</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>First Year</td>
<td>College Seminar</td>
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<td>3-4</td>
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<tr>
<td></td>
<td>CHM 040</td>
<td></td>
<td>4</td>
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<tr>
<td></td>
<td>CHM 041</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>ENGL 001</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>ENGL 002</td>
<td></td>
<td>3</td>
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<tr>
<td></td>
<td>MATH 021</td>
<td></td>
<td>4</td>
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<tr>
<td></td>
<td>MATH 022</td>
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<tr>
<td></td>
<td>PHY 011</td>
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<tr>
<td></td>
<td>PHY 012</td>
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**Total Credits: 30-31**

<table>
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<tbody>
<tr>
<td>Second Year</td>
<td>CHM 110</td>
<td></td>
<td>4</td>
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<tr>
<td></td>
<td>&amp; CHM 111</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CHM 112</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>&amp; CHM 113</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PHY 021</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>&amp; PHY 022</td>
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<tr>
<td></td>
<td>MATH 023</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>MATH 043</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>ENGR 010 or CSE 012</td>
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<td>2</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td>9</td>
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**Total Credits: 31**

Note that some concentrations would insert courses such as MATH 012, BIOS 041/BIOS 042 (B.S. Pharmaceutical Chemistry), ECO 001 (B.A.-Business), etc.

**Junior Year/Senior Year (30-32 credits)**

Student will need to meet with major advisor in order to formulate courses to be taken.

**MODEL ROSTER WHEN PATH B IS FOLLOWED**

<table>
<thead>
<tr>
<th>Year</th>
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<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>First Year</td>
<td>College Seminar</td>
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<td>3-4</td>
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<tr>
<td></td>
<td>CHM 040</td>
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<tr>
<td></td>
<td>CHM 041</td>
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<tr>
<td></td>
<td>ENGL 001</td>
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<tr>
<td></td>
<td>ENGL 002</td>
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<tr>
<td></td>
<td>MATH 051</td>
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<td>MATH 052</td>
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<td>PHY 010</td>
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<td></td>
<td>PHY 012</td>
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**Total Credits: 29-30**

<table>
<thead>
<tr>
<th>Year</th>
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<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Second Year</td>
<td>CHM 110</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>&amp; CHM 111</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>CHM 112</td>
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<td>4</td>
</tr>
<tr>
<td></td>
<td>&amp; CHM 113</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PHY 013</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>&amp; PHY 022</td>
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<td></td>
<td>MATH 043</td>
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<td>3</td>
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</table>
distribution requirements - free electives 15

Total Credits: 59-60

Note that some concentrations would insert courses such as MATH 012, BIOS 041/BIOS 042 (B.S. Pharmaceutical Chemistry), ECO 001 (B.A.-Business), etc.

junior year/senior year (30-32 credits)
Student will need to meet with major advisor in order to formulate courses to be taken.

B.S. DEGREE IN CHEMISTRY, COLLEGE OF ENGINEERING & APPLIED SCIENCE

Summary of Requirements

<table>
<thead>
<tr>
<th>College distribution</th>
<th>Physics, math, and computing</th>
<th>Chemistry</th>
<th>Unrestricted electives</th>
<th>Total Credits</th>
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<td>24</td>
<td>28</td>
<td>46</td>
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Model Roster

First Year

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Credits</th>
<th>Second Semester</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ENGL 001</td>
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<td>ENGL 002</td>
<td>3</td>
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<td>MATH 021</td>
<td>4</td>
<td>MATH 022</td>
<td>4</td>
</tr>
<tr>
<td>ENGR 010</td>
<td>2</td>
<td>ENGR 005</td>
<td>2</td>
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<td>Select one of the following:</td>
<td>4-5</td>
<td>Select one of the following:</td>
<td>4-5</td>
</tr>
<tr>
<td>CHM 040 or 030</td>
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<td>CHM 041 or 031</td>
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</tr>
<tr>
<td>PHY 011 &amp; PHY 012</td>
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<td>PHY 011 &amp; PHY 012</td>
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13-14 13-14

Second Year

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Credits</th>
<th>Second Semester</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CHM 110 &amp; CHM 111</td>
<td>4</td>
<td>CHM 112 &amp; CHM 113</td>
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<tr>
<td>PHY 021 &amp; PHY 022</td>
<td>5</td>
<td>MATH 205</td>
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<td>MATH 023</td>
<td>4</td>
<td>ECO 001</td>
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<tr>
<td>Modern Foreign Language Requirement (see details in introduction)</td>
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<td>Modern Foreign Language Requirement (see details in introduction)</td>
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17 15

Third Year

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Credits</th>
<th>Second Semester</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM 332 &amp; CHM 334</td>
<td>6</td>
<td>CHM 307 &amp; CHM 335</td>
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<tr>
<td>CHM 342</td>
<td>3</td>
<td>CHM 341</td>
<td>3</td>
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<tr>
<td>Distribution Requirement/ Elective</td>
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<td>CHM 343</td>
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</table>

17 15

Fourth Year

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Credits</th>
<th>Second Semester</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CHM 351</td>
<td>2</td>
<td>Free Elective</td>
<td>15</td>
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<tr>
<td>CHM 371</td>
<td>3</td>
<td></td>
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</tr>
<tr>
<td>Advanced Chemistry Elective</td>
<td>3</td>
<td></td>
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<tr>
<td>Select one of the following:</td>
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</table>

CHM 031 Chemical Equilibria in Aqueous Systems 4
or CHM 041 Honors General Chemistry II

CHM 110 & CHM 111 Organic Chemistry I and Organic Chemistry Laboratory I 4

CHM 332 Analytical Chemistry 3

CHM 342 Thermodynamics & Kinetics 3

CHM 343 Physical Chemistry Laboratory 2

Total Credits 16

ACCELERATED COMBINED B.S. - M.S. DEGREE OPTIONS IN CHEMISTRY

Individual degree paths can be designed to earn either the B.S. or both BS. and M.S. degrees in Chemistry over a reduced or accelerated time frame. A discussion with the Chemistry faculty advisor during the first academic year is required to successfully complete any of the following options:

1. If you have more than 20 credits total of AP or transfer courses, it may be possible to earn the B.S. in three years and the M.S. in four. This path may require up to two summers of courses and/or research for most students.

2. If you have 30 or more AP or transfer credits, then it may be possible to be supported as a Teaching Assistant or Research Assistant during the fourth year as a graduate student to finish the M.S. degree, although such support is not guaranteed. The B.S. degree must be completed in three years, and up to two summers of courses and/or research may be required.

3. If you have limited or no AP or transfer credits, then two paths are available: A) A five year path is possible with one summer of research work after the B.S. degree is finished in four years. B) A five year path with support during the fifth year as a TA or RA may be possible if courses are excluded from the undergraduate degree (requiring course overloads), and one summer of research is generally required, but support is not guaranteed.

Accelerated B.S. degree options are also possible for some students. See the Chemistry faculty advisor to develop a customized program for your situation.

B.S. IN BIOCHEMISTRY

An interdepartmental B.S. in Biochemistry major is offered in the College of Arts and Sciences. Faculty in both Chemistry (Glover, Pires and Thévenin) and Biological Sciences (Lowe-Krentz, Iovine and Behe) serve as advisors depending on student interest. Please see the section on Biochemistry (p. 83) for details of the major.

MINOR IN CHEMISTRY

A minor in chemistry may be achieved by completing the following requirements:

CHM 031 Chemical Equilibria in Aqueous Systems 4
or CHM 041 Honors General Chemistry II

CHM 110 & CHM 111 Organic Chemistry I and Organic Chemistry Laboratory I 4

CHM 332 Analytical Chemistry 3

CHM 342 Thermodynamics & Kinetics 3

CHM 343 Physical Chemistry Laboratory 2
Necessary pre- or co-requisites for the above would be CHM 030 or CHM 040 and MATH 021.

Students who wish to minor in chemistry but whose major program requires any of the above courses may achieve the minor with substitutions approved by the department chair.

GRADUATE PROGRAMS IN CHEMISTRY
The Department of Chemistry offers graduate studies leading to two advanced degrees. Doctor of philosophy degrees in Chemistry and Polymer science and engineering may be obtained by study and research in any appropriate area of chemistry.

The following information on admissions, proficiency examinations and other policies applies to doctor of philosophy degrees in chemistry.

Admission to graduate study in chemistry assumes that a student has met, or is willing to meet through further study, minimum undergraduate requirements for a bachelor’s degree in chemistry. This would include (beyond two semesters of introductory chemistry) two semesters of organic chemistry, two semesters of physical chemistry, two semesters of analytical chemistry and one semester of inorganic chemistry. A promising student whose degree is in a field related to chemistry (e.g., biology, chemical engineering) may be admitted to graduate study in chemistry provided that any deficiencies in basic chemistry preparation are made up in the first year of graduate study, noting that some of the courses required for this may not carry graduate credit.

The Chemistry Department administers proficiency examinations at the advanced undergraduate level in analytical, biochemistry, inorganic, organic and physical chemistry to all regular graduate students at the time of matriculation. Each student is required to take three examinations. Information regarding material to be covered on these examinations will be sent to each student several months in advance of matriculation. It is expected that each student will prepare diligently for these tests. A Ph.D. candidate must show proficiency in three areas. An incoming student who fails one or more of the examinations will have two additional opportunities to demonstrate proficiency by re-taking the examination(s). The student is highly encouraged to meet with the Graduate Advising Director to determine the best course of action in light of the exam performance and projected area of study. The student may prepare for the examination(s) by self-study and/or enrolling in or auditing of appropriate courses, and is strongly encouraged to seek faculty advice on preparing to retake any exam.

Doctor of Philosophy Degree
Completion of a doctor of philosophy degree program normally requires a minimum of four years fulltime work after entrance with a bachelor’s degree. There are few specific course credit requirements for the Ph.D.; however, approved degree programs generally have at least 24 hours of course work (including any applied toward a master’s degree) and 6 credits of research. Thus, the program consists of approximately one-third formal course work and two-thirds independent study and research. There is a two-credit seminar requirement (CHM 481). After Ph.D. proficiency has been established and the research advisor selected (this must be done by the end of the first year in residence), the major hurdle is the doctoral examination in the student’s area of concentration. This exam must be passed by the end of 2 1/2 years of residence. If this hurdle is surmounted, the remaining time is spent completing (ultimately defending) the dissertation research under the guidance of the research advisor and the dissertation committee.

Course Work  
CHM 421 Chemistry Research  
CHM 481 Chemistry Seminar  
Total Credits 24

1 Including any applied toward a master’s degree.

CURRENT RESEARCH PROJECTS
Current research projects of interest are listed below.

Analytical Chemistry
NMR studies of organic solids and polymeric systems; biosensors; microfluidic platforms; electroanalytical chemistry.

Biochemistry
Membrane protein interactions; structural characterization of membrane proteins; production of membrane proteins; biophysical characterization of membrane proteins; biomaterials; multi-drug resistance; selective drug delivery; anti-cancer therapy; antibiotic drug discovery; cell surface remodeling; immunotherapy; activity based probes; fluorescence assay development.

Inorganic Chemistry
Synthesis, characterization, and reactivity of transition metal complexes and nano particles; coordination chemistry and molecular self-assembly at metal surfaces and semi-metal surfaces; electrochemistry at metal, semi-metal, and oxide-coated electrodes; synthesis and characterization of mesoporous solids from transition metal and main-group element precursors; applications of mesoporous solids for carbon sequestration; formation of multilayered thin films of inorganic and organic-inorganic hybrid materials; and application of lanthanide catalysis in organic synthesis.

Materials and Polymer Chemistry
Inorganic and organometallic chemistry in the synthesis of thin-film materials; synthesis and dynamics of polymer interfaces; acoustic, optical, permeability, dielectric and mechanical behavior of thin films; laser light scattering and small-angle X-ray scattering studies on polymer solutions; polyelectrolytes and ion-containing solutions; nanofabrications in polymer systems; organic-inorganic hybrid solid state materials; synthesis and characterization of novel mesoporous materials; characterization of semiconducting material

Organic Chemistry
Synthesis of medicinal agents and functional materials, correlation of molecular structure with pharmacological behavior; chemical models for biochemical reactions; chemistry of monolayers and organized molecule assemblages; drug carriers; synthetic ion conductors; Langmuir-Blodgett films; organometallic reaction mechanisms; organofluorine chemistry; protein folding and renaturation; molecular recognition; calorimetry; electrochemical studies of electron transfer reactions; synthetic methods development.

Physical Chemistry
Chemistry at surfaces and interfaces of polymers, electrodes, thin films, and biosensors using an array of surface sensitive methods: spectroscopic ellipsometry, scanning probe microscopy, angle resolved X-ray photo electron spectroscopy, electrochemistry, and quartz crystal microbalance; nanomechanics; intermolecular interactions in soft matter; single-molecule force spectroscopy; chemically sensitive imaging at nanoscale; development of optics-based tools for chemical analysis; femtosecond ultra-fast spectroscopy; investigation of charge transfer in energy materials; spectroscopy; transient absorption spectroscopy; time-resolved photoluminescence; proton-coupled electron transfer reactions.

Major Instrumentation
Chemistry research spans all areas: analytical, biochemistry, inorganic, organic, and physical. Special equipment available for graduate research in chemistry is as follows.

Research facilities
LC/MS/MS, GC-MS, MALDI-TOF-MS, HPLCs, GCs, ultracentrifuges, cold rooms, cell disintegrator, zone and disc electrophoresis apparatus, column chromatograph, autoclave, freezers (-80C), rotary vaporator, Milli-Q water purification system, shaking heated water baths, spectropolarimeter with circular dichroism capability. Cell culture facilities – complete with optical microscopes having fluorescent and photographic capabilities. Electron optical facilities – transmission electron microscopy with x-ray fluorescence analysis capability, scanning electron microscope, and scanning electron microprobe. Gas chromatographs. Liquid chromatographs – high performance for analytical and preparative work. NMR spectrometers – 400 MHz for both solids and solutions, and 500 MHz for solutions with enhanced sensitivity multinuclear cryroscope. Photochemistry equipment – lamps and filters for selected wavelength work. Polarographs, chronopotentiometers, electrophoresis apparatus, electrochemical impedance, electrochemical scanning tunneling microscope, potentiostats, and rotating disk electrode. Portable data interface (8-
channel 50 KHz), digital readout polarimeter, Vibron elastoviscometers, differential refractometer.

**Spectrometers**

UV/visible double beam automated, fluorescence, UV/visible/near IR, Fourier transform IR with diffuse reflectance, photoacoustic and attenuated reflectance capability, and GC mass spectrometers. Surface analysis facilities – rotating anode high-sensitivity high-energy resolution ESCA with imaging capability (ESCA is equipped with automated angular data acquisition). Surface science facility – Low energy electron diffraction (LEED), photocorrelation spectroscopy for submicron particle analysis. Ellipsometer, contact angle capabilities, gas adsorption apparatus (BET), atomic force microscope, instrumental scanning tunneling microscope, and light scanning. Microcalorimeter (flowing with UV and refractive index detectors), differential scanning calorimeter (DSC).

**Courses**

**CHM 030 Introduction to Chemical Principles 4 Credits**

An introduction to important topics in chemistry: atomic structure, properties of matter, chemical reactions, energy, structure and bonding in organic and inorganic compounds. The course features a lecture tightly linked to a three-hour studio experience that combines laboratory work and recitation.

Attribute/Distribution: NS

**CHM 031 Chemical Equilibria in Aqueous Systems 4 Credits**

An introduction to: intermolecular forces and their influence on physical properties and phase behavior; chemical kinetics; thermodynamics in chemical systems; and electrochemistry. The course includes a detailed treatment of equilibria in aqueous solutions, including acid-base, precipitation-solubility, metal-ligand, oxidation-reduction and distribution equilibria. The laboratory work emphasizes the qualitative and quantitative analysis of equilibria in aqueous media. Three lectures and one three-hour laboratory period.

Prerequisites: (CHM 030 or CHM 040) and (MATH 021 or MATH 031 or MATH 051 or MATH 076)

Attribute/Distribution: NS

**CHM 040 Honors General Chemistry I 4 Credits**

A first-semester course in chemistry for students planning to major in chemistry, biochemistry, chemical engineering, materials science, or other chemistry-related fields. Chemical and physical properties, structures, bonding concepts, and quantitative analysis. Laboratory includes synthesis, separation and analysis procedures; computer applications to chemistry. Three lectures and one three-hour laboratory period.

Attribute/Distribution: NS

**CHM 041 Honors General Chemistry II 4 Credits**

Continuation of Chemistry 40. Three lectures and one three-hour laboratory period.

Prerequisites: (CHM 040 or CHM 030) and (MATH 021 or MATH 031 or MATH 051)

Attribute/Distribution: NS

**CHM 110 Organic Chemistry I 3 Credits**

Systematic survey of the typical compounds of carbon, their classification, and general relations; study of synthetic reactions.

Prerequisites: CHM 031 or CHM 041

Attribute/Distribution: NS

**CHM 111 Organic Chemistry Laboratory I 1 Credit**

Preparation of pure organic compounds. Modern techniques of characterization.

Prerequisites: CHM 110

Can be taken Concurrently: CHM 110

Attribute/Distribution: NS

**CHM 112 Organic Chemistry II 3 Credits**

Continuation of CHM 110.

Prerequisites: CHM 110

Attribute/Distribution: NS

**CHM 113 Organic Chemistry Laboratory II 1 Credit**

Continuation of Organic Chemistry Laboratory I.

Prerequisites: CHM 111 and CHM 112

Can be taken Concurrently: CHM 111, CHM 112

Attribute/Distribution: NS

**CHM 177 Introduction to Research 1-2 Credits**

For advanced freshmen and sophomore chemistry majors. Consent of department chair required.

Repeat Status: Course may be repeated.

**CHM 194 Physical Chemistry for Biological Sciences 3 Credits**

The principles and applications of physical chemical concepts to systems of biological interest, including the gas laws, thermodynamics of metabolic reactions, colligative properties, electrochemical equilibria, reaction kinetics and enzyme catalysis, and transport of macromolecules and viruses.

Prerequisites: (CHM 030 or CHM 040) and (CHM 031 or CHM 041)

Attribute/Distribution: NS

**CHM 250 Special Topics 1-4 Credits**

Selected topics in chemistry. Consent of instructor required.

Repeat Status: Course may be repeated.

**CHM 300 Apprentice Teaching 3 Credits**

Consent of instructor required.

Repeat Status: Course may be repeated.

**CHM 301 Chemistry Seminar 1 Credit**

A course designed for seniors will involve the literature research of a topic of the student’s choosing followed by a 35 minute oral presentation to the class and professor. Must have senior standing.

**CHM 305 Organometallic Chemistry 3 Credits**

The chemistry of compounds containing bonds between carbon and the transition metals. Topics include the synthesis, characterization, and electronic structure of organometallic compounds, and mechanistic studies of their reactions. A description of common ligands and their bonding is covered, as well as applications of organometallic chemistry in organic synthesis and catalysis.

Prerequisites: CHM 112

Attribute/Distribution: NS

**CHM 307 Advanced Inorganic Chemistry 3 Credits**

Introduction to transition metal complexes; theories of bonding; kinetics and mechanisms of transition metal complex reactions; selected aspects of organometallic chemistry; bioorganic chemistry.

Prerequisites: CHM 031 or CHM 041

Attribute/Distribution: NS

**CHM 323 Chemical Biology 3 Credits**

Chemical biology is a discipline at the interface of organic and biological chemistry. It entails the design, synthesis, and evaluation of probes, substrates, and materials for the study of biological systems using chemical principles. Chemical biology can also take inspiration from biological systems for the design and synthesis of novel molecules and materials for non-biological applications. The class is designed to be an introduction to chemical biology for upper-level undergraduates and graduate students.

Prerequisites: CHM 112 and (BIOS 371 or CHM 371)

**CHM 332 Analytical Chemistry 3 Credits**

Theory and practice of chemical analysis. Principles of quantitative separations and determinations; theory and application of selected optical and electrical instruments in analytical chemistry; interpretation of numerical data, design of experiments, solute distribution in separation methods.

Prerequisites: (CHM 031 or CHM 041) and CHM 110

Attribute/Distribution: NS

**CHM 334 Advanced Chemistry Laboratory I 3 Credits**

Exploration of synthetic methods and analysis techniques for inorganic and organic compounds. Determination of product structures and quantitative analysis using modern chemical analysis techniques, including NMR, GC-MS, GC, HPLC, FT-IR, and Electrochemistry.

Prerequisites: (CHM 110 and CHM 111 and CHM 112 and CHM 113 and CHM 332)

Can be taken Concurrently: CHM 332
CHM 335 Advanced Chemistry Laboratory II 3 Credits
Continuation of CHM 334.
Prerequisites: (CHM 334)

CHM 336 Clinical Chemistry 3 Credits
Applications of analytical chemistry to clinical problems. Discussion of methods in common use and the biochemical/medical significance of the results.
Prerequisites: CHM 332 or CHM 112
Attribute/Distribution: NS

CHM 337 Crystallography and Diffraction 3 Credits
Introduction to crystal symmetry, point groups, and space groups. Emphasis on materials characterization by X-ray diffraction and electron diffraction. Specific topics include crystallographic notation, stereographic projections, orientation of single crystals, textures, phase identification, quantitative analysis, stress measurement, electron diffraction, ring and spot patterns, convergent beam electron diffraction (CBED), and space group determination. Applications in mineralogy, metallurgy, ceramics, microelectronics, polymers, and catalysts. Lectures and laboratory work. Prerequisites may be waived if student has senior standing in chemistry.
Prerequisites: MAT 203 or EES 131
Attribute/Distribution: NS

CHM 340 Solid-State Chemistry 3 Credits
This solid state chemistry course will introduce students into symmetry of extended solids, X-ray crystallography of solids, crystal structures, band theory, electronic and ionic conductivity in solids, defects in solids, silicate chemistry and nonporous solids.
Prerequisites: CHM 031 or CHM 041
Attribute/Distribution: NS

CHM 341 Molecular Structure, Bonding and Dynamics 3 Credits
Nature of chemical bonding as related to structure and properties of molecules and extended systems. Quantum chemistry of atoms and molecules applied to chemical transformations and spectroscopic transitions. Symmetry analysis and selection rules. Interpretation of electronic, vibrational and rotational spectra.
Prerequisites: (MATH 022 or MATH 096 or MATH 032) and (PHY 011 or PHY 013) and (CHM 031 or CHM 041)
Attribute/Distribution: NS

CHM 342 Thermodynamics & Kinetics 3 Credits
Development of the principles of classical and statistical thermodynamics and their application to chemical systems. In classical thermodynamics emphasis will be on systems in which composition is of major concern: solutions, chemical and phase equilibria. Kinetic theory of gases; chemical reaction kinetics; chemical reaction dynamics.
Prerequisites: (CHM 031 or CHM 041) and (PHY 013 or PHY 021) and (MATH 022 or MATH 023)

CHM 343 Physical Chemistry Laboratory 2 Credits
Laboratory studies that illustrate and extend the various fields of study in experimental physical chemistry as discussed in CHM 341 and CHM 342. This course fulfills the junior year writing intensive course requirement in CAS.
Prerequisites: CHM 194 or CHE 210 or CHM 342
Attribute/Distribution: NS

CHM 350 Special Topics 1-3 Credits
Selected advanced topics in chemistry.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS

CHM 351 Professional Development Seminar 2 Credits
Topics for the developing professional chemist include lab safety, using a laboratory notebook, searching the scientific literature, reading and writing scientific papers, ethics, and developing both a poster and an oral presentation. Students will present their own poster and a short talk on the same subject. Each student will write his/her own resume and participate in a mock interview session.
Attribute/Distribution: NS

CHM 356 Spectral Analysis 3 Credits
Use of data from nuclear magnetic residence, infrared, ultraviolet, and mass spectrometric techniques for the determination of structure of organic compounds. Emphasis on information from one- and two-dimensional proton and carbon NMR, and a mechanistic interpretation of data from mass spectrometry.
Prerequisites: CHM 112

CHM 357 Organic Reaction Mechanisms 3 Credits
Intensive in class problem solving that involves the formulation of reasonable reaction mechanisms for complex multistep pathways, i.e. organic transformations that proceed via highly energetic intermediates such as carbocations, carbanions, free radicals, carbenes, and nitrenes.
Prerequisites: CHM 112

CHM 358 Advanced Organic Chemistry 3 Credits
Reaction mechanism types and supporting physical-chemical data. Classes of mechanisms include elimination, substitution, rearrangement, oxidation-reduction, enolate alkylations, and others. Must have completed one year of organic chemistry.
Prerequisites: CHM 112
Attribute/Distribution: NS

CHM 360 Molecular Biophysics 3 Credits
This course focuses on the physical tools that exist to obtain information about biological macromolecules, with an emphasis on spectroscopic and imaging techniques (e.g., circular dichroism, fluorescence spectroscopy, FRET, BRET, calorimetry, analytical ultracentrifugation, X-ray crystallography, electron microscopy, dynamic light scattering, surface plasmon resonance). Lectures and discussion of research articles are used to illustrate the use of the different tools and methods.
Prerequisites: BIOS 371 or CHM 371
Attribute/Distribution: NS

CHM 362 Molecular Biophysics 3 Credits
Prerequisites: BIOS 371 or CHM 371

CHM 365 Protein Separation & Biophysical Analysis 3 Credits
Laboratory studies of techniques and principles used for the isolation, characterization, and biophysical analysis of proteins.
Prerequisites: BIOS 371 or CHM 371
Attribute/Distribution: NS

CHM 371 (BIOS 371) Elements of Biochemistry I 3 Credits
A general study of carbohydrates, proteins, lipids, nucleic acids and other biological substances and their importance in life processes. Protein and enzyme chemistry are emphasized. Must have completed one year of organic chemistry.
Prerequisites: CHM 112
Attribute/Distribution: NS

CHM 372 (BIOS 372) Elements of Biochemistry II 3 Credits
Dynamic aspects of biochemistry: enzyme reactions including energetics, kinetics and mechanisms, metabolism of carbohydrates, lipids, proteins and nucleic acids, photosynthesis, electron transport mechanisms, coupled reactions, phosphorylations, and the synthesis of biological macromolecules.
Prerequisites: (BIOS 371 or CHM 371) and BIOS 041
Attribute/Distribution: NS

CHM 373 Lipids and Membranes 3 Credits
The study of lipids and lipid membranes similar to those found in mammalian cells including methods of synthesis, surface activity, bilayer and micellar structures, lipid mixing, fluidity, permeability and membrane stability. Special emphasis will be given to the current evidence for and against the lipid raft hypothesis.
Prerequisites: BIOS 372 or CHM 372
Attribute/Distribution: NS

CHM 375 Research Chemistry Laboratory 1-3 Credits
An introduction to independent study or laboratory investigation under faculty guidance. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS

CHM 376 Advanced Research Chemistry Laboratory 1-6 Credits
Advanced independent study or laboratory investigation under faculty guidance. Consent of faculty research supervisor.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS
CHM 377 (BIOS 377) Biochemistry Laboratory 3 Credits
Laboratory studies of the properties of chemicals of biological origin and the influence of chemical and physical factors on these properties. Laboratory techniques used for the isolation and identification of biochemicals.
Prerequisites: (BIOS 371 or CHM 371) and (BIOS 031 or BIOS 041)
Can be taken Concurrently: BIOS 371, CHM 371
Attribute/Distribution: NS

CHM 388 (CHE 388, MAT 388) Polymer Synthesis and Characterization Laboratory 3 Credits
Techniques include: free radical and condensation polymerization; molecular weight distribution by gel chromatography; crystallinity and order by differential scanning calorimetry; pyrolysis and gas chromatography; dynamic mechanical and dielectric behavior; morphology and microscopy; surface properties.
Prerequisites: (CHM 341 or CHE 210 or CHM 342) and CHM 110
Attribute/Distribution: NS

CHM 389 Honors Project 1-6 Credits
Repeat Status: Course may be repeated.

CHM 391 (CHE 391) Colloid and Surface Chemistry 3 Credits
Physical chemistry of everyday phenomena. Intermolecular forces and electrostatic phenomena at interfaces, boundary tensions and films at interfaces, mass and charge transport in colloidal suspensions, electrostatic and London forces in disperse systems, gas adsorption and heterogeneous catalysis.
Prerequisites: CHM 342
Attribute/Distribution: NS

CHM 393 (CHE 393, MAT 393) Physical Polymer Science 3 Credits
Structural and physical aspects of polymers (organic, inorganic, natural). Molecular and atomic basis for polymer properties and behavior. Characteristics of glassy, crystalline, and paracrystal-line states (including viscoelastic and relaxation behavior) for single- and multi-component systems. Thermodynamics and kinetics of transition phenomena. Structure, morphology, and behavior. Available to graduate and undergraduate students (with senior level standing) in CHE, CHEM or MAT.
Prerequisites: CHM 112 or CHM 342 or CHE 210
Attribute/Distribution: NS

CHM 394 (CHE 394) Organic Polymer Science I 3 Credits
Organic chemistry of synthetic high polymers. Polymer nomenclature, properties, and applications. Functionality and reactivity of monomers and polymers. Mechanism and kinetics of step-growth and chain-growth polymerization in homogenous and heterogenous media. Brief description of emulsion polymerization, ionic polymerization, and copolymerization. Must have completed one year of physical chemistry and one year of organic chemistry.
Prerequisites: CHM 112 or CHM 342 or CHE 210
Attribute/Distribution: NS

CHM 400 First Year Graduate Student Seminar 0 Credits
First year graduate student seminar course and introduction to research. Topics include: research opportunities in the department, introduction to instrumentation facilities, ethics in science, use of library facilities, effective teaching methods.

CHM 405 Organometallic Chemistry 3 Credits
The chemistry of compounds containing bonds between carbon and the transition metals. Topics include the synthesis, characterization, and electronic structure of organometallic compounds, and mechanistic studies of their reactions. A description of common ligands and their bonding is covered, as well as applications of organometallic chemistry in organic synthesis and catalysis.

CHM 407 Advanced Inorganic Chemistry 3 Credits
Introduction to transition metal complexes; theories of bonding; kinetics and mechanisms of transition metal complex reactions; selected aspects of organometallic chemistry; bio-inorganic chemistry. Must have completed one semester of physical chemistry and have CAS graduate student status.

CHM 421 Chemistry Research 1-6 Credits
Research in one of the following fields of chemistry: analytical, inorganic, organic, physical, polymer, biochemistry.

CHM 423 Chemical Biology 3 Credits
Chemical biology is a discipline at the interface of organic and biological chemistry. It entails the design, synthesis, and evaluation of probes, substrates, and materials for the study of biological systems using chemical principles. Chemical biology can also take inspiration from biological systems for the design and synthesis of novel molecules and materials for non-biological applications. The class is designed to be an introduction to chemical biology for upper-level undergraduates and graduate students.

CHM 424 Medicinal and Pharmaceutical Chemistry 3 Credits
Principles of drug design, structure-reactivity relationships in antibacterial, antimalarial, antinflammatory and psychoactive drugs; synthesis and modes of action of pharmaco logically active agents in pharmaceuticals.
Prerequisites: CHM 358

CHM 425 Pharmaceutical Regulatory Affairs I: Drug Discovery to Approval 3 Credits
Coverage includes the stages of the drug approval process and how these relate to the laboratory activities that provide the scientific basis of the New Drug Application (NDA). Lectures treat drug discovery, chemical process development of the active pharmaceutical ingredient (API), and pharmaceutical process development of the drug product. Regulatory issues in screening and testing, the management of the preclinical trials, and the management of clinical trials will be covered.
Attribute/Distribution: NS

CHM 426 Statistical Thermodynamics 3 Credits
Principles and applications of statistical mechanics to chemical problems. A study of the techniques for evaluating the properties of matter in bulk from the properties of molecules and their interactions.

CHM 427 Thermodynamics & Kinetics 3 Credits
Development of the principles of classical and statistical thermodynamics and their applications to chemical systems. In classical thermodynamics, emphasis will be on systems in which composition is of major concern: solutions, chemical and phase equilibria. Kinetic theory of gases; chemical reaction kinetics. Must have CAS graduate student status. This course cannot be taken by students who have already taken CHM 342.

CHM 428 Pharmaceutical Regulatory Affairs II: Biomarkers for Pharmaceutics and Diagnostics: Laws & Regulation 3 Credits
For decades diagnostic products and technologies have been used to monitor or detect a variety of indicators for disease and infection. Each year, over 4,000 devices are reviewed by the U.S. Food & Drug Administration for safety and efficacy before being allowed to enter the marketplace. Today, regulations have set in motion the use of Biomarkers as a key element for new pharmaceutical development. Biomarkers in a way similar to Diagnostic markers will become a method to demonstrate safety and efficacy of experimental drugs during human trials. This course will review the history of Biomarker and medical device law and regulations in the United States. It will also define the current scientific requirements for Biomarkers to meet the new regulations. Case studies will be used to educate participants on the use of Biomarkers in pharmaceutical development as well as Design Controls, Quality System Regulations, Manufacturing Requirements for diagnostic testing technologies. Specific examples include Nucleic Acid Diagnostics, Cardiovascular Stents, Drug Delivery, Cancer Diagnostics, and Consumer Self-Testing. Students will also use knowledge gained to prepare class presentations to address current issues within the field. This course is one of four courses required to fulfill the requirements for a Certificate in Regulatory Affairs. It may be applied as a 400-level credit in the Masters of Chemistry degree program.
Attribute/Distribution: NS

CHM 450 Organic Chemistry of Synthetic Polymers 3 Credits
Organic chemistry of synthetic high polymers. Polymer nomenclature, properties, and applications. Functionality and reactivity of monomers and polymers. Mechanism and kinetics of step-growth and chain-growth polymerization in homogenous and heterogenous media. Brief description of emulsion polymerization, ionic polymerization, and copolymerization. Must have completed one year of physical chemistry and one year of organic chemistry.
CHM 430 Chemical and Biochemical Separations 3 Credits
Theory and applications of equilibrium and nonequilibrium separation techniques at both the analytical and preparative levels. Solvent and buffer extractions, chromatographic separations (e.g., thin layer, partition, gas liquid, gel filtration, ion exchange, affinity, supercritical fluid), electrophoretic separations (e.g., gel, capillary, isoelectric focusing, immunoalectrophoresis), centrifugal separations (e.g., differential, velocity sedimentation, density gradient) and other separation methods (e.g., dialysis, ultrafiltration). Examples will focus on biological applications.

CHM 431 Contemporary Topics in Analytical Chemistry 1 Credit
Discussion of the current literature in analytical chemistry, including spectroscopy, separations, and electrochemistry. Students find current papers and lead discussions.

Repeat Status: Course may be repeated.

CHM 432 Chemometrics 3 Credits
Mathematical and statistical methods for experimental design, calibration, signal resolution, and instrument control and optimization.

CHM 434 Advanced Topics in Spectroscopy 3 Credits
Fundamentals of interactions of electromagnetic radiation with matter: electronic, vibrational, scattering based spectroscopies, instrumentation and signal processing. Advanced applications to the analysis of molecular structure and chemical processes including surface analysis, time-resolved spectroscopies, and ultrasensitive spectroscopic techniques.

CHM 436 Special Topics in Analytical Chemistry 1-3 Credits
Topics of contemporary interest in analytical chemistry.

Repeat Status: Course may be repeated.

CHM 437 (BIOS 437) Pathophysiological Chemistry 3 Credits
Biochemical basis of human diseases involving abnormal metabolism of proteins, nucleic acids, carbohydrates, and lipids. Emphasis on the correlation of the clinical presentation of disease processes seen as physiological dysfunctions with clinical laboratory methods. Lectures, student presentations, and clinical case discussions. Must have completed one semester of biochemistry.

CHM 438 Analytical Chemistry 3 Credits
Theory and practice of chemical analysis. Principles of quantitative separations and determinations; theory and application of selected optical and electrical instruments in analytical chemistry; interpretation of numerical data; design of experiments; solute distribution in separation methods. Must have CAS graduate student status.

CHM 442 Pharmaceutical Regulatory Affairs 3: Analytical Methods, Validation, and Data Manipulation 3 Credits
A review of the FDA guidance and common industry practices. A presentation of the more user-friendly and higher accuracy analytical methods, which are supplanting traditional analyses. Lectures will cover the eight fundamentals of analytical method validation: accuracy, linearity, precision, limits of detection, selectivity, limits of quantification, specificity, and ruggedness of method. In addition, the student will be taught what to do when the results do not meet the Acceptance Criteria. Lectures also cover evaluation of data streams for supporting conclusions.

CHM 443 (MAT 443) Solid-State Chemistry 3 Credits
This solid state chemistry course will introduce students into symmetry of extended solids, X-ray crystallography of solids, crystal structures, band theory, electronic and ionic conductivity in solids, defects in solids, silicate chemistry and nonporous solids.

CHM 444 Molecular Structure, Bonding and Dynamics 3 Credits
Nature of chemical bonding as related to structure and properties of molecules and extended systems. Quantum chemistry of atoms and molecules applied to chemical transformations and spectroscopic transitions. Symmetry analysis and selections rules. Interpretation of electronic, vibrational and rotational spectra. Must have CAS graduate student status.

CHM 452 Advanced Organic Chemistry 3 Credits
Reaction mechanism types and supporting physical chemical data. Classes of mechanisms include elimination, substitution, rearrangement, oxidation reduction, enolate alkylations, and others. Must have completed one year of organic chemistry and have CAS graduate student status.

CHM 453 Heterocyclic Compounds 3 Credits
An intensive study of the syntheses, reactions and properties of heteroaromatic compounds including derivatives of thiophene, pyrrole, furan, indole, pyridine, quinoline, the azoles and the diazines all considered from the viewpoint of modern theories of structure and reaction mechanisms.

Prerequisites: CHM 358 or CHM 452

CHM 455 Organic Reactions 3 Credits

Prerequisites: or CHM 452, CHM 358 or CHM 452

CHM 456 Spectral Analysis 3 Credits
Use of data from nuclear magnetic resonance, infrared, ultraviolet, and mass spectrometric techniques for the determination of structure of organic compounds. Emphasis on information from one- and two-dimensional proton and carbon NMR, and a mechanistic interpretation of data from mass spectrometry.

CHM 457 Organic Reaction Mechanisms 3 Credits
Intensive in class problem solving that involves the formulation of reasonable reaction mechanisms for complex multistep pathways, i.e., organic transformations that proceed via highly energetic intermediates such as carboxations, carbanions, free radicals, carbenes, and nitrenes.

CHM 458 Topics in Organic Chemistry 1-3 Credits
An intensive study of limited areas in organic chemistry.

Repeat Status: Course may be repeated.

CHM 462 3 Credits
This course focuses on the physical tools that exist to obtain information about biological macromolecules, with an emphasis on spectroscopic and imaging techniques (e.g., circular dichroism, fluorescence spectroscopy, FRET, BRET, calorimetry, analytical ultracentrifugation, X-ray crystallography, electron microscopy, dynamic light scattering, surface plasmon resonance). Lectures and discussion of research articles are used to illustrate the use of the different tools and methods.

CHM 463 Pharmaceutical Regulatory Affairs 4: Commercial Production, Validation, and Process Qualification 3 Credits
This course covers the scientific principles and the registry requirements for polymeric implants, controlled-release drug depot units, pumps, point-of-care testing kits, contrast media for MRI, x-ray, and ultrasound and all FDA controlled products not defined as therapeutic pharmaceuticals.

CHM 465 Protein Separation & Biophysical Analysis 3 Credits
Laboratory studies of techniques and principles used for the isolation, characterization, and biophysical analysis of proteins.

Attribute/Distribution: NS

CHM 467 (BIOS 467) Principles of Nucleic Acid Structure 3 Credits
An examination of the principles underlying nucleic acid structure including stereochemistry, electrostatics, hydration, torsional constraints, sequence specific effects, and interaction with nuclear proteins. Special emphasis will be placed on DNA structure. Must have completed one year of biochemistry and one year of physical chemistry or have consent of the department chair.

CHM 468 (BIOS 468) Principles of Protein Structure 3 Credits
An examination of the principles underlying protein structure including stereochemistry, preferred tertiary structures, protein homology, excluded volume effects, time dependent structural fluctuations, and prediction of protein structure from sequence information. Must have completed one year of biochemistry and one year of physical chemistry or consent of department required.
Applications of concepts covered in BIOS/CHM 372 including techniques used in research.

CHM 472 (BIOS 472) Lipids and Membranes 3 Credits

The study of lipids and lipid membranes similar to those found in mammalian cells including methods of synthesis, surface activity, bilayer and micellar structures, lipid mixing, fluidity, permeability and membrane stability. Special emphasis will be given to the current evidence for and against the lipid raft hypothesis.

Prerequisites: BIOS 372 or CHM 372

CHM 473 (BIOS 473) Principles of Biochemistry I 3 Credits

Study of proteins, carbohydrates, lipids, nucleic acids and other biological substances. Protein and enzyme chemistry are emphasized. Must have completed one year each of general chemistry and organic chemistry.

CHM 474 Pharmaceutical Regulatory Affairs 5: Pharmaceuticals 3 Credits

This course covers the development of therapeutic products subsequent to the initial discovery of the active pharmaceutical ingredient (API) through to the final dosage form. Both small molecule drugs and biotechnological pharmaceuticals will be included. Issues of API formulation, choice of excipients, control of release, target specificity, mode of delivery, drug-drug interactions, and product stabilization will be addressed with special reference to the regulatory issues involved at that stage of drug development. This course builds upon a foundation in organic, analytical, and biochemistry.

CHM 475 Advanced Topics in Chemistry 1 Credit

Audiovisual courses in topics such as acid-base theory, NMR, chromatography, electroanalytical chemistry and mass-spectroscopy interpretation; course material obtained from the American Chemical Society.

Repeat Status: Course may be repeated.

CHM 477 (BIOS 477) Topics In Biochemistry 1-3 Credits

Selected areas of biochemistry, such as mechanisms of enzyme action, new developments in the chemistry of lipids, nucleic acids, carbohydrates and proteins. Must have completed one semester of biochemistry.

Repeat Status: Course may be repeated.

CHM 479 (BIOS 479) Biochemical Techniques 3 Credits

Laboratory studies of the techniques and principles involved in the isolation, identification, and biochemical transformation of carbohydrates, lipids, nucleic acids and proteins.

CHM 480 (BIOS 480) Advanced Biochemical Preparations 1-3 Credits

An advanced laboratory course in the preparation, isolation, purification, and identification of biochemically produced materials. Emphasis is placed on materials and procedures of current interest in biochemistry. Must have completed two semesters of biochemistry.

CHM 481 Chemistry Seminar 1-6 Credits

Student presentations on current research topics in the student’s discipline but not on subjects close to the thesis. A one-hour presentation and attendance at other presentations are required for credit.

Repeat Status: Course may be repeated.

CHM 482 (CHE 482, MAT 482) Mechanical Behaviors of Polymers 3 Credits

Mechanical behavior of polymers. Characterization of experimentally observed viscoelastic response of polymeric solids with the aid of mechanical model analogs. Topics include time-temperature superposition, experimental characterization of large deformation and fracture processes, polymer adhesion, and the effects of fillers, plasticizer, moisture, and aging on mechanical behavior.

CHM 483 (CHE 483, MAT 483) Emulsion Polymers 3 Credits

Fundamental concepts important in manufacture, characterization, and application of polymer latexes. Topics include colloidal stability, polymerization mechanisms and kinetics, reactor design, characterization of particle surfaces, latex rheology, morphology considerations, polymerization with functional groups, film formation and various application problems.

CHM 485 (CHE 485, MAT 485) Polymer Blends and Composites 3 Credits

Synthesis, morphology, and mechanical behavior of polymer blends and composites. Mechanical blends block and graft copolymers, interpenetrating polymer networks, polymer impregnated solids and fiber and particulate-reinforce polymers are emphasized.

CHM 487 Topics in Colloid and Surface Chemistry 3 Credits

Applications of colloid chemistry; special topics in surface chemistry. Lectures and seminar.

Repeat Status: Course may be repeated.

CHM 488 Advanced Topics in Physical Chemistry 1-3 Credits

Advanced topics in physical chemistry, such as photochemistry and molecular beam dynamics, Fourier transform spectroscopy, kinetics of rapid reactions, theory of magnetic resonance, liquids and solutions.

Repeat Status: Course may be repeated.

CHM 489 Organic Polymer Science II 3 Credits


CHM 490 Thesis 1-6 Credits

Repeat Status: Course may be repeated.

CHM 492 (CHE 492, MAT 492) Topics in Polymer Science 3 Credits

Intensive study of topics selected from areas of current research interest such as morphology and mechanical behavior, thermodynamics and kinetics of crystallization, new analytical techniques, molecular weight distribution, non-Newtonian flow behavior, second-order transition phenomena, novel polymer structures. Credit above three hours is granted only when different material is covered.

CHM 494 Quantum Chemistry 3 Credits

Principles and applications of quantum mechanics to chemical problems. Applications to chemical bonding, molecular structure, reactivity and spectroscopy.

CHM 499 Dissertation 1-15 Credits

Repeat Status: Course may be repeated.

Classical Studies

Program Director: Barbara Pavlock, Ph. D. (Cornell) (https://english.cas2.lehigh.edu/node/36)

Email: bp01@lehigh.edu | Phone: 610-758-3309

Website: http://classics.cas2.lehigh.edu/

Supported by the Office of Interdisciplinary Programs, 610-758-3996; incasp@lehigh.edu

Williams Hall, 31 Williams Drive

** THIS PROGRAM IS CURRENTLY ON HIATUS. NO NEW MAJORS OR MINORS ARE BEING ADMITTED INTO CLASSICS, CLASSICAL CIVILIZATIONS, OR LATIN. **

The study of Classics examines first the origins and growth of Greek and Roman culture in the Mediterranean area and second its impact on that area (and others) until the present. This study is by nature interdisciplinary: the study of language and literature, history, philosophy and religion, archaeology, economics and science all contribute to an appreciation of Greco-Roman civilization.

Students in either major or minor programs may concentrate in various combinations of these and other disciplines as they relate to ancient
civilization. The diversity of the program should encourage the student to follow her or his special interests while simultaneously gaining an overview of classical civilization.

Courses in ancient Greek and Latin lead to proficiency in language while introducing the student to major literary texts. The Joseph A. Maurer Classics Prize is awarded yearly, at the discretion of the program, to the senior(s) who has demonstrated outstanding achievement in Classics (ancient Greek or Latin) and/or classical civilization. Courses in classical civilization require no knowledge of the ancient languages; they offer introductions to various disciplines of Classics with frequent reference to modern perspectives. Upper-level courses tend to be small, fostering closeness between faculty and students.

Petitions are required for freshmen to take 100-level or higher courses and for sophomores to take 200-level or higher courses.

**Emeritus Faculty**

C. Robert Phillips II (Department of History)

**MAJOR PROGRAMS**

Students may major either in Classical Civilization or in Classics. The Classics major offers a comprehensive view of language and culture; it is possible to begin an ancient language at Lehigh and to complete the major program successfully. The Classical Civilization major enables the student to gain a broad perspective on Greek and Roman civilization. The program welcomes double majors and the educational perspectives to be derived from combining ancient and modern studies.

Classics as a major has stood the test of time, offering helpful preparation for careers in widely diverse fields in the professions, business, and public service. Lehigh Classics majors have gone on to law school, to the ministry, to business school, with appropriate science courses to medical school, to graduate work in Classics, and to all kinds of entry-level employment.

**Departmental Honors**

A student may be recommended for program honors by vote of the student's course work.

**Study Abroad**

Lehigh University is a cooperating institution of the Intercollegiate Center for Classical Studies at Rome. Lehigh students are eligible for tuition grants in Athens and Rome.

**MAJOR IN CLASSICAL CIVILIZATION**

This major allows the student to gain an overview of Greco-Roman culture through the literature, archaeology, and history along with basic language study. A minimum of 36 credits is expected, but adjustments may be made for prior language study. Students need to consult the Program Director to determine appropriate adjustments to the guidelines for major requirements.

Select four of the following: 16

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Any two courses in ancient history 8

At least one elective from the remaining program offerings 4 (ANTH 178 may be included)

Two semesters of elementary Latin or Greek 8

Total Credits 36

**MAJOR IN CLASSICS**

This major allows the student to concentrate in ancient Greek, Latin or both. Specific programs for this major are worked out for each student with due consideration for the individual's particular previous study of the language(s). Thus a student may begin ancient Greek or Latin at Lehigh and successfully complete a major in it. A minimum of 36 credits is expected, but adjustments may be made for prior language study.

Students need to consult the Program Director to determine appropriate adjustments to the guidelines for major requirements.

**Required Major Courses**

Select one of the following: 8

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Three advanced courses in the major language minimum. 12

Any two ancient history courses. 8

At least one elective from the remaining program offerings. 4

Total Credits 40

1 Depending on prior preparation.
2 Depending on prior preparation and on the extent of coursework in the second Classical language. Students entering with significant previous language study in their major language (Latin or Greek) will be expected to take four or more advanced courses. The specific number of credits for language study will be determined in consultation with the Program Director.

**MINOR PROGRAMS**

The program has three minors: Classics, Latin, and Classical Civilization. The minor in Classics combines language study and civilization courses (with a minimum of two courses in the languages). The minor in Latin focuses exclusively on the study of Latin. For the minor in Classical Civilization, students may take any combination of courses in Classical Civilization (any courses designated CLSS). All the minors require a minimum of 16 credits. The program can arrange individual courses of study.

<table>
<thead>
<tr>
<th>Minor</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classics Minor</td>
<td>16</td>
</tr>
<tr>
<td>Latin Minor</td>
<td>16</td>
</tr>
<tr>
<td>Classical Civilizations Minor</td>
<td>16</td>
</tr>
</tbody>
</table>

**Classics Courses**

**CLSS 021 (HIST 021) Greek History 4 Credits**

The development of civilization from palaeolithic times to the world empire of Alexander the Great. The social, economic, religious, philosophic, artistic and literary development of the ancient world; the origin of political institutions.

Attribute/Distribution: SS

**CLSS 022 (HIST 022) Roman History 4 Credits**

Rome from its origins to A.D. 476. Political, social and religious developments. Transformation of the late Roman Empire to the early medieval period.

Attribute/Distribution: SS

**CLSS 050 (ENGL 050) Classical Mythology 4 Credits**

Introduction to the study of the Greco-Roman myths in their social, political, and historical contexts. Emphasis on myths and their analysis as important evidence for studying classical antiquity.

Attribute/Distribution: HU

**CLSS 052 (ENGL 052) Classical Epic 4 Credits**

Study of major epic poems from Greece and Rome. Works include Homer's Iliad and Odyssey, Apollonius' Argonautica, Vergil's Aeneid, and Ovid's Metamorphoses.

Attribute/Distribution: HU

**CLSS 054 (ENGL 054, THTR 054) Greek Tragedy 4 Credits**

Aspects of Greek theater and plays of Aeschylus, Sophocles, and Euripides in their social and intellectual contexts.

Attribute/Distribution: HU
CLSS 056 (ENGL 056) Topics in Greek and Roman Literature 4 Credits
Classical literature in translation, including themes or specific periods in Greek or Roman literature.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

CLSS 091 Independent Study 1-4 Credits

CLSS 112 (ANTH 112) Doing Archaeology 4 Credits
Principles of archaeological method and theory. Excavation and survey methods, artifact analysis, dating techniques, and cultural reconstruction. Course includes field project.
Attribute/Distribution: SS

Early Christianity from its beginnings until the end of the second century. Coverage includes the Jewish and Hellenistic matrices of Christianity, traditions about the life of Jesus and his significance, and the variety of belief and practice of early Christians. Emphasis on encountering primary texts.
Attribute/Distribution: HU

CLSS 131 (PHIL 131) Ancient Philosophy 4 Credits
Historical survey of selected texts and issues in the classical world, from the pre-Socratics through Aristotle, with emphasis on the origins of the western philosophical traditions in ethics, metaphysics, and epistemology.
Attribute/Distribution: HU

CLSS 132 (PHIL 132) Hellenistic Philosophy 4 Credits
Historical survey of selected texts and issues in Post-Aristotelian Greek and Roman philosophy from the fourth century B.C. to the third century A.D. Areas of focus may include epicureanism, stoicism, academic and pyrrhonian scepticism, and neoplatonism.
Attribute/Distribution: HU

CLSS 171 Independent Study 1-4 Credits

CLSS 174 (ANTH 174, ARCH 174, ART 174) Greek Archaeology 4 Credits
Ancient Greek culture from the neolithic to Hellenistic periods. Reconstructions of Greek social dynamics from the study of artifacts.
Attribute/Distribution: SS

CLSS 176 (ANTH 176, ARCH 176, ART 176) Roman Archaeology 4 Credits
Cultures of the Roman Empire. Reconstructions of social, political, and economic dynamics of the Imperial system from the study of artifacts.
Attribute/Distribution: SS

CLSS 191 Special Topics 1-4 Credits

CLSS 231 (PHIL 231) Figures and Themes in Ancient Philosophy 4 Credits
This seminar course will involve in-depth focus upon a major ancient thinker (e.g. Plato, Aristotle, Sextus Empiricus, Plotinus, etc.) or the classical treatment of a particular theme (e.g. “human nature,” “the good life,” ethical or political theory, etc.). Content varies. May be repeated for credit if content differs from previous.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

CLSS 232 (PHIL 232) Figures/Themes in Hellenistic Philosophy 4 Credits
This seminar course will involve an in-depth focus upon a major movement in Hellenistic Philosophy (roughly 4th century B.C.E. to the 2nd Century C.E.) such as Epicureanism, Stoicism, Ancient Scepticism, or Neoplatonism, or the Hellenistic treatment of a particular theme (e.g. freedom from anxiety, the nature of the Cosmos and our place within it, or human nature). Content varies.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

CLSS 281 Readings 4 Credits
Advanced study of a historical period or theme. Emphasis on primary sources. Consent of program head required.
Prerequisites: CLSS 021 or CLSS 022
Attribute/Distribution: ND

CLSS 282 Readings 4 Credits
Advanced study of a historical period or theme. Emphasis on primary sources. Consent of program head required.
Prerequisites: CLSS 021 or CLSS 022
Attribute/Distribution: ND

CLSS 291 Independent Study 1-4 Credits

CLSS 300 Apprentice Teaching 3 Credits

CLSS 312 (HIST 312) Decline and Fall of the Roman Empire 3-4 Credits
Political, social, and economic history of the Roman Empire, A.D. 117- A.D. 565. Romanization of the provinces, diffusion of Christianity, and special attention to transformation to medieval period. Includes readings in translation of primary sources.
Attribute/Distribution: SS

CLSS 314 (HIST 314) Age of Caesar and Christ 4 Credits
Roman history of the first century A.D. Political, cultural, and socio-economic changes; special attention to the evolution of absolute power. Lectures, discussions, papers.
Attribute/Distribution: SS

CLSS 389 Honors Project 1-8 Credits

Greek Courses

GRK 001 Elementary Ancient Greek I 4 Credits
Attribute/Distribution: HU

GRK 002 Elementary Ancient Greek II 4 Credits
Continued work in Greek vocabulary, forms, and syntax. Selected readings in Greek. Students should have completed one semester of elementary ancient Greek or the equivalent.
Prerequisites: GRK 001
Attribute/Distribution: HU

GRK 011 Intermediate Ancient Greek 4 Credits
Readings in Herodotus, Homer, or Xenophon. Grammar review. Students should have completed two semesters of elementary ancient Greek or the equivalent.
Attribute/Distribution: HU

GRK 012 Intermediate Ancient Greek 4 Credits
May include Plato: Euthyphro, Apology and Crito, or other dialogues. Students should have completed two semesters of elementary Greek or the equivalent.
Attribute/Distribution: HU

GRK 091 Independent Study 1-4 Credits
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

Latin Courses

LAT 001 Elementary Latin I 4 Credits
Attribute/Distribution: HU

LAT 002 Elementary Latin II 4 Credits
Continuation of grammar, easy Latin prose and poetry. Students should have completed one semester of elementary Latin or the equivalent.
Attribute/Distribution: HU

LAT 011 Intermediate Latin 4 Credits
Readings in Latin prose or poetry. Consolidation of reading ability; introduction to literary analysis. Students should have completed two semesters of elementary Latin or the equivalent.
Attribute/Distribution: HU

LAT 012 Intermediate Latin 4 Credits
Readings in Latin prose or poetry. Consolidation of reading ability; introduction to literary analysis. Students should have completed two semesters of elementary Latin or the equivalent.
Attribute/Distribution: HU
The mission of the Cognitive Science Program is to advance the study of minds and brains, real or artificial, in all their aspects, through research and teaching. This interdisciplinary field, encompassing the fields of psychology, linguistics, computer science, philosophy, anthropology, and neuroscience, provides excellent preparation for life in the age of information. The program aims to instill in students a solid grasp of the intellectual problems, frameworks, and methodologies currently available; to provide experience exploring these through guided research; and to foster the desire to create and disseminate new knowledge. With this foundation, students are well prepared for a wide variety of careers at the interfaces of technology, minds, brains, and behavior, and for graduate study in Cognitive Science or any of the contributing disciplines.

We offer undergraduate B.A. and B.S. degrees in Cognitive Science, an undergraduate minor, and a graduate certificate. A Cognitive Science major is easy to combine with a second major in the humanities, natural sciences, social sciences, or computer science.

**Professors.** Kiri Lee, PhD (Harvard University); Barbara C. Malt, PhD (Stanford University); Hector Munoz-Avila, PhD (Technische Universität Kaiserslautern); Pádraig O’OSSZaghda, PhD (University of Toronto); Dominic J. Packer, PhD (University of Toronto)

**Associate Professors.** Catherine M. Arrington, PhD (Michigan State University); Amanda C. Brandone, PhD (University of Michigan); Jeffrey D. Heflin, PhD (University of Maryland, College Park); Almut Hupbach, PhD (Universität Trier)

**Assistant Professor.** Nancy B. Carlisle, PhD (Vanderbilt University, Peabody College)

**B.A. IN COGNITIVE SCIENCE**
The B.A. in Cognitive Science requires a minimum of 14 courses. All majors take COGS 007, an introduction to cognitive science, plus core courses in cognitive psychology, philosophy, artificial intelligence, and cognitive neuroscience, and collaterals in computer science. They also complete a course in research methods or tools. Students then pursue their individual interests by completing at least five electives from across three tracks. A capstone integration occurs in the required two-semester senior project (COGS 301 and COGS 302, or, for Honors, COGS 391 and COGS 392), in which students focus on a topic of their choice spanning at least two cognitive science sub-disciplines.

Additional coursework in affiliated disciplines is recommended, to be selected in consultation with the major adviser and dependent upon anticipated career path. These courses may fulfill college distribution requirements. Note: A number of major courses have pre-requisites. Students considering this major should check pre-requisites and plan accordingly. A preliminary meeting with the program director may be useful.

**Collateral Requirements**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>CSE 001</td>
<td>Breadth of Computing</td>
</tr>
<tr>
<td>or CSE 012</td>
<td>Survey of Computer Science</td>
</tr>
<tr>
<td>CSE 002</td>
<td>Fundamentals of Programming</td>
</tr>
<tr>
<td>PSYC 110</td>
<td>Statistical Analysis of Behavioral Data</td>
</tr>
<tr>
<td>or PSYC 210</td>
<td>Experimental Research Methods and Laboratory</td>
</tr>
<tr>
<td>PSYC 201</td>
<td>Research Methods and Data Analysis I</td>
</tr>
<tr>
<td>or PSYC 202</td>
<td>Research Methods and Data Analysis II</td>
</tr>
<tr>
<td>SOAN 111</td>
<td>Research Methods and Data Analysis</td>
</tr>
<tr>
<td>CSE 160</td>
<td>Introduction to Data Science</td>
</tr>
<tr>
<td>BIOS 130</td>
<td>Biostatistics</td>
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</tbody>
</table>

**Introductory Course**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>COGS 007</td>
<td>Introduction to Cognitive Science</td>
</tr>
</tbody>
</table>

**Disciplinary Core Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>COGS/PSYC 117</td>
<td>Cognitive Psychology</td>
</tr>
<tr>
<td>COGS/PSYC 176</td>
<td>Cognitive Neuroscience</td>
</tr>
<tr>
<td>COGS/PHIL 250</td>
<td>Philosophy of Mind</td>
</tr>
<tr>
<td>COGS/CSE 327</td>
<td>Artificial Intelligence Theory and Practice</td>
</tr>
</tbody>
</table>

**Major Electives**

15-20 credits

Select a minimum of five electives, with at least one course from each of the three tracks.

**Senior Project**

6-8 credits

- COGS 301 & COGS 302
- Senior Project in Cognitive Science: Proposal and Senior Project in Cognitive Science: Execution

- COGS 391 & COGS 392

**Total Credits**

40-47

**B.S. IN COGNITIVE SCIENCE**
The B.S.in Cognitive Science entails additional courses beyond those in the B.A. to provide both additional breadth and depth. It requires a minimum of 20 courses. All majors take COGS 007, an introduction to cognitive science, plus core courses in cognitive psychology, philosophy, artificial intelligence, and cognitive neuroscience, and collaterals in computer science, math, and social science. They also complete two courses in research methods or tools and at least one semester of supervised research. Students then pursue their individual interests by choosing a concentration area from among three tracks and completing at least six electives with a minimum of four in the concentration area. A capstone integration occurs in the required two-semester senior project (COGS 301 and COGS 302, or, for Honors, COGS 391 and COGS 392), in which students focus on a topic of their choice spanning at least two cognitive science sub-disciplines.

Additional coursework in affiliated disciplines is recommended, to be selected in consultation with the major adviser and dependent upon anticipated career path. These courses may fulfill college distribution requirements. Note: A number of major courses have pre-requisites. Students considering this major should check pre-requisites and plan accordingly.
Collateral Requirements

1. CSE 001 Breadth of Computing
   or CSE 012 Survey of Computer Science
2. CSE 002 Fundamentals of Programming
3. MATH 021 Calculus I
   or MATH 051 Survey of Calculus I
   or MATH 075 Calculus I, Part A
   & MATH 076 Calculus I, Part B
4. CSE 140 Foundations of Discrete Structures and Algorithms
5. PSYC 001 Introduction to Psychology
   or ECO 001 Principles of Economics
   or ANTH 011 Cultural Diversity and Human Nature

Two courses in research methods and tools.

For Artificial Intelligence and Formal Models Concentration:

1. CSE 160 Introduction to Data Science
   & MATH 231 and Probability and Statistics
   or ECO 045 Statistical Methods

For all other concentrations:

1. PSYC 201 Research Methods and Data Analysis I
   & PSYC 202 Research Methods and Data Analysis II

Introductory Course

1. COGS 007 Introduction to Cognitive Science

Disciplinary Core Course

1. COGS/PSYC 117 Cognitive Psychology
2. COGS/PSYC 176 Cognitive Neuroscience
3. COGS/PHIL 250 Philosophy of Mind
4. COGS/CSE 327 Artificial Intelligence Theory and Practice
5. COGS 183
   or COGS 184 Cognitive Neuroscience Recitation

Concentrations

Choose six electives from the concentration lists, at least four of them from within the same concentration. The lists are the same for the B.A. and the B.S. Requirements specific to each concentration for the B.S. are as follows:

Artificial Intelligence and Formal Models

1. CSE 017 Programming and Data Structures

Cognition, Culture, and Meaning

1. COGS 140 Introduction to Linguistics

Cognitive Neuroscience

1. BIOS 121 Biology Core III: Integrative & Comparative Biology

Research Experience

1. COGS 161 Supervised Research

Senior Project

1. COGS 301 Senior Project in Cognitive Science: Proposal
   & COGS 302 and Senior Project in Cognitive Science: Execution
   or COGS 391 Honors Thesis in Cognitive Science: Proposal
   & COGS 392 and Honors Thesis in Cognitive Science: Project Execution and Thesis

Total Credits

46-56

1. Collateral courses may count toward CAS distribution requirements where applicable.
2. BIOS 121 Biology Core III: Integrative & Comparative Biology pre-reqs:
   any CHM course that fulfills the pre-requisite for BIOS 041, plus BIOS 041 Biology Core I: Cellular and Molecular and BIOS 042 Biology Core I: Cellular and Molecular Lab. These are not part of the major but can count toward CAS Natural Science distribution.

3. Students are encouraged to take the required research credits beginning in the second year or even earlier. At least two semesters of relevant research experience (minimum 4 credits) are required for B.S. students prior to enrolling in COGS 391 Honors Thesis in Cognitive Science: Project Execution and Thesis for their senior project.

4. May be repeated for credit.

MAJOR ELECTIVES

Artificial Intelligence and Formal Models

1. CSE 017 Programming and Data Structures
2. CSE 042 Game Design
3. CSE 140 Foundations of Discrete Structures and Algorithms
4. CSE 262 Programming Languages
5. CSE 318 Introduction to the Theory of Computation
6. CSE 326 Fundamentals of Machine Learning
7. CSE 331 User Interface Systems and Techniques
8. CSE 335 Topics on Intelligent Decision Support Systems
9. CSE 337 Reinforcement Learning
10. CSE 347 Data Mining
11. CSE 348 AI Game Programming
12. CSE 360 Introduction to Mobile Robotics
13. CSE 428 Semantic Web Topics
14. CSE 431 Intelligent Agents
15. PHIL/MATH 114 Symbolic Logic
16. PHIL/MATH 214 Topics in Philosophical Logic
17. PHIL 265 Philosophy of Mathematics
18. PHIL/MATH 303 Mathematical Logic
19. MATH 261 Discrete Structures
20. MATH 304 Axiomatic Set Theory
21. MATH 329 Computability Theory

Cognition, Culture, and Meaning

1. ANTH 376 Culture and the Individual
2. COGS/ANTH/MLL 140 Introduction to Linguistics
3. COMM 385 Seminar in Communication Issues
4. CSE 252 Computers, the Internet, and Society
5. PHIL 128 Philosophy Of Science
6. PHIL 135 Modern Philosophy
7. PHIL 139 Contemporary Philosophy
8. PHIL 220 Ways of Knowing
9. PHIL 228 Topics in the Philosophy of Science
10. PHIL 260 Making Sense of Words
11. PSYC 307 Higher Order Cognition
12. PSYC 313 Person Perception
13. PSYC 314 Social Cognition
14. PSYC 320 Psychology of Language
15. PSYC/HS 344 Health Care Reasoning and Decision Making
16. PSYC 351 Children’s Thinking
17. PSYC/ES 357 Psychology of Environmental Issues
18. PSYC 358 Inside the Infant Mind
19. PSYC 362 Cognition in Practice & Policy
20. PSYC/GS 365 Human Development in Cross-Cultural Perspective
21. PSYC 384 Self and Identity
22. SOC/JOUR 135 Human Communication

Cognitive Neuroscience

1. ANTH 012 Human Evolution and Prehistory
2. ANTH 145 Human Evolution
**BIOS 121** Biology Core III: Integrative & Comparative Biology  
**BIOS 276** Central Nervous System and Behavior  
**BIOS 277** Experimental Neuroscience Laboratory  
**BIOS 365** Neurobiology of Sensory Systems  
**BIOS 366** Diseases of the Nervous System  
**BIOS 382** Endocrinology of Behavior  
**BIOS 385** Synapses, Plasticity and Learning  
**BIOS 386** Genes and the Brain  
**PSYC 012** Introduction to Human Neuroscience  
**PSYC 316** The Talking World: Psychology and Neuroscience of Speaking  
**PSYC 347** Cognitive Neuroscience of Memory  
**PSYC 355** Seminar in Cognitive Neuroscience  
**PSYC 369** Memory Under Construction  
**PSYC 377** Attention and Attentional Failures  
**PSYC 433** Cognitive Neuroscience Techniques  

### MINOR IN COGNITIVE SCIENCE

The undergraduate minor in Cognitive Science requires five courses:

**COGS 007** Introduction to Cognitive Science 4  
Four additional courses selected from among the major's core courses and major electives, with at least two of these being Disciplinary Core Courses 12-16  
Total Credits 16-20

### PROGRAM HONORS

Majors seeking to graduate with honors in cognitive science must have a 3.30 GPA in the major, a 3.30 GPA overall, and complete a high quality senior thesis with enrollment in COGS 391 Honors Thesis in Cognitive Science: Project Execution and Thesis. Theses submitted for honors will be evaluated by a committee of at least three cognitive science faculty.

### GRADUATE CERTIFICATE IN COGNITIVE SCIENCE

The graduate certificate provides the opportunity to develop an interdisciplinary perspective on human and machine intelligence. It is available to both enrolled and external students.

Students in Lehigh University graduate degree programs such as computer science, psychology, and instructional technology are encouraged to participate with the approval of an adviser in their major program. Non-degree, post-baccalaureate individuals with sufficient background to complete the coursework are also welcome to undertake the certificate. The certificate may be especially relevant to those working in technology-related fields. Interested individuals should contact the Director of the Cognitive Science Program. External candidates will also need to apply to the College of Arts and Sciences for non-degree graduate status.

The certificate will appear on the student's transcript after submission of a signed completion form by the program director.

The Graduate Certificate requires four courses from the list below. At least two of the courses must be at the 400-level, and the four courses must be spread over at least two departments. For Lehigh degree candidates, at least three of the four courses must be outside the home department. The certificate will entail 12-16 credits.

### ELECTIVES

**Computer Science**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>CSE 327</td>
<td>Artificial Intelligence Theory and Practice</td>
</tr>
<tr>
<td>CSE 331</td>
<td>User Interface Systems and Techniques</td>
</tr>
<tr>
<td>CSE 332</td>
<td>Multimedia Design and Development</td>
</tr>
<tr>
<td>CSE 335</td>
<td>Topics on Intelligent Decision Support Systems</td>
</tr>
<tr>
<td>CSE 348</td>
<td>AI Game Programming</td>
</tr>
<tr>
<td>CSE 409</td>
<td>Theory of Computation</td>
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<tr>
<th>Course Code</th>
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</thead>
<tbody>
<tr>
<td>CSE 426</td>
<td>Fundamentals of Machine Learning</td>
</tr>
<tr>
<td>CSE 428</td>
<td>Semantic Web Topics</td>
</tr>
<tr>
<td>CSE 431</td>
<td>Intelligent Agents</td>
</tr>
<tr>
<td>CSE 435</td>
<td>Topics on Intelligent Decision Support Systems</td>
</tr>
<tr>
<td>CSE 437</td>
<td>Reinforcement Learning and Markov Decision Preceses</td>
</tr>
<tr>
<td>CSE 447</td>
<td>Data Mining</td>
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<tr>
<td>CSE 460</td>
<td>Mobile Robotics</td>
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**Psychology**

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<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>PSYC 307</td>
<td>Higher Order Cognition</td>
</tr>
<tr>
<td>PSYC 313</td>
<td>Person Perception</td>
</tr>
<tr>
<td>PSYC 314</td>
<td>Social Cognition</td>
</tr>
<tr>
<td>PSYC 316</td>
<td>The Talking World: Psychology and Neuroscience of Speaking</td>
</tr>
<tr>
<td>PSYC 320</td>
<td>Psychology of Language</td>
</tr>
<tr>
<td>PSYC/HMS 344</td>
<td>Health Care Reasoning and Decision Making</td>
</tr>
<tr>
<td>PSYC 347</td>
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<td>PSYC 358</td>
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<td>PSYC 362</td>
<td>Cognition in Practice &amp; Policy</td>
</tr>
<tr>
<td>PSYC 377</td>
<td>Attention and Attentional Failures</td>
</tr>
<tr>
<td>PSYC 402</td>
<td>Developmental Psychology</td>
</tr>
<tr>
<td>PSYC 403</td>
<td>Cognitive Psychology</td>
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<tr>
<td>PSYC 406</td>
<td>Social Cognition</td>
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<tr>
<td>PSYC 433</td>
<td>Cognitive Neuroscience Techniques</td>
</tr>
<tr>
<td>PSYC 448</td>
<td>Seminar in Psychology of Language</td>
</tr>
<tr>
<td>PSYC 464</td>
<td>Naive Realism in Social Judgement</td>
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<tr>
<td>PSYC 476</td>
<td>Seminar In Cognition</td>
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<tr>
<td>PSYC/COGS 478</td>
<td>Ontological Psychology</td>
</tr>
<tr>
<td>PSYC 480</td>
<td>Seminar in Cognitive Development</td>
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</table>

**Philosophy**

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<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>PHIL/COGS 250</td>
<td>Philosophy of Mind</td>
</tr>
<tr>
<td>PHIL 260</td>
<td>Making Sense of Words</td>
</tr>
</tbody>
</table>

**Sociology and Anthropology**

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<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTH 376</td>
<td>Culture and the Individual</td>
</tr>
</tbody>
</table>

Total Credits 0

Note: These particular 200-level courses may be taken by graduate students.

### Courses

**COGS 007 Introduction to Cognitive Science 4 Credits**

What is a mind? How is the mind related to the brain? Could we make an artificial mind? Issues concerning knowledge representation and intelligence in minds and computers as investigated by psychologists, philosophers, linguists, neuroscientists, and researchers in artificial intelligence.

**COGS 117 (PSYC 117) Cognitive Psychology 4 Credits**

The architecture and dynamics of the human mind: How we acquire knowledge through perception, represent and activate it in memory, and use it to communicate, make decisions, solve problems, and reason creatively. May not be taken pass/fail.

**Prerequisites:** PSYC 001 or COGS 007

**Attribute/Distribution:** SS

**COGS 127 (CSE 127) Survey of Artificial Intelligence 3 Credits**

An introduction to artificial intelligence (AI) intended for non-majors. AI concepts, systems, and history. Credit will not be given for both CSE/COGS 127 and CSE/COGS 327.

**Prerequisites:** CSE 002 or CSE 004 or CSE 007
COGS 140 (ANTH 140, MLL 140) Introduction to Linguistics 4 Credits
Relationship between language and mind; formal properties of language; language and society; how languages change over time. May not be taken pass/fail. 
Attribute/Distribution: SS

COGS 161 Supervised Research 1-3 Credits
Research under the direct supervision of a faculty member in the cognitive science program. Students must arrange the particular project with a faculty member before enrolling. Consent of program director required. 
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

COGS 176 (PSYC 176) Cognitive Neuroscience 4 Credits
Perception and cognitive neuroscience as the link between mental processes and their biological bases. Visual and auditory perception; the control of action; neuropsychological syndromes of perception, language, memory, and thought; neural network (connectionist) models of mental processes. May not be taken pass/fail. 
Prerequisites: PSYC 001 or COGS 007
Attribute/Distribution: NS

COGS 183 (PSYC 183) Cognitive Psychology Recitation 1 Credit
Research, discussion, and analysis of topics in cognitive psychology. 
Prerequisites: PSYC 117 or COGS 117

COGS 184 (PSYC 184) Cognitive Neuroscience Recitation 1 Credit
Research, discussion, and analysis of topics in cognitive neuroscience. 
Prerequisites: PSYC 176 or COGS 176

COGS 194 Special Topics in Cognitive Science 2-4 Credits
Topics vary from semester to semester. Topics are addressed at an intermediate level. Previous course work in cognitive science and consent of faculty sponsor is required. 
Repeat Status: Course may be repeated.

COGS 250 (PHIL 250) Philosophy of Mind 4 Credits
An exploration of the mind-body problem. Are the body and mind distinct substances (dualism); or is there only body (materialism); or only mind (idealism)? Other views to be considered include behaviorism (the view that behavior can be explained without recourse to mental states), and the view that the mind is a complex computer. 
Attribute/Distribution: HU

COGS 300 Apprentice Teaching 1-4 Credits

COGS 301 Senior Project in Cognitive Science: Proposal 1-3 Credits
For students not intending to apply for program Honors. Background reading and preparation of a short written proposal are conducted in the first semester in consultation with a faculty adviser. Students must enroll for a total of three credits which may be split between the sections of a primary and secondary adviser. Consent of program director and project adviser required. 

COGS 302 Senior Project in Cognitive Science: Execution 1-3 Credits
For students not intending to apply for program Honors. Execution of the project is conducted in the second semester in consultation with a faculty adviser. A presentation will be given at the end of the semester. Students must enroll for a total of three credits which may be split between the sections of a primary and secondary adviser. Consent of program director and project adviser required. 
Prerequisites: COGS 301

COGS 327 (CSE 327) Artificial Intelligence Theory and Practice 3 Credits
Detailed analysis of a broad range of artificial intelligence (AI) algorithms and systems. Problem solving, knowledge representation, reasoning, planning, uncertainty and machine learning. Applications of AI to areas such as natural language processing, vision, and robotics. Credit will not be given for both CSE/COGS 127 and CSE/COGS 327. 
Prerequisites: CSE 017 and CSE 140

COGS 361 Independent Research 2-4 Credits
Independent research in cognitive science with a faculty advisor. Students must arrange the particular project with a faculty advisor before enrolling. Consent of program director required. 
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

COGS 391 Honors Thesis in Cognitive Science: Proposal 1-4 Credits
For students with 3.3 or higher major and overall GPA by the spring of the junior year, who want to undertake a project with the potential for program Honors. Literature review and preparation of a written proposal are conducted in the first semester in consultation with a faculty adviser. An oral presentation will be given at end of the semester. Students must enroll for four credits which may be split between co-advisers. Consent of program director and project adviser required.

COGS 392 Honors Thesis in Cognitive Science: Project Execution and Thesis 1-4 Credits
For students with 3.3 or higher major and overall GPA by the spring of the junior year. Project execution and preparation of the written report is conducted in the second semester. An oral presentation will be given at the end of the semester. Theses will be evaluated for Honors by three cognitive science faculty. Students must enroll for a total of four credits which may be split between co-advisers. Consent of program director and project adviser required. 
Prerequisites: COGS 391

COGS 394 Special Topics in Cognitive Science 3-4 Credits
Topics vary from semester to semester. Topics are presented at an advanced level. 
Repeat Status: Course may be repeated.

COGS 399 Senior Project in Cognitive Science: Thesis 1-3 Credits
Research during senior year culminating in senior thesis advised by a member of the Cognitive Science faculty. Execution and written report of project proposed and approved in COGS 301. Students must enroll for a total of three credits which may be split between the sections of a primary and secondary adviser. Theses submitted for honors will be evaluated by a committee of at least three cognitive science faculty. 
Prerequisite: COGS 301 and consent of the program director. 
Repeat Status: Course may be repeated.
Prerequisites: COGS 301

COGS 405 Individual Study in Cognitive Science 1-6 Credits
Study of a topic not covered in regular course offerings. By arrangement with a consulting faculty member. Consent of program director required.
Repeat Status: Course may be repeated.

COGS 423 (PSYC 423) Foundations of Cognitive Science 3 Credits
Survey of fundamental theory and methodologies from artificial intelligence, linguistics, cognitive psychology, philosophy, and neuroscience, as well as salient research problems such as knowledge acquisition and representation, natural language processing, skill acquisition, perception and action, and the philosophical question of intentionality.

COGS 478 (PSYC 478) Ontological Psychology 3 Credits
Principles and constraints for modeling psychological phenomena. Representation; perception; memory; knowing; learning; emotions; consciousness; language; rationality.

Earth and Environmental Sciences

The Department of Earth and Environmental Sciences (EES) is Lehigh's home for teaching and research in the areas of ecology, environmental science, and geological sciences. Matters of environmental quality and natural resources will increasingly impact people and society in the years to come, and the EES department offers a range of undergraduate and graduate programs that provide students with an understanding of Earth’s biosphere, atmosphere, lithosphere, and hydrosphere, with an emphasis on how these components function as an integrated Earth system. Training in Earth and Environmental Sciences can lead to technical and scientific careers in research, environmental consulting, conservation ecology, government agencies, and the petroleum industry, and can also serve as an excellent liberal arts degree that provides context and preparation for careers such as law, policy, journalism and economics.
Faculty in the EES department have a wide range of interests and strong reputations in the fields of geology, ecology, and environmental sciences. In instruction at all levels, the department emphasizes field experiences, laboratory techniques, and experiential learning, as well as the development of quantitative and communication skills. The EES department maintains a relaxed and personal atmosphere in which students can interact with faculty in many ways, including seminars, special symposia on topics of the students’ choice, field research, and departmental field trips.

EES is a core department in the Environmental Initiative Program (EIP), which offers students access to interdisciplinary training in Environmental Science, Engineering, and Policy. At the undergraduate level, students may choose from a B.A. or a B.S. degree in Earth and Environmental Sciences. The flexible B.A. program provides a five-year opportunity to acquire a broad B.S. or a specialized program, or find room for a double major. A popular choice is a double major in Earth and Environmental Sciences and in Environmental Studies, a major offered through the Environmental Initiative (http://www.ei.lehigh.edu). This degree is well suited to students with career aspirations in areas such as engineering, environmental law, journalism, economics, government, among many other possibilities. The B.S. degree, while still offering considerable flexibility, provides the more in-depth technical training required for graduate school and scientific careers, and is well suited for students seeking science graduate degrees or employment as professionals in the earth and environmental sciences.

An accessible minor program is available for students wishing to add Earth and Environmental Science insight into any number of other technical or non-technical degree programs, helping students distinguish themselves as they prepare to enter today’s fast-evolving job markets and graduate programs.

For students with strong interests in areas such as hydrology, water and soil remediation, hazards and associated geotechnical strategies, EES, in conjunction with the Department of Civil and Environmental Engineering (CEE), offers a five-year program leading to dual B.S. degrees in EES and CEE (students having these interests may also want to see the description of the B.S. in Environmental Engineering in the catalog entry for the Department of Civil and Environmental Engineering). EES offers graduate training leading to either M.S. or Ph.D. in Earth and Environmental Sciences. The EES graduate program is marked by close faculty-student collaboration. Graduate students can take advantage of strong externally funded faculty research programs and the extensive analytical and computing facilities available in the department; these facilities and specific EES research programs are described in some detail on the EES departmental web page at www.ees.lehigh.edu.

FIELD WORK AND EXPERIENTIAL LEARNING
Field experiences are a hallmark of the EES undergraduate program. The goal of these experiences is to place students into learning environments that are distinct from the classroom or lab, where all the complexities and subtleties of the field can be appreciated in their natural setting. The Department runs a nationally recognized ~5 week long (6 credit) summer field camp in the Rocky Mountains, which offers intense field training in hydrology, geology, and field methods including computer-based mapping. As part of the Lehigh in Costa Rica Program, the Department teaches a field course in Costa Rica every winter term that focuses on tropical ecology and natural history. Students can participate in the department’s longstanding research programs in limnological and ecological research in the Pocono Lakes region and in the Lehigh River watershed. Supervised internships allow students at all levels to become engaged in projects involving cross-disciplinary research, assessment, and consulting work. Undergraduate students can also become involved in forefront research programs. In recent years, students have played a role in research in the Himalaya, Alaska, California, Idaho, Argentina, and Italy, in addition to more nearby sites in the mid-Atlantic states. We strongly encourage all EES majors to take advantage of the special field programs and opportunities made available by the department. Most EES courses also include field experiences in the form of one-day or weekend-long field trips, and several courses include weekly or bi-weekly field trips.

PROGRAMS IN EARTH AND ENVIRONMENTAL SCIENCES

The descriptions of the following programs in the Department of Earth and Environmental Sciences are organized as follows:

- Minor in Earth and Environmental Sciences
- Bachelor of Arts Degree in Earth and Environmental Sciences
- Bachelor of Sciences Degree in Earth and Environmental Sciences
- Department Honors in Earth and Environmental Sciences
- Civil and Environmental Engineering and Earth and Environmental Sciences
- Graduate Studies

**Professors.** David J. Anastasio, PHD (Johns Hopkins University); Gray E. Bebout, PHD (University of California Los Angeles); Robert K. Booth, PHD (University of Wyoming); Edward B. Evenson, PHD (University of Wisconsin); Kenneth P. Kodama, PHD (Stanford University); Anne S. Meltzer, PHD (Rice University); Frank J. Pazzaglia, PHD (The Pennsylvania State University); Dork Sahagian, PHD (University of Chicago); Zicheng Yu, PHD (University of Toronto); Peter K. Zeitler, PHD (Dartmouth College)

**Associate Professors.** Benjamin S. Felzer, PHD (Brown University); Donald P. Morris, PHD (University of Colorado Boulder); Stephen C. Peters, PHD (University of Michigan); Joan Ramage Macdonald, PHD (Cornell University)

**Assistant Professor.** Jill McDermott, PHD (Massachusetts Institute of Technology)

**Emeriti.** Bobb Carson, PHD (University of Washington); Bruce R. Hargreaves, PHD (University of California, Berkeley); Paul B. Myers, Jr., PHD (Lehigh University); Dale R. Simpson, PHD (California Institute of Technology)

**REQUIREMENTS FOR A MINOR IN EARTH AND ENVIRONMENTAL SCIENCES**

A minor is designed for students wishing to explore an area of Earth or Environmental Sciences in conjunction with a major program in another field for personal development or career enhancement.

Select one of

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EES 080</td>
<td>Introduction to the Earth System</td>
<td>4</td>
</tr>
<tr>
<td>EES 022</td>
<td>Exploring Earth</td>
<td>1</td>
</tr>
</tbody>
</table>

EES Courses & One additional EES course

<table>
<thead>
<tr>
<th>Code</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EES Courses</td>
<td>3</td>
</tr>
<tr>
<td>EES Courses at 100 level or above</td>
<td>5</td>
</tr>
</tbody>
</table>

Total Credits: 15

1 Students are recommended to take EES080 to satisfy upper division prerequisites. Careful planning is required if a student selects EES022 + a course instead.

Natural science (NS) designated EES College seminars (EES 090) may be used to meet minor requirements.

**DEGREE REQUIREMENTS FOR A BACHELOR OF ARTS DEGREE IN EARTH AND ENVIRONMENTAL SCIENCES**

The B.A. degree is designed with flexibility in mind and is recommended for students interested in a sound liberal arts degree that will permit them to bring a scientific perspective to a wide variety of careers. The degree also permits students to take a double major, or design a specialized program tailored to specific topics in the earth and environmental sciences. Students who choose the B.A. but are interested in attending graduate school should talk to their faculty advisor and consult the B.S. program descriptions to see the type of requirements that may be required for graduate admission.

**College Requirements**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Seminar</td>
<td>3</td>
</tr>
<tr>
<td>English Composition (2 courses)</td>
<td>6</td>
</tr>
<tr>
<td>Distribution Requirements: at least 2 Humanities courses</td>
<td>8</td>
</tr>
<tr>
<td>Distribution Requirements: at least 2 Social Science courses</td>
<td>8</td>
</tr>
</tbody>
</table>

**Junior Writing Requirement**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EES 200</td>
<td>Earth History</td>
</tr>
</tbody>
</table>

**MATH and Collateral Science Requirements**

<table>
<thead>
<tr>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8</td>
</tr>
</tbody>
</table>
Select one course in Mathematics (MATH 012 or above) for at least 4 credits
Select one course from Chemistry (CHM 030 or above), Physics (PHY 010 or above), or Mathematics (MATH 012 or above)

**Core Sequence in EES Major**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EES 080</td>
<td>Introduction to the Earth System</td>
</tr>
<tr>
<td>EES 200</td>
<td>Earth History</td>
</tr>
<tr>
<td>EES 380</td>
<td>The Practice of Science</td>
</tr>
</tbody>
</table>

**Major Electives**
Select six courses from EES or cross-listed offerings at the 100 level or above.

**Free Electives**
Courses chosen from anywhere in the University’s curriculum, sufficient to bring the total to a minimum of 120 credits.

1. Writing intensive
2. Students interested in scientific careers or pursuing graduate education in the sciences are recommended to take at least two additional math and collateral science courses chosen in consultation with an advisor.
3. Up to 8 credits of EES internship (EES 293) and EES research (EES 393) may be used as major electives (no more than 4 of which can be EES 293).
4. Four credits of EES 341 may be applied to major electives; all 6 credits for this course apply to the graduation requirement of 120 total credits.

**DEGREE REQUIREMENTS FOR BACHELOR OF SCIENCES DEGREE IN EARTH AND ENVIRONMENTAL SCIENCES**

**College Requirements**
25 credits

English Composition (2 courses)
6 credits

Distribution Requirements: at least 2 Humanities courses
8 credits

Distribution Requirements: at least 2 Social Science courses
8 credits

**Junior Writing Requirement**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EES 200</td>
<td>Earth History</td>
</tr>
</tbody>
</table>

**Mathematics and Collateral Science Requirements**
22-25 credits

Select one of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 021</td>
<td>Calculus I</td>
</tr>
<tr>
<td>MATH 031</td>
<td>Honors Calculus</td>
</tr>
<tr>
<td>MATH 051</td>
<td>Survey of Calculus</td>
</tr>
<tr>
<td>MATH 075</td>
<td>Calculus I, Part A</td>
</tr>
<tr>
<td>MATH 076</td>
<td>Calculus I, Part B</td>
</tr>
</tbody>
</table>

One additional Mathematics course (MATH 012 and above).
3-4 credits

Select one of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM 030</td>
<td>Introduction to Chemical Principles</td>
</tr>
<tr>
<td>CHM 040</td>
<td>Honors General Chemistry I</td>
</tr>
</tbody>
</table>

Select one of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHY 010</td>
<td>General Physics</td>
</tr>
<tr>
<td>PHY 012</td>
<td>Introductory Physics Laboratory I</td>
</tr>
<tr>
<td>PHY 011</td>
<td>Introductory Physics I</td>
</tr>
<tr>
<td>PHY 012</td>
<td>Introductory Physics Laboratory I</td>
</tr>
</tbody>
</table>

Select at least two additional courses in Biology (BIOS 041 or above), Chemistry (CHM 031 or above), Mathematics (MATH 012 or above), Computer Science and Engineering (CSE 001 or above), or Physics (PHY 013 or above).
4-8 credits

**Core Sequence in EES Major**
21 credits

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EES 080</td>
<td>Introduction to the Earth System</td>
</tr>
<tr>
<td>EES 115</td>
<td>Surficial Processes</td>
</tr>
<tr>
<td>EES 131</td>
<td>Introduction to Rocks and Minerals</td>
</tr>
<tr>
<td>EES 152</td>
<td>Ecology</td>
</tr>
<tr>
<td>EES 200</td>
<td>Earth History</td>
</tr>
<tr>
<td>EES 380</td>
<td>The Practice of Science</td>
</tr>
</tbody>
</table>

**Major Electives**

Select three courses from EES or cross-listed offerings at the 100 level or above.
12 credits

Select four courses from EES or cross-listed offerings at the 300 level or above.
16 credits

**Free Electives**
Courses chosen from anywhere in the University's curriculum, sufficient to bring the total to a minimum of 120 credits.

**Field Requirement**
Select one of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EES 341</td>
<td>Field Camp in Earth and Environmental Sciences</td>
</tr>
</tbody>
</table>

Complete 5 of the following 7 courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EES 089</td>
<td>Geographic Analysis of our Changing World</td>
</tr>
<tr>
<td>EES 115</td>
<td>Surficial Processes</td>
</tr>
<tr>
<td>EES 152</td>
<td>Ecology</td>
</tr>
<tr>
<td>EES 201</td>
<td>Seismology: The Earth and Environment</td>
</tr>
<tr>
<td>EES 250</td>
<td>Terrestrial Ecosystems</td>
</tr>
<tr>
<td>EES 223</td>
<td>Structural Geology and Tectonics</td>
</tr>
<tr>
<td>EES 316</td>
<td>Hydrogeology</td>
</tr>
</tbody>
</table>

**DEPARTMENT HONORS IN EARTH AND ENVIRONMENTAL SCIENCES**

Students in either the B.A. or B.S. degree programs may undertake a program that leads to graduation with department honors. To participate, the student must (1) have a minimum major GPA of 3.4 and an overall cumulative GPA of 3.0 expected at graduation, (2) complete at least four credits of EES 393 (Supervised Research in Earth and Environmental Sciences), and (3) prepare a written honors thesis on the EES 393 research project. To graduate with honors students should (1) file a written request with the EES undergraduate instruction coordinator no later than the beginning of the senior year (preferably during the junior year), (2) constitute an advisory committee of two EES faculty plus the student’s research supervisor to guide the research, (3) prepare a research proposal for committee’s approval, and (4) give an oral presentation of research results and conclusions at a department seminar on or before the last day of classes in the second semester of the senior year. The committee should approve the research proposal and the honors thesis by signing the required form and cover sheet, which will be filed with the Department.

**CIVIL AND ENVIRONMENTAL ENGINEERING AND EARTH AND ENVIRONMENTAL SCIENCES**

This program is designed for students interested in combining programs in two departments: Civil & Environmental Engineering and Earth & Environmental Sciences, leading to two bachelor of science degrees, a civil and environmental engineering B.S. degree and a B.S. degree in earth and environmental sciences. Both degrees would be awarded at the end of the fifth year. This program is one of the dual degree programs mentioned in the Five-Year Programs section. The student will have a primary advisor in the P.C. Rossin College of Engineering and Applied Sciences and a secondary advisor in the College of Arts and Sciences. The program provides alternatives for students who may decide not to complete the dual-degree program. Students who make this decision prior to the beginning of the fourth year may qualify at the end of that year for the bachelor of science in civil or environmental engineering, as well as a minor in earth and environmental sciences. Also, if a student decides after two years to pursue only a B.S. degree in the EES department, it is possible to complete the requirements in four years. If the decision to work toward this degree is made during the fourth year, at least one additional semester is required to qualify for either B.S. degree. Interested students should consult with the respective departmental advisors to create a schedule of courses to resolve conflicts or if a specified course is not offered that semester. Required courses and major electives for the EES B.S. degree are listed in the catalog entry for EES. Crosslisted EES/CEE courses used to
satisfy Civil Engineering Approved Electives can reduce the individual semester and total program credits when chosen to satisfy EES program requirements. The dual degree, and a suggested schedule of courses, is described more fully elsewhere in the catalog (p. 385). Additional useful information can be found on the web sites (www.lehigh.edu/~incee/ and www.ees.lehigh.edu).

**GRADUATE STUDIES**

The Department of Earth & Environmental Sciences offers graduate programs leading to the M.S. and Ph.D. in Earth and Environmental Sciences. These degrees emphasize what we feel is an important and growing trend in ecology, environmental science, and geology, namely the blending of expertise and perspectives from many disciplines. Research is an integral component of all EES graduate programs and leads to an M.S. thesis or Ph.D. dissertation prepared under a research supervisory committee and chaired by a departmental faculty research advisor. An advising commitment by one or more faculty members is required for graduate admission.

The University has outlined the general academic requirements for M.S. and Ph.D. students in its Graduate Student Handbook, and EES has additional Departmental requirements that must also be fulfilled. It is the student’s responsibility to insure that all graduation requirements are met. All graduate students work with an advisor who chairs the student’s research supervisory committee. Graduate students make annual presentations of their research to the Department. All graduate students are required to take one of the Department's four graduate core courses (EES 411, EES 415, EES 426, and EES 484) and five additional courses (15 credits) at the 400-level. M.S. students complete 30 credits of coursework and thesis research and orally defend a written thesis that encompasses the findings and conclusions of their research. Candidates for the Ph.D. must first pass the qualification evaluation in the first year, then defend their dissertation proposal in the General Exam, and finally, orally defend a dissertation. For more details beyond this brief summary, please see the graduate handbook online at: www.ees.lehigh.edu/graduate/grad_handbook.html.

**Research Facilities**

Our Department is well equipped for a broad range of field and laboratory investigations in the Environmental, Ecological, and Geological Sciences. Our laboratories and equipment include:

- Petrographic microscopy facilities, rock-crusher, ball mill, rock saws, and cathodoluminescence and camera lucida digitizing capabilities;
- Laboratory for Ar-Ar, U-Th/He, and fission-track geochronology including dual UV and CO2 lasers, VG 3600 noble-gas mass spectrometer, Balzers quadrupole mass spectrometer, dedicated He and Ar extraction lines with low-blank furnaces, all under full LabVIEW automation;
- A stable isotope geochemistry laboratory equipped with a Finnigan MAT model 252 mass spectrometer (with dual-inlet and carrier gas capabilities), on-line peripherals, and off-line vacuum extraction lines, for O, H, C, and N isotope analyses of silicate minerals and rocks, carbonates, fluid inclusions, and organic matter;
- Equipment for sampling groundwater wells as well as automated samplers for surficial water systems;
- A microbial ecology laboratory (fluorescence and phase contrast microscopy, bioreactors, UV phototron, walk-in controlled environment chambers);
- Field instruments to characterize solar radiation (UV bands, PAR, broadband, and high resolution spectral irradiance with automated shadowband options for diffuse and direct spectral irradiance), water quality & optical properties (Biospherical PUV profilers, YSI datasondes, SCUFA CDOM fluorometers), weather parameters, and hydrology (precise water level, precipitation, wind, humidity, atmospheric pressure, water temperature thermistor chains) plus automated ISCO rain-triggered samplers for applications in aquatic and terrestrial ecosystem studies;
- Aquatic ecology laboratory instruments to characterize water quality and optical properties (pH, specific conductance, dissolved oxygen, UV-VIS spectrophotometers, scanning fluorometer, Turner CDOM/Chlorophyll fluorometer, N & P nutrient analyzer, automated Shimadzu TOC/TN analyzer, CHN analyzer, scintillation counter, photobleaching laboratory, low-carbon water purification system);
- An aqueous geochemistry laboratory with a ThermoElectron X-Series inductively-coupled plasma mass spectrometer with collision cell, and hydride generation apparatus that can be coupled to an HPLC system for species analysis, a Dionex ion chromatograph for simultaneous analysis of anions and cations, a Mercury analyzer for analysis of gaseous and liquid samples, and a Class 100 clean room for ultra trace sample preparation; additional instruments including a Waters computer-assisted ion chromatograph, an ARL 34000 inductively-coupled plasma atomic emission spectrometer, a Netzsch DTA/TGA instrument, and a high-pressure core-holder/column reactor for flow-through experiments;
- A sedimentation and soils analysis laboratory including equipment for particle size analysis;
- A paleomagnetism laboratory with a magnetically shielded room, a 2G superconducting magnetometer and built-in af demagnetizer, Molspin spinner magnetometer, a Schonstedt AF demagnetizer modified to apply pARMs, and an ASC thermal demagnetizer, and a KLY-3S Kappabridge magnetic susceptibility system, and an ASC impulse magnetizer;
- A reflection seismology laboratory has equipment including broadband seismometer linked to global networks; computer workstations for seismic processing, Bison DIFP multi-channel seismograph, various seismic energy sources, and ground-penetrating radar;
- Field geophysical equipment includes a Worden Master gravimeter, and a Geometrics portable proton precession magnetometer;
- Geomorphology lab including a Topcon total station, field cameras, LASCO digitizer, complete airphoto analysis facility, and a flume facility in the CEE hydraulics lab. We also maintain several PC and UNIX computer labs devoted to GIS (ArcGIS) and large spatial digital topographic databases;
- Paleoecological laboratories with facilities for the analysis and photo documentation of tree rings, pollen, macrofossils, and other biological and physical parameters of environmental archives, including lake and peatland sediments;
- A sediment core laboratory with facilities for initial core preparation and core storage, including a walk-in cold room, a GeoTek MultiSensor Core Logger, a VirTis AdsVantage Freeze Dryer and various corers (Livingstone, Mackereth, Giw Gravity, Russian peat Corers);
- A remote sensing laboratory with image processing software, extensive spatial data collections, as well as equipment for measuring field characteristics of important remotely sensed parameters.

**Courses**

**EES 002 (ES 002) Introduction to Environmental Science 3 Credits**

Focuses on natural and human-induced drivers and consequences of environmental change. Exploring options for mitigating and adapting to environmental change in ecosystems, physical and social systems, the course examines such topics as biogeochemical cycles, population pressure, ecosystem diversity, productivity and food security, energy, water resources, climate change, pollution, ozone, urban issues and sustainability. Stress interactions using case studies. Intended for any student with an interest in the environment. May be combined with EES 022 or EES 004 for 4 credits.  
**Attribute/Distribution:** NS

**EES 004 (ES 004) The Science of Environmental Issues 1 Credit**

Analysis of current environmental issues from a scientific perspective. The focus on the course will be weekly discussions based on assigned readings. May be combined with other EES 3 credit courses for 4 credits.  
**Attribute/Distribution:** NS

**EES 011 Environmental Geology 3 Credits**

Analysis of the dynamic interaction of geologic processes and human activities. Catastrophic geologic processes (earthquakes, volcanoes, landslides), pollution of geologic systems, and engineering case studies. May be combined with EES 022 or EES 004 for 4 credits.  
**Attribute/Distribution:** NS
EES 012 Glaciers and Glaciation 3 Credits
An investigation of how cold climates and the associated processes of glaciation and periglacial activity have left their imprint on the Earth. May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: NS

EES 014 Lands of the Midnight Sun 3 Credits
Investigations of polar exploration and science, the environment at high latitudes, and cultures of the Arctic, as well as discussion of issues related to understanding interactions among extreme environments, global change, pollution, and indigenous cultures. Lecture, discussion, classroom activities. May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: NS

EES 015 Volcanoes and the Ring of Fire 3 Credits
Volcanoes are a tangible, often breathtaking, reminder of the inner workings of our restless planet. In this course, we consider the processes leading to volcanic eruptions, the significance of volcanism for long-term Earth evolution, and the hazards volcanoes create for humans, particularly those living in the circum-Pacific (the Ring of Fire). May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: NS

EES 016 Geology of War 3 Credits
Introduction to Earth and Environmental Sciences through a study of the geologic underpinnings of human conflict, the geologic influences over the outcomes of great battles, and the long-term environmental impacts of war. Instructional format includes lectures, discussions, student projects, and a field trip to Gettysburg National Military Park. May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: NS

EES 021 Introduction to Planet Earth 3 Credits
Processes within the Earth and dynamic interactions between the solid earth, the atmosphere, and the oceans. Lectures. May be combined with EES 022 or EES 004.
Attribute/Distribution: NS

EES 022 Exploring Earth 1 Credit
Laboratory course in methods, data acquisition, data analyses and scientific communication relevant to Earth and Environmental Sciences. Building on the framework of the “Earth Science Literacy Initiative” the course introduces students to the foundations of the scientific method, the basic concepts of the Earth systems, and the influence and interaction of the natural world in everyday life. Topics include Hazards, resources, anthropogenic forcing and impacts, biogeochemical cycles and sustainability. May be combined with other EES Courses for 4 credits.
Attribute/Distribution: NS

EES 023 Weather and Climate: Past, Present, and Future 3 Credits
Introduction to the basic principles of meteorology, as they pertain to past, present, and future climates. Earth’s energy balance, cloud formation and precipitation, winds and atmospheric circulation, regional climatologies, past warm periods and ice ages in Earth’s history, the latest ideas about future climate change and global warming. Students will maintain a weather notebook to enable them to relate theory to observations from real weather data. May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: NS

EES 024 Climate Change 3 Credits
Examination and discussion of Earth’s climate history and the multiple interactions among components of the climate system, including ice, water, air, land, and vegetation; review of the causes of climate change at various time scales. Assessment of historical and future climate change and the role of humans in causing climate change, including global warming. May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: NS

EES 025 The Environment and Living Systems 3 Credits
The course will provide an introduction to the role of the environment in regulating living systems at a variety of scales and levels of organization. The role of the environment in regulating and shaping populations, communities, and ecosystems will be explored. In addition, the role of the environment will be discussed as it relates to the origin, evolution, and diversity of life on earth. Whenever possible, the role of anthropogenic environmental change will be discussed as it relates to the above topics. May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: NS

EES 026 Energy – Origins, Impacts, and Options 3 Credits
Critical assessment of current and predicted energy resources used by humans, including their origins, distribution, environmental impacts, and feasibility. Lectures, discussion, field trips. May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: NS

EES 027 Natural Hazards: Impacts and Consequences 3 Credits
Earthquakes, volcanoes, tsunamis, floods, and hurricanes are a natural part of the Earth and our environment. These events have violent consequences for our lives and significant economic implications. This course examines the causes, predictability, and risk mitigation for these events. We will also consider how natural disasters are represented by popular media and whether this helps or hurts public understanding of our dynamic planet and our relationship to it. May be combined with EES 022 or EES 004 for 4.
Attribute/Distribution: NS

EES 028 Conservation and Biodiversity 3 Credits
An introduction to the science of conservation biology. We examine the evolution of biodiversity on earth, spatial patterns of biodiversity, the impact of human activities on biodiversity, and assess strategies for the management and conservation of biodiversity. Students gain the scientific literacy necessary to make informed decisions about topics such as wilderness preservation, species conservation, and land use. May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: NS

EES 029 Human Health and the Environment 3 Credits
An introductory course that explores the connections between the environment and human health. Topics related to human health include climate change, energy production, genome-environment interactions, zoonotic disease, and drinking water chemistry. Introduction to the disciplines of geochemistry, ecology, geospatial data analysis, environmental epidemiology, toxicology, risk assessment, and exposure science. Course format includes a combination of lectures on fundamentals and seminar style topical readings. May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: NS

EES 032 (BIOS 032) Oceanography 3 Credits
An introduction to the structure, composition, and processes of the earth from a marine perspective. Topics include earth structure, plate tectonics, continental margins, coastal processes, seawater chemistry, ocean circulation, wave dynamics, primary productivity, plankton and plants, marine organisms and communities. May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: NS

EES 033 Life from Stardust 3 Credits
An examination of the history of planet Earth and the development of life. Includes the formation of Earth and the evidence for changing conditions in the inter-connected geosphere, hydrosphere, atmosphere, and biosphere over the past 4.5 billion years, and theories for the origin and early evolution of life. Discuss the tools used for the search for life on other planetary bodies, both in our solar system and around other stars. May be combined with EES022 or EES004 for 4 credits.
Attribute/Distribution: NS
EES 042 The Natural History of Costa Rica 3 Credits
The interaction of ecology, geology, and climate shaping the natural history of Costa Rica. Population, community, and ecosystem ecology; evolution and natural selection; biodiversity and conservation biology. Offered during the winter inter-term through Lehigh Study Abroad, and involving lectures, electronic media, observations, and field experiences. Consent of instructor required. Limited enrollment. Requires payment of additional program fee and transportation to Costa Rica.
Attribute/Distribution: NS

EES 072 Topics in Earth and Environmental Science 1-4 Credits
Study of topics in earth and environmental science not covered in other introductory courses. Primarily used for transfer credit. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS

EES 080 Introduction to the Earth System 4 Credits
Study of the earth system, including the atmosphere, biosphere, geosphere, and hydrosphere and their interactions (e.g., plate tectonics, biogeochemical cycling, climate, anthropogenic impacts). The course is designed to prepare students for a major in EES and includes a lab that develops important skills including data analysis, modeling, use of maps and geospatial data, and field work. Lectures and lab. Open to declared EES majors and minors. Also open to intended majors and others by departmental permission.
Attribute/Distribution: NS

EES 089 Geographic Analysis of our Changing World 3 Credits
An introduction to maps, spatial data, and electronic tools for geographic analysis. Fundamental geographic and database concepts will include map types, spatial referencing systems, map projection systems, map scale, and database characteristics. Tools including ArcGIS Desktop software and Global Positioning System receivers will be used to acquire and analyze spatially referenced environmental data. Students will use their new skills in geographic analysis to develop an electronic portfolio. May be combined with EES 022 or EES 004 for 4 credits.
Attribute/Distribution: NS

EES 093 Freshman Supervised Internship in Earth and Environmental Sciences 1-2 Credits
Experiential learning opportunities supervised by EES faculty, including fieldwork, data collection or analysis, literature review, and information management. A maximum of two credits is allowed. Consent of supervising faculty required.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

EES 115 Surficial Processes 4 Credits
An introduction to process geomorphology and sedimentology that emphasizes the dynamic interactions of climate, tectonics, and watershed hydrology on the erosional, transportational, depositional, and biological processes that shape landscapes. Includes a field and computer-intensive lab.
Prerequisites: EES 080
Can be taken Concurrently: EES 080
Attribute/Distribution: NS

EES 131 Introduction to Rocks and Minerals 4 Credits
Hand-specimen identification of the major mineral groups and rock types. Atomic structure of minerals; relationship of mineral structure to chemical and physical properties. Placement of igneous, sedimentary, and metamorphic rocks into a plate tectonics context. Introduction to optical mineralogy and x-ray diffraction techniques. Lectures, laboratories, field trips.
Prerequisites: EES 080 or (EES 021 and EES 022)
Can be taken Concurrently: EES 080
Attribute/Distribution: NS

EES 152 Ecology 4 Credits
The study of relationships among organisms and their physical environment. Ecology of individual organisms, populations, communities, ecosystems, landscapes, and the biosphere. Topics include organism adaptations and natural selection, life histories, population growth and dynamics, species interactions, energy flow, nutrient cycling, and ecological impacts of human activities. Field-based laboratories focus on the quantitative study of biological populations and communities. Lectures, field-based laboratories, and applied activities.
Prerequisites: EES 025 or EES 028 or EES 080
Can be taken Concurrently: EES 025, EES 028, EES 080
Attribute/Distribution: NS

EES 172 Topics in Earth & Environmental Science 1-4 Credits
Study of topics in earth and environmental science not covered in other 100-level courses. Primarily used for transfer credit. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS

EES 200 Earth History 4 Credits
Review of the coevolution of Earth, life, climate, and the environment, and introduction to the records used to constrain this history. The course addresses environmental changes at both geologic and human time spans. Includes laboratory exercises and field trips.
Prerequisites: EES 080
Attribute/Distribution: NS

EES 201 Seismology: The Earth and Environment 4 Credits
An examination of how earthquakes and active source seismology are used to understand the Earth beneath our feet. Fundamentals of seismic wave propagation in the Earth. Study of earthquakes, and reflection and refraction techniques at a variety of scales: near-surface, crustal, lithospheric, and whole Earth. Practical applications to both earth and environmental science, experiment design, data collection, processing, analysis and interpretation. Field and laboratory projects.
Prerequisites: EES 080 and EES 115 and EES 131
Can be taken Concurrently: EES 115
Attribute/Distribution: NS

EES 223 Structural Geology and Tectonics 4 Credits
Material behavior of rocks and the architecture of the Earth's crust. Plate tectonic processes and plate margin deformation. Introduction to geologic maps and field techniques. Lectures, laboratories, and one or two weekend field trips.
Prerequisites: EES 115 or EES 131
Can be taken Concurrently: EES 131

EES 250 Terrestrial Ecosystems 4 Credits
Ecosystem ecology in the context of the Earth system; discussion of mechanisms by which terrestrial ecosystems function, including the flow of water and energy and the cycling of carbon and nutrients; characterization of temporal and spatial patterns in ecosystem processes and their sensitivity to environmental and biotic changes; integration of global scale effects of these processes. Includes lectures, field trips and laboratories.
Prerequisites: EES 115 or EES 152

EES 293 Supervised Internship in Earth and Environmental Sciences 1-4 Credits
Experiential learning opportunities supervised by EES faculty, including data collection or analysis, literature review, and/or information management most likely as part of a longterm, continued project. The student should submit a work plan that describes activities involved and credits requested. A maximum of four credits of EES 293 and no more than eight credits combined from EES 093, EES 293 and 393 may be applied to EES B.A. and B.S. degrees (additional credits apply to free electives). Consent of supervising faculty required.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS
EES 300 Apprentice Teaching 3 Credits

EES 306 Geologic Records of Environmental Change 3,4 Credits
This course provides an overview of high-resolution geologic records of environmental and global change, how they are analyzed, and how they can be used in a variety of disciplines. Time series analysis, age control, completeness of sequences, and correlation of records will be covered. A class project will use acquisition and analysis of environmental magnetic data to demonstrate how records of global and environmental change are constructed.
Prerequisites: EES 080 and EES 115
Attribute/Distribution: NS

EES 316 (CEE 316) Hydrogeology 3,4 Credits
Water plays a critical role in the physical, chemical, and biological processes that occur at the Earth's surface. This course is an introduction to surface and groundwater hydrology in natural systems, providing fundamental concepts and a process-level understanding using the hydrologic cycle as a framework. Geochemistry will be integrated to address natural variations and the human impact on the environment. Topics covered include: watershed hydrology, regional and local groundwater flow, water chemistry, and management of water resources. Lectures and laboratory.
Prerequisites: (EES 080 and EES 115 or EES 131 or EES 152) or (CEE 170)
Can be taken Concurrently: EES 115, EES 131, EES 152
Attribute/Distribution: NS

EES 318 Geographic Analysis in EES 3,4 Credits
Techniques for acquisition, manipulation and integration of data in Geographic Information System (GIS) environment, with emphasis on statistical and spatial analysis. Traditional and digital maps, spatial data collection and integration, geodesy concepts and time series analysis will be applied to case studies and projects relevant to EES subjects, environmental sciences, and other disciplines according to the diversity of the audience. Different OS platforms and software will be used throughout the course. Includes lectures and laboratory exercises.
Prerequisites: (EES 080 and (EES 115 or EES 152), ) or EES 319
Attribute/Distribution: NS

EES 320 (CEE 320) Engineering Hydrology 3 Credits
Prerequisites: (CEE 222)
Attribute/Distribution: NS

EES 323 (CEE 323) Environmental Groundwater Hydrology 3 Credits
The study of subsurface water, its environment, distribution, and movement. Included are flow patterns, well hydraulics, and an introduction to the management of contaminants. Design problems are included to simulate flow with analytical and numerical models, and contaminant migration using analytical models.
Prerequisites: CEE 122 or CEE 316 or EES 316 or ME 231 or CHE 044

EES 325 Remote Sensing of Terrestrial and Aquatic Environments 3,4 Credits
Techniques of observing the Earth from air- and space-borne instruments, including issues of geometry and scale associated with making measurements, electromagnetic properties of Earth surface materials, the range of instruments used to observe the Earth, image interpretation, and applications of satellite remote sensing to geological, ecological, and environmental questions. Lecture and lab.
Prerequisites: (EES 080 and (EES 115 or EES 152 or EES 131), ) or EES 319
Attribute/Distribution: NS

EES 327 (CEE 327) Surface Water Quality Modeling 3 Credits
Fundamentals of modeling water quality parameters in receiving water bodies, including rivers, lakes, and estuaries. Modeling of dissolved oxygen, nutrients, temperature, and toxic substances. Emphasis on water quality control decisions as well as mechanics and model building.
Prerequisites: (CEE 122 or ME 231 or CHE 044) and CEE 222

EES 334 Geosphere Structure and Evolution 3,4 Credits
Synthesis of the state of knowledge of Earth structure and long-term evolution, with emphasis on the crust and mantle, and integrating petrologic, geophysical, and geochemical perspectives. Mass and energy transfer through time among the crust, mantle, hydrosphere, biosphere, and atmosphere. Petrographic study of selected rock suites, and introduction to geophysical observations of the deep structure of the solid Earth. Lectures, discussion, laboratories, field trip.
Prerequisites: EES 080 and EES 115 and EES 131
Attribute/Distribution: NS

EES 341 Field Camp in Earth and Environmental Sciences 6 Credits
Integrated, capstone field experience for Earth and Environmental scientists using the diverse natural settings of the Rocky Mountains as the classroom. Projects challenge students to synthesize field data in solving real science problems. Projects include but not limited to classic and computer-based geologic mapping, section measuring, structural analysis, stream hydrology, sediment transport. Five weeks in the field; summer session. Students must apply through the Lehigh Field Camp Program, consent of Field Camp director required. Must have declared major in EES.
Prerequisites: EES 131 and EES 115 and EES 223 and EES 316
Attribute/Distribution: NS

EES 342 Atmospheric Science 3,4 Credits
An intermediate course on the basic principles of meteorology. The course considers atmospheric structure and composition, earth's energy balance and radiation laws, cloud formation and precipitation, atmospheric motion and circulation, including jet streams and planetary waves, atmospheric stability, frontal systems and air masses, regional climatologies, weather and climate modeling, and the latest ideas about future climate change and global warming. Students will view daily atmospheric charts to enable them to relate theory to observations from real weather data.
Prerequisites: EES 080 and EES 200 and MATH 021
Attribute/Distribution: NS

EES 352 Limnology 3,4 Credits
Study of inland waters, incorporating physical, chemical, and biological aspects of the environment. The origin and morphology of lakes; light, heat, carbon, salinity, nutrients (N+P), dissolved gases, primary production, and secondary production. Emphasis is on lakes, but watersheds, streams and wetlands are also considered. Relies heavily on laboratory exercises and data analysis to underscore concepts in limnology.
Attribute/Distribution: NS

EES 357 Paleocology and Landscape History 3,4 Credits
Principles and methodologies of paleoecology, with emphasis on palynology. Applications of paleo-records in tracing flora, vegetation, climate and landscape history. Long-term ecological interactions and ecosystem responses to past environmental change. Field and laboratory experiences in collecting and characterizing sediments and interpreting pollen and other proxy data. Students will explore regional vegetation, climate and landscape history by coring and analyzing sediments from lakes and wetlands. Requires one or more weekend day-long field trips.
Prerequisites: EES 080 or EES 115 or EES 152 or EES 250
Attribute/Distribution: NS

EES 358 Microbial Ecology 3,4 Credits
The role of microorganisms in the environment. Topics include: Survey of microbial classification, structure, and metabolism; study of microbes at population, community, and ecosystem levels of organization; the role of microbes in biogeochemical cycles; application of microbes to bioremediation and resource recovery problems.
Prerequisites: EES 132
Attribute/Distribution: NS
EES 363 Volcanology 3,4 Credits
Volcanic eruptions can result in devastating effects on both a regional and a global scale. This course will examine physical dynamics that control eruptive processes at active volcanoes. Topics will include the role of volatiles, magma decompression, magma chamber and conduit dynamics, magma rheology, crystallization, fragmentation criteria, and transitions from explosive to effusive behavior. We will examine specifically how geochemical/textural analyses of volcanic rocks and minerals can provide quantifiable information on eruption processes.
Prerequisites: EES 131 and EES 115
Attribute/Distribution: NS

EES 364 Glacial and Periglacial Processes 4 Credits
The mineral ice. The formation, deformation and flow of glaciers. Erosion and deposition by glaciers and glacial meltwater. Subglacial processes. Distribution and age of Quaternary glacial deposits. Quaternary dating techniques and periglacial processes. A three day required field trip, recitations, readings from the primary literature and student presentations augment instructor lectures.
Prerequisites: EES 131 and EES 115
Attribute/Distribution: NS

EES 371 Methods in Water Quality Analysis 3,4 Credits
Survey of methods used in water quality analysis. The course will include: (1) theory and application of standard techniques and instrumentation, (2) quantitative analysis or modeling of existing or acquired data sets, and (3) data presentation and scientific report writing. Fulfills college writing intensive course requirements. Includes both lectures and laboratories.
Prerequisites: CHM 025
Attribute/Distribution: NS

EES 372 Topics in Earth & Environmental Science 1-4 Credits
Study of topics in earth and environmental science not covered in other 300-level courses. Primarily used for transfer credit. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS

EES 376 Geochemistry of Natural Waters 3,4 Credits
Introduction to aqueous geochemistry. Applications of thermodynamics, mass balance, systems science, and kinetics to understanding mineral-water interactions in natural aquatic systems on a variety of spatial and temporal scales. Laboratories emphasize analytical and computer methods. Lectures, and seminar/laboratory.
Prerequisites: EES 080 and EES 115
Can be taken Concurrently: EES 080
Attribute/Distribution: NS

EES 379 (CEE 379) Environmental Case Studies 3-4 Credits
Case studies will be used to explore the impact of politics, economics, society, technology, and ethics on environmental projects and preferences. Environmental issues in both affluent and developing countries. Multidisciplinary student teams investigate site characterization; environmental remediation design; environmental policy; and political, financial, social, and ethical implications of environmental projects.
Prerequisites: (EES 022 or CEE 276 or CHE 276)
Attribute/Distribution: NS

EES 380 The Practice of Science 1 Credit
The knowledge, skills, and discipline of mind developed in the Earth and Environmental Sciences major present students with a number of opportunities and career paths. Students will explore a variety of career paths and further develop professional skills. The seminar explores strategies for applying to graduate school or for a job, professional ethics and responsibility, and the methods and process of effective communication. Must have EES Major and senior standing.
Attribute/Distribution: NS

EES 386 Wetland Ecology 3,4 Credits
Ecology of wetlands and factors controlling wetland structure and function. Responses and feedbacks of wetlands to natural and human-induced environmental variability. Topics include wetland classification and delineation, origin and development of wetlands, biotic adaptations to the wetland environment, wetland hydrology, wetland biogeochemistry and microbial communities, wetland vegetation dynamics, and wetland restoration. Lectures, laboratories, applied activities, and field trips.
Prerequisites: EES 152
Attribute/Distribution: NS

EES 393 Supervised Research in Earth and Environmental Sciences 1-4 Credits
Research opportunities supervised by EES faculty to carry out a well-defined project, including exposure to problem definition, selection of research approach, and communication of results. The student should prepare a proposal and, if taking 3 or more credits, should present the results at Undergraduate Research Symposium and write a research thesis. Both proposal and thesis are filed with EES Department. No more than eight credits may be applied to EES B.A. and B.S. degrees (additional credits apply to free electives). Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS

EES 402 (ES 402) Scientific Foundations for Environmental Policy Design 3 Credits
This course explores the science behind the environmental issues that bear on policy process at local, national and global scales. The course delves into the science of selected environmental issues that have either arisen from anthropogenic activities, that impact social systems, or that help policy-makers understand the consequence of different policy options. The course consists of readings and discussions of timely topics and one major project.
Attribute/Distribution: NS

EES 403 Earth System Modeling 3 Credits
This course will introduce the concepts behind computer modeling, including deterministic vs stochastic, stocks and fluxes, finite differencing, initial and boundary conditions, sensitivity, feedbacks, calibration, validation, and uncertainty. We will apply these ideas to projects of interest to students in the course, and may include any of the components of the earth system. Students will learn both agent-based and systems dynamics modeling using NetLogo, Stella, and Excel, simple programming with C++, and research-oriented models as their independent research projects allow.
Repeat Status: Course may be repeated.

EES 405 Paleo- and Environmental Magnetism 3 Credits
Topics in paleomagnetism and environmental magnetism. Class will design and conduct a research project, read the relevant literature and write a research paper. Consent of instructor required.

EES 407 Seismology 3 Credits
Seminar on advanced topics in seismology, review of classic and current literature. Topics include but are not limited to: wave propagation in ideal media and earth materials, seismic imaging of complex structures, tomography, modeling, and high-resolution seismic imaging. Must have completed an introductory geophysics course.

EES 411 Physical and Chemical Processes at the Earth’s Surface 3 Credits
An advanced treatment of physical and chemical processes and their interaction in the critical zone. Quantitative methods, modeling, and process-oriented approaches are presented in a systems context from the meter, to watershed, to continental scale. Topics include weathering and soils, chemical and physical fluxes from watersheds, and global hydrology and erosion.

EES 412 Advanced Fluvial and Tectonic Geomorphology 3 Credits
Lecture, seminar, lab, and field-based investigation of the classic and contemporary geomorphologic literature using the processes and evolution of a watershed and its dynamic interaction with tectonics as an integrative common theme. Topics change according to student interest but typically include active tectonics, fluvial processes, landscape response to climate, and biogeomorphology. Include ArcGIS training, field trips, flume analogue modeling, and class projects with the goal of a published paper.
EES 414 Glacial and Quaternary Geology 3 Credits
Study of the origin, distribution, and movement of present and past glaciers. Special emphasis on glacial land forms and deposits, Quaternary stratigraphy and dating techniques, periglacial phenomena, and Pleistocene environments. Lectures and required field trips. Consent of instructor required.

EES 415 Paleoclimatology 3 Credits
Overview of climate system, including energy budget, feedbacks, atmospheric and ocean circulations, and their interactions. Earth’s climate history and mechanisms of past climate variations at various time scales, with emphasis on late Quaternary. Lectures, presentations and discussion of recent literature, especially on approaches to studying climate change and paleo-perspectives on ongoing climate change. Must have graduate standing in EES, or consent of course instructor. Repeat Status: Course may be repeated.

EES 426 Tectonic Processes 3 Credits
Current models of tectonic processes in intraplate settings and at plate boundaries. Critical evaluations by the class of the geological, geochemical and geophysical data sets which gave rise to these models. Must have graduate standing in EES, or consent of department chairperson.

EES 427 Orogenic Belts 3 Credits
Geometry, kinematics, and mechanics of orogenic belts. will explore current paradigms of depositional, deformational, and metamorphic processes in the Earth’s crust. Lectures, seminars, and field trips. Topically variable Consent of instructor required. Repeat Status: Course may be repeated.

EES 429 Methods and Applications of Geochronology 3 Credits
Examination of isotopic techniques used to measure geologic time, and their applications. Lectures, laboratories, research projects, field trips. Must have graduate standing in EES. Repeat Status: Course may be repeated.

EES 438 Petrogenetic Processes 3 Credits
Metamorphism, melting, and magmatism in the Earth’s crust and mantle. Tectonic evolution, crust-mantle heat and mass transfer, fluid-rock interactions, and rate processes. Varying combinations of lecture and seminar formats. May be repeated for credit when topics differ. May include laboratory and field experience and computational exercises. Consent of instructor required. Repeat Status: Course may be repeated.

EES 446 Human-Climate Interactions 3 Credits
This course explores climatic impacts of human activity, along with feedbacks between climate change and the land/sea surface, hydrology, productivity, etc., in the context of assessing both the causes and societal consequences of climate change. Such consequences include storm frequency, SSTs, floods/droughts, sea level rise, etc. Emphasis is placed on understanding the processes controlling climate response greenhouse gases, land cover, and land-atmosphere / ocean-atmosphere mass and energy exchanges.

EES 453 Advanced Microbial Ecology 3 Credits
Lectures and seminars will focus on topics of current interest in the microbial ecology of pelagic (freshwater and marine), sediment, and/or soil environments. Emphasis will be placed on the role of microbes in ecosystems level processes such as energy transformations and elemental cycling. May include laboratory and field exercises. Must have graduate standing or consent of course instructor.

EES 457 Advanced Remote Sensing of the Environment 3 Credits
Seminars and hands-on, quantitative analysis of specialized satellite and aircraft data, including microwave and hyperspectral sources, will be used to investigate significant environmental questions. Students will refine visual and technical skills for image interpretation, digital image processing, change detection of environmental systems, and presentation of spatial data. Required research project. Must have graduate standing in EES or consent of the instructor.

EES 459 Reconstructing Environmental Change 3 Credits
Lectures, seminars, and in-depth discussion on current issues and selected topics in Quaternary paleoecology and paleoclimatology. Survey of techniques in studying and reconstructing environmental changes and biological responses. Use of multiple proxy data from paleo-archives (e.g., ice cores, lake sediments) to address nature of past climate variability. Quantitative analyses of paleo-records to test paleoeological hypothesis (e.g., multivariate analysis) and to infer possible causes and forcing mechanisms of past climate change (e.g., time series analysis). May include field and laboratory exercises.

EES 471 Stable Isotope Chemistry - Theory, Techniques, and Applications in Earth and Environmental Sciences 3 Credits
Distributions of stable isotopes (primarily of O, H, C, S, and N) in the lithosphere, hydrosphere, biosphere, and atmosphere. Topics include mechanisms of fractionation and mixing, advancements in techniques for extractions and mass spectrometry, and recent applications of stable isotopes in the earth and environmental sciences. Lectures, seminars, laboratory sessions. Consent of instructor required.

EES 473 Aquaeous Geochemistry 3 Credits
Advanced study of the equilibria and kinetics of chemical reactions occurring at the earth’s surface. A review of concepts in geochemistry including activity, solubility, thermodynamics, kinetics, and oxidation-reduction reactions is followed by readings from the literature. Topics covered depend on student interest, and have included chemical weathering, chemical evolution of surface and groundwater, acid mine drainage, trace element chemistry, biogeochemical cycles, and ocean chemistry. Must have graduate standing in EES or consent of instructor. Repeat Status: Course may be repeated.

EES 477 Chemical and Geological Oceanography 3 Credits
This course will investigate the pathways that chemical species follow on their transit through the world’s oceans, and related geologic processes. Fundamental principles will be combined with quantitative approaches to construct mass balance models across boundaries including the atmosphere, rivers, groundwater, and hydrothermal systems. Chemistry topics, including seawater composition, isotope tracers, ocean circulation, carbonate chemistry and biogeochemical cycling, will be linked with geology topics, including sedimentation and the formation of basaltic crust of the seafloor via igneous petrogenesis and volcanism.

EES 484 Ecosystem Processes 3 Credits
Theoretical and experimental approaches to investigate ecosystem processes at local, regional, and global scales. Emphasis on interactions among physical, chemical, and biotic components of ecosystems. Must have graduate standing in EES.

EES 485 Advanced Topics in Geophysics 1-6 Credits
Intensive study of topics in geophysics not covered in more general courses. Repeat Status: Course may be repeated.

EES 490 Thesis Research 1-6 Credits
Masters’ thesis research directed by research committee. 3-6 credits required for EES M.S. programs. Consent of research advisor required. Repeat Status: Course may be repeated.

EES 491 Investigations in Earth and Environmental Sciences 1-3 Credits
Research on a special problem; field, laboratory, or library study; report required. Credit above three hours granted only when a different problem is undertaken.

EES 492 Advanced Topics in Modern and Quaternary Processes 3 Credits
Intensive study of topics in modern and Quaternary geology not covered in more general courses. Repeat Status: Course may be repeated.

EES 493 Advanced Topics in Tectonics 1-6 Credits
Intensive study of tectonic processes and products not covered in more general courses. Repeat Status: Course may be repeated.
ECK 282 Independent Study 2-4 Credits
Directed readings for Eckardt Scholars. Requires consent of program director.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

ECK 389 Honors Project for Eckardt Scholars 1-8 Credits
Opportunity for Eckardt Scholars to pursue an extended project for senior honors. Transcript will identify department in which project was completed. Consent of department required.
Repeat Status: Course may be repeated.

English
The Department of English has developed a focus on Literature and Social Justice, the outcome of a multi-year effort to revitalize the traditional period-based approach to literary studies. Our classes foster a series of related activities: an exploration of how studying literature contributes to questions of social justice; an immersion in historical periods informed by strong theoretical commitments; an engagement with contemporary literature and culture; and an emphasis on theorized pedagogy, reflective practice, and the scholar-teacher model. Our faculty interact with Lehigh's varied interdisciplinary programs, including Africana Studies; Classics; Women, Gender, and Sexuality Studies; Jewish Studies; and American Studies.

Professors. Elizabeth A. Dolan, PHD (University of North Carolina at Chapel Hill); Scott Paul Gordon, PHD (Harvard University); Dawn E. Keetley, PHD (University Wisconsin-Madison); Barry M. Kroll, PHD (University of Michigan); Seth Moglen, PHD (University of California, Berkeley); Barbara R. Pavlock, PHD (Cornell University); Amardeep Singh, PHD (Duke University); Edward Whitley, PHD (University of Maryland, College Park)

Associate Professors. Katherine Crassons, PHD (Duke University); Lyndon Dominique, PHD (Princeton University); Suzanne Edwards, PHD (University of Chicago); Mary C. Foltz, PHD (State University of NY at Buffalo); David Michael Kramph, PHD (Washington State University); Jenna D. Lay, PHD (Stanford University); Edward E. Lotto, PHD (Indiana University East); Stephanie Powell Watts, PHD (University of Missouri Columbia); Bobby Michael Watts, PHD (University of Missouri Columbia)

Assistant Professors. Marilisa Jimenez, PHD (University of Florida); Brooke Elyse Rollins, PHD (University of South Carolina); Lorenzo Servitje, PHD (California State University); Emily Weissbourd, PHD (University of Pennsylvania)

Professor Of Practice. Mark Ouellette, PHD (University of Pennsylvania)

Emeriti. Rosemarie Arbur, PHD (University of Illinois at Chicago); Peter G. Beidler, PHD (Lehigh University); Addison C. Bross, PHD (Louisiana State University at Eunice); Jack A. DeBellis, PHD (University of California Los Angeles); Jan S. Ferguson, PHD (City University of New York); Elizabeth Fifer, PHD (University of Michigan); Edward J. Gallagher, PHD (University of Notre Dame); Rosemary J. Munden, PHD (University of California Los Angeles); Barbara H. Traister, PHD (Yale University); John F. Vickrey, PHD (Indiana University)

UNDERGRADUATE MAJOR IN ENGLISH
The major in English is designed to give students experience in reading analyzing, and formulating thoughts about people and ideas that matter; an understanding of how literary artists find the appropriate words to express their thoughts and feelings; and a basic knowledge of the historical development of British, American, and world literature.

Students who major in English go on to careers in teaching, writing, law, business, science, medicine, engineering–and many others. The analytical and communication skills acquired in the study of literature and writing will be of use in almost any profession or human activity.

Depending on their interests, abilities, and career plans, students who major in English are encouraged to consider double majors or one as an elective. One of the five courses must be designated as WI.

ENGL 100 Working with Texts
Select four courses, one from each of the following categories: 1

British to 1660
ENGL 125  British Literature I
ENGL 126  British Literature II
ENGL 143  Introduction to Writing Creative Non-Fiction
ENGL 144  Introduction to Writing Fiction
ENGL 170  Amaranth
ENGL 201  Special Topics in Writing
ENGL 342  Advanced Poetry Writing
ENGL 343  Advanced Creative Non-Fiction
ENGL 344  Advanced Fiction Writing
ENGL 345  Advanced Fiction Writing
ENGL 346  Creative Writing and Literary Studies
ENGL 347  Creative Writing Thesis Proposal
ENGL 348  and Creative Writing Thesis

Select one of the following: 1

ENGL 142  Introduction to Writing Poetry
ENGL 143  Introduction to Writing Creative Non-Fiction
ENGL 144  Introduction to Writing Fiction
ENGL 201  Special Topics in Writing
ENGL 342  Advanced Poetry Writing
ENGL 343  Advanced Creative Non-Fiction
ENGL 344  Advanced Fiction Writing
ENGL 345  Advanced Fiction Writing
ENGL 346  Creative Writing and Literary Studies
ENGL 347  Creative Writing Thesis Proposal
ENGL 348  and Creative Writing Thesis

Total Credits 16

1 Note: the same course cannot fulfill both the core requirement except in the case of courses that can be repeated for credit—ENGL 201, ENGL 342, ENGL 343 and ENGL 344—which can be taken twice, once for core credit and once as an elective.

DEPARTMENTAL HONORS IN ENGLISH

In order to receive departmental honors the English major must attain a 3.5 grade-point average in courses presented for the major and must complete at least 44 credit hours of course work in English (beyond ENGL 001 and ENGL 002). For the additional credits beyond the 36 required of all English majors, honors students must take the following courses:

ENGL 309  Interpretation: Critical Theory and Practice
ENGL 312  or ENGL 318  Studies in Literary and Cultural Theory
ENGL 307  Undergraduate Thesis Proposal
ENGL 308  Undergraduate Thesis

Total Credits 7-8

Recommendations for students pursuing honors: second-year college competency in at least one foreign language and study abroad experience.

PRESIDENTIAL SCHOLARS

Students who anticipate becoming Presidential Scholars should speak to the Director of Graduate Studies in their junior year.

MINORS IN ENGLISH

The Department of English offers three minors, each requiring 16 hours of course work beyond English 1 and 2. Students' major advisors monitor the minor programs, but students should consult the minor advisor in the Department of English when setting up a minor program.

To minor in English students take 4 courses in literature or film, one at the 300 level.

To minor in creative writing, students take:

Select one of the following: 4

ENGL 142  Introduction to Writing Poetry
ENGL 143  Introduction to Writing Creative Non-Fiction
ENGL 144  Introduction to Writing Fiction
ENGL 201  Special Topics in Writing
ENGL 342  Advanced Poetry Writing
ENGL 343  Advanced Creative Non-Fiction
ENGL 344  Advanced Fiction Writing

Select one of the following: 1

ENGL 142  Introduction to Writing Poetry
ENGL 143  Introduction to Writing Creative Non-Fiction
ENGL 144  Introduction to Writing Fiction
ENGL 201  Special Topics in Writing
ENGL 342  Advanced Poetry Writing
ENGL 343  Advanced Creative Non-Fiction
ENGL 344  Advanced Fiction Writing

Note: Additional courses may be offered that meet distribution requirements; please consult departmental course descriptions each semester for these additions.

1 A student may use a 100-level survey course in British or American literature (123, 124, 125, or 126) to fulfill one period requirement; however, students must still take a total of five courses at the 300-level.

Nine courses (36 credits) are the minimum for the major: ENGL 100: Working with Texts, five courses at the 300 level (one designated WI), and three electives (at any level) including courses in film and one in advanced writing. Many students elect to take additional courses, depending on their career plans, their other majors and minors, their plans to study abroad, and so on. Each major has a departmental advisor to assist in selecting courses and to offer counsel about career plans.

The department strongly recommends that any student contemplating the possibility of advanced study of literature at the graduate level should work toward departmental honors.

ENGLISH MAJOR WITH CONCENTRATION IN CREATIVE WRITING

Minimum number of hours: 16 (4 courses)

To have entered on the transcript Concentration in Creative Writing, the students must take:

Select one of the following:

ENGL 142  Introduction to Writing Poetry
ENGL 143  Introduction to Writing Creative Non-Fiction
ENGL 144  Introduction to Writing Fiction
ENGL 342  Advanced Poetry Writing
ENGL 343  Advanced Creative Non-Fiction
ENGL 344  Advanced Fiction Writing

Select one of the following:

ENGL 345  Advanced Fiction Writing
ENGL 346  Creative Writing and Literary Studies
ENGL 347  Creative Writing Thesis Proposal
ENGL 348  and Creative Writing Thesis

Total Credits 16
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ENGL 170</td>
<td>Amaranth</td>
<td></td>
</tr>
<tr>
<td>ENGL 201</td>
<td>Special Topics in Writing</td>
<td></td>
</tr>
<tr>
<td>ENGL 342</td>
<td>Advanced Poetry Writing</td>
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<tr>
<td>ENGL 343</td>
<td>Advanced Creative Non-Fiction</td>
<td></td>
</tr>
<tr>
<td>ENGL 344</td>
<td>Advanced Fiction Writing</td>
<td></td>
</tr>
<tr>
<td>ENGL 483</td>
<td>Creative Writing and Literary Studies</td>
<td></td>
</tr>
</tbody>
</table>

**Total Credits:** 15

1. Note: the same course cannot fulfill both the core requirements except in the case of a course that can be repeated for credit—ENGL 201, ENGL 342, ENGL 343, and ENGL 344—which can be taken twice, once for core credit and once as an elective.

To minor in writing, students take:

Select one of the following: 4

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 142</td>
<td>Introduction to Writing Poetry</td>
<td>4</td>
</tr>
<tr>
<td>ENGL 143</td>
<td>Introduction to Writing Creative Non-Fiction</td>
<td>4</td>
</tr>
<tr>
<td>ENGL 144</td>
<td>Introduction to Writing Fiction</td>
<td>4</td>
</tr>
<tr>
<td>ENGL 171</td>
<td>Writing for Audiences</td>
<td>4</td>
</tr>
</tbody>
</table>

Select one of the following: 4

<table>
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<tr>
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<tbody>
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<td>Special Topics in Writing</td>
<td>4</td>
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<td>4</td>
</tr>
<tr>
<td>ENGL 343</td>
<td>Advanced Creative Non-Fiction</td>
<td>4</td>
</tr>
<tr>
<td>ENGL 344</td>
<td>Advanced Fiction Writing</td>
<td>4</td>
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</tbody>
</table>

Select two of the following: 8

<table>
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<tr>
<th>Course Code</th>
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</tr>
</thead>
<tbody>
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<td>4</td>
</tr>
<tr>
<td>ENGL 344</td>
<td>Advanced Fiction Writing</td>
<td>4</td>
</tr>
</tbody>
</table>

**Total Credits:** 16

1. Note: the same course cannot fulfill both the core requirements except in the case of a course that can be repeated for credit—ENGL 201, ENGL 342, ENGL 343, and ENGL 344—which can be taken twice, once for core credit and once as an elective.

**FILM STUDIES MINOR**

The minor will consist of four courses (15-16 credits) and will include FILM 001 Introduction to Film, a course on non-English-language film, and two electives, one of which may be a course in the production of visual images or film.

**FILM 001 Introduction to Film** 4

One course focused on non-English-language film/film traditions 4

Electives 1, 2, 3 4

**Total Credits:** 15-16

1. Students must take FILM 001 Introduction to Film prior to completing 300-level coursework.
2. At least 4 elective credits must be at the 300 level.
3. Courses taken during study abroad may fulfill elective requirement with Program Director approval.

**ELECTIVES**

Electives

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FILM/ART 007</td>
<td>Digital Photography I</td>
<td>4</td>
</tr>
<tr>
<td>FILM/ART 052</td>
<td>Introduction to Video Recording and Editing</td>
<td>4</td>
</tr>
<tr>
<td>FILM/MLL 100</td>
<td>The Sports Documentary</td>
<td>4</td>
</tr>
<tr>
<td>FILM/ENGL 119</td>
<td>Introduction to the Horror Film</td>
<td>4</td>
</tr>
<tr>
<td>FILM/PHIL 120</td>
<td>Philosophy and Film</td>
<td>4</td>
</tr>
<tr>
<td>FILM/DG 150</td>
<td>Introduction to Documentary</td>
<td>4</td>
</tr>
<tr>
<td>FILM/ENGL 163</td>
<td>Topics in Film Studies</td>
<td>4</td>
</tr>
<tr>
<td>FILM/MLL/GERM 231</td>
<td>New German Cinema</td>
<td>4</td>
</tr>
<tr>
<td>FILM/FREN 242</td>
<td>The Harem in French and Francophone Literature and Film</td>
<td>4</td>
</tr>
<tr>
<td>FILM/DG 250</td>
<td>Legal and Ethical Issues in Documentary Practice</td>
<td>4</td>
</tr>
<tr>
<td>FILM/SPAN/LAS 265</td>
<td>Spanish and Latin American Cinema</td>
<td>4</td>
</tr>
<tr>
<td>FILM/ART 277</td>
<td>Digital Photography II</td>
<td>4</td>
</tr>
<tr>
<td>FILM/MLL/GERM/WGS/ENG 303</td>
<td>Advanced Studies in the Horror Film</td>
<td>3-4</td>
</tr>
<tr>
<td>FILM/ENG 319</td>
<td>Advanced Studies in the Horror Film</td>
<td>3-4</td>
</tr>
<tr>
<td>FILM/FREN 322</td>
<td>Contemporary French Films</td>
<td>4</td>
</tr>
<tr>
<td>FILM/FREN 325</td>
<td>Illegal immigration in Francophone Literature and Film</td>
<td>4</td>
</tr>
<tr>
<td>FILM/DG 370</td>
<td>Capstone in Documentary Storymaking</td>
<td>4</td>
</tr>
<tr>
<td>FILM 387 FILM 387/ENGL 387</td>
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<td>8</td>
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</table>

**Sophomore Credits**

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<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FILM 001</td>
<td>Digital Photography I</td>
<td>4</td>
</tr>
</tbody>
</table>

**Junior Credits**

One course focused on non-English-language film/film traditions 4

**Elective**

4

**Senior Credits**

Elective 4

**Total Credits:** 16

**FIRST-YEAR COMPOSITION REQUIREMENT**

With the two exceptions noted below, all undergraduate students take six credit hours of freshman English courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 001</td>
<td>Critical Reading and Composition</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 002</td>
<td>Research and Argument</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Credits:** 6

The exceptions are:

- Students may place out of English 1 if they meet departmental criteria.
- Students with English as a Second Language. Categories include students on non-immigrant visas, students on immigrant visas, registered aliens, and citizens either by birth or by naturalization.

Students in all these categories for whom English is not the first language may petition for special instruction through the program in English as a Second Language.

All non-native English speakers will be assessed in their English skills either through the TOEFL or by other means to determine the kind of instruction best suited to their needs. From this determination, matriculating freshmen will either roster ENGL 001 followed by ENGL 002 or be enrolled in ENGL 003, followed by ENGL 005 (or ENGL 002).

Students enrolled in the English as a Second Language program are expected to reach a level of competence comparable to those in the usual freshman program. The form of instruction, however, will differ in the ESL program by taking into account the special language and cultural needs of non-native speakers.
Graduate Work in English

The Department of English has developed a focus on Literature and Social Justice, the outcome of a multi-year effort to revitalize the traditional period-based approach to literary studies. Our graduate programs provide students with skills necessary to recognize how literature and other forms of cultural production intervene in questions of justice and shape our conceptions of the world.

The Master of Arts Program

Candidates for the master’s degree must complete at least 33 credit hours. Students take at least seven of the required courses at the 400 level but may select the balance of their curricula from 300-level course offerings. Course work for the M.A. must include:

- Two courses in pre-1830 literature
- Two courses in post-1830 literature

ENGL 482, Theories of Literature and Social Justice

One additional theory course

This distribution allows for some concentrated study at the master’s level. ENGL 485 and ENGL 486, the required courses for new teaching fellows, are not counted in the 33 credits toward the M.A. but will be counted later toward the Ph.D., even if rostered during the M.A. program.

The Doctor of Philosophy Program

The department admits to its doctoral program only students of proven competence and scholarly promise. An average of 3.5 in M.A. course work and strong endorsements from graduate instructors are minimum requirements for acceptance.

Doctoral candidates with a Lehigh master’s degree are required to take eight courses and register for 42 credit hours beyond the M.A. Those entering the doctoral program with a master’s from another institution are required to take nine courses and register for 48 credit hours.

Candidates must also demonstrate a reading knowledge of one or two foreign languages after having agreed on choices with the director of graduate studies.

No later than six months after completing their course work, candidates will take written and oral examinations in one major field and two minor fields.

Candidates write their dissertations after having their dissertation proposals approved by the department and being admitted to candidacy by the appropriate college.

Graduate Certificate in Composition and Rhetoric

The Graduate Certificate in Composition and Rhetoric is awarded to students in the M.A. or Ph.D. programs in English when they complete a program of training in the theory and practice of composition-rhetoric consisting of 12 credit hours of course work. At least 8 credits must be in graduate seminars or independent studies: English 480 (3 cr.), 481 (3 cr., topic must be in rhetoric), 485 (2 cr.), 491 (1-3 cr.), or 495 (3 cr.).

The other 4 credits may be in seminars, independent studies, and/or any combination of courses in pedagogy, field work, or research: English 486, 487, 488, or 489 (all 1 cr.).

Graduate students in the M.A. program in English will be able to complete the certificate requirements in four semesters alongside their M.A. coursework, by taking a total of 9 or 10 credits each semester; students who proceed from the M.A. to the Ph.D. can spread the courses over additional years. The certificate requires 12 credits of course work. At least 8 credits must be in graduate seminars or independent studies, including English 485 (2 cr., Introduction to Writing Theory); English 480 (3 cr., Composition and Rhetoric); English 481 (3 cr., Theory and Criticism, topic in rhetoric); English 495 (3 cr., Independent Study); or English 491 (1-3 cr., Special Topics in Comp-Rhet); and 4 credits may be in seminars, independent studies, and any combination of 1-credit courses in pedagogy, field work, or research: English 486, 487, 488 (new), and 489 (new), some of which may be repeated for credit.

Sample course of study for M.A. students. Courses for the certificate are italicized and labeled “Comp”; courses for the M.A. in Literature and Social Justice are labeled “Lit.”

Fall, Year 1: Comp: English 485 (2)                    Spring, Year 1: Lit: Theories LSJ (3)
                      Comp: English 486 (1)                    Lit: Post-1830 Lit (3)
                      Lit: Pre-1830 Lit (3)                    Lit: Post-1830 (3)
                      Comp: English 487 (1)                    Lit: MA Thesis (3)
                      Fall, Year 2: Lit: Pre-1830 (3)                 Spring, Year 2: Lit: MA
                      Comp: English 488 (1)                                Elective (3)
                      Elective (3)                                    Lit & Comp: English 481 Rhet Theory (3)
                      Comp: English 489 (1)                                    Lit: Elective (3)
                      Elective (3)                                    Elective (3)

Literature Courses = 30 credits
Composition-Rhetoric Courses = 12 credits (note that English 481, when offered on a topic in Rhetorical Theory, meets requirements for both M.A. in English and Certificate in Composition and Rhetoric).

Undergraduate Courses

ENGL 052, ENGL 054, ENGL 056, ENGL 087 and ENGL 089 are open to all undergraduates, including first-year students also taking freshman English.

Prerequisites: Each literature course is a self-contained unit. Thus, students may roster ENGL 126 whether or not they have had, or ever plan to take, ENGL 125. Creative writing courses may have specific prerequisites as listed below.

Graduate Students Taking 300-Level Courses Receive 3 Credits; Undergraduates Receive 4 Credits.

Graduate Courses in English

Graduate (400-level) courses are seminars, ordinarily limited to no more than twelve graduate students, but undergraduate English majors who are planning to go on to graduate school in English and who have shown proficiency in the study of literature may petition to take one of these seminars in their senior year.

Courses

ENGL 001 Critical Reading and Composition 3 Credits

Introduction to academic writing that supports a claim in respectful conversation with others. Topics drawn from important issues in the world in which students live. The course provides multiple opportunities to engage thoughtfully in the writing process. Students must receive a grade of C- or higher to advance to English 2.

ENGL 002 Research and Argument 3 Credits

Continuation of ENGL 1. Designed to refine the skills of argument and research. Students will make persuasive, thoughtful, and well-supported arguments in a variety of forms, including multi-modal genres. The course provides a number of occasions to think, research, and write about pressing issues of public concern. Must have a grade of C- or higher in English 1.

Prerequisites: (ENGL 001) Attribute/Distribution: ND

ENGL 003 Composition and Literature I for International Writers 3 Credits

Students improve both their advanced academic written English and academic writing style through a process of reading fiction and non-fiction and by writing well-organized, coherent essays for academics. Author citation, style, and written fluency and accuracy are addressed within students’ writing. Enrollment is limited to nonnative speakers; prior academic writing history, English placement testing, and/or ESL director’s recommendation determines placement. Attribute/Distribution: ND
ENGL 005 Composition and Literature II for International Writers 3 Credits
Continuation of English 3. Students practice more advanced methods and modes of writing for academics, including writing and reading for their specific field of study. Students continue to work on advanced written fluency and accuracy of idiomatic language and expression and are taught advanced methods of author citation and source integration.
Prerequisites: (ENGL 003)
Attribute/Distribution: ND

ENGL 011 Seminar in Critical Reading & Writing 3 Credits
English 11 is designed to deepen your skills in critical reading and writing through a close engagement with literary and cultural texts and advanced training in best writing practices. You will make persuasive, thoughtful, and well-supported arguments in a variety of forms.
Prerequisites: APEN or APES or S11 or IBEN or A32 or A10 or (S25 and S26 and S27 )

ENGL 015 Speech Communication for International Speakers of English 1 Credit
Spoken English improvement through the practice of American English in “real contexts.” This course is for first or second year undergrads who have advanced English skills, but who need to improve their advanced communication and idiomatic language skills for the advanced speaking contexts of the American university classroom and campus. Advanced Spoken English accent improvement and academic presentations skills are also practiced as needed.
Attribute/Distribution: ND

ENGL 016 Critical Reading and Composition Recitation 1 Credit
For multilingual speakers of English taking English 001. This recitation class will give students a space to ask questions about English grammar, American rhetorical conventions, academic genres, and the writing process in a small class setting.
Repeat Status: Course may be repeated.
Corequisites: ENGL 001

ENGL 017 Research and Argument Recitation 1 Credit
For multilingual speakers of English taking English 002. This recitation class will give students a space to ask questions about English grammar, American rhetorical conventions, academic genres, and the writing process in a small class setting.
Repeat Status: Course may be repeated.
Corequisites: ENGL 002

ENGL 038 (AAS 038) Introduction to African Literature 3 Credits
Sub-Saharan African literary themes and styles; historical and social contexts, African folktales, oral poetry, colonial protest literature, postcolonial writing, and films on contemporary Africa.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 050 (CLSS 050) Classical Mythology 4 Credits
Introduction to the study of the Greco-Roman myths in their social, political, and historical contexts. Equal emphasis on learning the myths and strategies for interpreting them as important evidence for studying classical antiquity.
Attribute/Distribution: HU

ENGL 052 (CLSS 052) Classical Epic 4 Credits
Study of major epic poems from Greece and Rome. Works include Homer’s Iliad and Odyssey, Apollonius’ Argonautica, Vergil’s Aeneid, and Ovid’s Metamorphoses.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 054 (CLSS 054, THTR 054) Greek Tragedy 4 Credits
Aspects of Greek theater and plays of Aeschylus, Sophocles, and Euripides in their social and intellectual contexts.
Attribute/Distribution: HU

ENGL 056 (CLSS 056) Topics in Greek and Roman Literature 4 Credits
Classical literature in translation, including themes or specific periods in Greek or Roman literature.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 060 (THTR 060) Dramatic Action 4 Credits
How plays are put together; how they work and what they accomplish. Examination of how plot, character, aural and visual elements of production combine to form a unified work across genre, styles and periods. Recommended as a foundation for further studies in design, literature, or performance.
Attribute/Distribution: HU

ENGL 065 (THTR 065) Introduction to Playwriting 4 Credits
An introduction to writing for the stage, with an emphasis on creating characters, exploring story and structure, experimenting with theatrical language, and working within the context of theatrical history and the wider world. This course combines in-class exercises with seminar-style discussion of the student’s work.
Attribute/Distribution: HU

ENGL 089 Popular Literature 4 Credits
The form of literature that has been designated in one way or another as “popular,” such as folklore and detective fiction. May be repeated for credit as content changes. Cannot be taken pass/fail.
Repeat Status: Course may be repeated.

ENGL 091 Special Topics 1-4 Credits
A topic, genre, or approach in literature or writing not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 100 Working with Texts 4 Credits
A course to help students to become, through intense practice, independent readers of literary and other kinds of texts; to discern and describe the devices and process by which texts establish meaning; to gain an awareness of the various methods and strategies for reading and interpreting texts; to construct and argue original interpretations; to examine and judge the interpretations of other readers; to write the interpretive essay that supports a distinct position on some literary topic of importance; and to learn to find and assimilate into their own writing appropriate information from university library resources. To be rostered as early as possible in the English major’s program.
Attribute/Distribution: HU

ENGL 102 (AAS 102, JST 102, REL 102) Promised Lands: Jewish and African American Children’s Literature 4 Credits
In the Hebrew Bible, Psalm 137 asks, “How can we sing the Lord’s song in a strange land?” For Jews, blacks, and black Jews, this was and is a poignant question. This course examines how these two rich, often overlapping and interacting groups tell their stories in literature for children and young adults, with a particular focus on the mediation of traumatic pasts. What does it mean to imagine promised lands beyond such pasts—and can they be reached?
Attribute/Distribution: HU

ENGL 104 (WGSS 104) Special Topics in Gender Studies 4 Credits
This course will involve extended study in a sub-area of English language culture, and literature with a focus on gender, sexuality, and/or race/ethnicity.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 105 (LAS 105) Intro to Latino/a Literature and Culture 4 Credits
This course provides an overview of the literary history and criticism of Latino/a literature and media. Through a combination of critical and literary theory, we will focus on works Latino/a-centered texts including poetry, prose, film, and television which portray issues of migration/immigration, colonialism, history, race, and gender. We will also examine the role of literature in the development of Latino/a Studies. Authors and scholars featured in the course include José Martí, Pura Belpré, Pedro Pietri, the Young Lords Party,..
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<td>ENGL 115 (HMS 115) Topics in Literature, Medicine, and Health 4 Credits</td>
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<td>ENGL 119 (FILM 119) Introduction to the Horror Film 4 Credits</td>
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<td>ENGL 120 Literature from Developing Nations 4 Credits</td>
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<td>ENGL 121 (AAS 121) Topics in African-American Literature 4 Credits</td>
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<td>ENGL 127 (THTR 127) History of Theatre I 4 Credits</td>
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<td>ENGL 135 Playwriting II 4 Credits</td>
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<td>ENGL 142 Introduction to Writing Poetry 4 Credits</td>
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<td>ENGL 144 Introduction to Writing Fiction 4 Credits</td>
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<td>ENGL 155 The Novel 4 Credits</td>
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<td>ENGL 157 Poetry 4 Credits</td>
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<td>ENGL 163 (FILM 163) Topics in Film Studies 4 Credits</td>
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<td>ENGL 170 Amaranth 1 Credit</td>
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<td>ENGL 171 Writing for Audiences 4 Credits</td>
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<td>ENGL 175 Individual Authors 4 Credits</td>
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<td>ENGL 177 Individual Works 4 Credits</td>
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<td>ENGL 183 Independent Study 1-4 Credits</td>
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Largely focused on narratives about health, illness and disability, this course will examine individual experiences with attention to social context. Topics may include the physician/patient relationship, illness and deviance, plague literature, gender and medicine, autism, AIDS, mental illness, aging.

Repeat Status: Course may be repeated.

Attribute/Distribution: HU

Examination of the horror film from beginnings to the present, including classic horror of the 1930s, the slasher film in the 1970s, the self-reflexive horror of the 1990s, the faux-documentary horror at the end of the 20th century, and the renaissance of the genre in our contemporary world, from so-called torture porn" to the return of the "possession" film. The course will focus on U.S. film but will sometimes include the highly influential horror traditions of other countries.

Repeat Status: Course may be repeated.

Attribute/Distribution: HU

Contemporary literature from Africa, Central America, South America, or Asia. Must have completed six hours of first-year English. Cannot be taken pass/fail.

Attribute/Distribution: HU

Selected works of African American literature and/or the literatures of the African diaspora. Must have completed six hours of freshman English. Repeat Status: Course may be repeated.

Attribute/Distribution: HU

Masterpieces of American literature from the 17th through the mid-19th century.

Attribute/Distribution: HU

Masterpieces of American literature from the middle of the 19th century to the present.

Attribute/Distribution: HU

British literature and literary history from Beowulf through the Pre-Romantics.

Attribute/Distribution: HU

British literature and literary history from the Romantic period into the 20th century.

Attribute/Distribution: HU

A multi-cultural survey of dramatic literature and theatrical practice from its ritual origins to the 18th century.

Attribute/Distribution: HU

A multi-cultural survey of dramatic literature theatre and theatrical practice from the 18th century to the present day.

Attribute/Distribution: HU

For students interested in continuing and deepening their writing for the stage. Instructor approval required.

Attribute/Distribution: HU

Survey of African American prose narrative and poetry from the 18th century to the present. Features writers from the Harlem Renaissance, the Black Arts Movement, and the post-Black Power era.

Attribute/Distribution: HU

Instruction in the craft of writing poetry, with a focus on prosody. Practice in and classroom criticism of poems written by students taking the course. Must have completed six hours of freshman English.

Repeat Status: Course may be repeated.

Attribute/Distribution: ND

Practice in writing non-fiction from immediate experience, with emphasis on accurate, persuasive description writing. Must have completed six hours of freshman English.

Repeat Status: Course may be repeated.

Attribute/Distribution: ND

Instruction in the craft of writing fiction. Practice in and classroom criticism of stories written by students taking the course. Must have completed six hours of freshman English.

Repeat Status: Course may be repeated.

Attribute/Distribution: ND

Selected novels, with attention to such matters as narrative, characterization, and cultural context.

Attribute/Distribution: HU

Selected traditional and modern poetry, with attention to voice, form, and cultural context.

Attribute/Distribution: HU

History and aesthetics of narrative film. May be repeated for credit as subject varies.

Repeat Status: Course may be repeated.

Attribute/Distribution: HU

Amaranth editorial staff. Students can earn one credit by serving as editors (literary, production, or art) of Lehigh's literary magazine. Work includes soliciting and reviewing manuscripts, planning a winter supplement and spring issue, and guiding the magazine through all phases of production. Editors attend weekly meetings with the faculty advisor. Consent of department chair required.

Repeat Status: Course may be repeated.

Attribute/Distribution: ND

Practice in writing in a variety of discourse modes for different audiences. Consideration of the role of style, clarity, and careful observation in writing. Course may be repeated as topics vary.

Repeat Status: Course may be repeated.

Attribute/Distribution: ND

Intensive study of the works of one or more literary artists, such as Jane Austen, Ernest Hemingway, or Toni Morrison. May be repeated for credit as writers and texts vary.

Repeat Status: Course may be repeated.

Attribute/Distribution: HU

Intensive study of one or more literary works, such as Moby Dick, and study of other major texts such as the Bible with attention to literary form.

Repeat Status: Course may be repeated.

Attribute/Distribution: HU

Individually supervised study of a topic in literature, film, or writing not covered in regularly listed courses. Consent of department chair required.

Repeat Status: Course may be repeated.

Attribute/Distribution: HU
ENGL 187 Themes in Literature 4 Credits
Study of a theme as it appears in several works of literature, such as Love in the Middle Ages.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 189 Popular Literature 4 Credits
Literature that has been designated in one way or another as “popular,” such as science fiction or graphic narrative.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 191 Special Topics 1-4 Credits
A topic, genre, or approach in literature or writing not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 201 Special Topics in Writing 1-4 Credits
Approaches not covered in other writing courses. Individual projects.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

ENGL 202 (GS 202, LAS 202, MLL 202) Latin America In Fact, In Fiction 4 Credits
This class couples a survey of Latin American literature in translation with an interdisciplinary approach to the study of Latin America. Departing initially from readings of literary and cinematographic works, our analyses will engage methodologies from multiple disciplines including history, sociology, and cultural studies. Accordingly, this course will examine critical developments in Latin American aesthetics along with the cultural climates in which they matured. This course assumes no prior study of Spanish, Portuguese, or Latin American culture.
Attribute/Distribution: HU

ENGL 282 Professional Internship 1-4 Credits
Individualized work experience, on- or off-campus, in a field that a student of English wishes to explore as a career. Before registering, a student must meet with the internship adviser and obtain departmental approval. Internship credits do not count toward major in English. Sophomore standing and departmental approval required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 291 Special Topics 1-4 Credits
A topic, genre, or approach in literature or writing not covered in other courses.

ENGL 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

ENGL 301 Topics in Literature 3-4 Credits
A theme, topic, or genre in literature, such as autobiography as literature and the gothic novel.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 302 (GS 302, LAS 302, MLL 302) Travel and Adventure in Latin American Fiction 4 Credits
Centering on a corpus of works presenting tales of travel and adventure, this class offers an overview of Latin American narrative genres (including “fantastic” narrative, magical realism, and postmodern fiction) from the mid 20th century to present day. Through close readings of works by Adolfo Bioy Casares and Roberto Bolaño, among others, and the analysis of filmic representations of travel in Latin America, we will examine differing modes of perceiving the region defined as Latin America.
Attribute/Distribution: HU

ENGL 303 (GERM 303, MLL 303, WGSS 303) Grimms' Fairy Tales: Folklore, Feminism, Film 4 Credits
This intercultural history of the Grimms' fairy tales investigates how folktales and gender stereotypes developed and became models for children and adults. The course covers the literary fairy tale in Germany as well as Europe and America. Versions of "Little Red Riding Hood", "Cinderella", or "Sleeping Beauty" exist not only in the Grimms' collection but in films and many forms of world literature. Modern authors have rewritten fairy tales in feminist ways, promoting social change. Taught in English. German language students may receive a German component.
Attribute/Distribution: HU

ENGL 304 (WGSS 304) Special Topics in Gender Studies II 3,4 Credits
This course will involve extended study in a sub-area of English language, culture, and literature with a focus on gender, sexuality, and/or race/ethnicity.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 305 Creative Writing Thesis Proposal 1 Credit
Preparation to write creative thesis. Requirements include writing a proposal and bibliography.
Attribute/Distribution: ND

ENGL 306 Creative Writing Thesis 3 Credits
Portfolio of original creative work in poetry, fiction, or creative non-fiction, plus introductory researched essay. Required for concentration in creative writing.
Attribute/Distribution: ND

ENGL 307 Undergraduate Thesis Proposal 1 Credit
To be enrolled by senior honors students preparing to write honors thesis. Requirements include conducting preliminary research for the thesis and writing a detailed thesis proposal and bibliography. May not be rostered concurrently with English 308.
Attribute/Distribution: HU

ENGL 308 Undergraduate Thesis 3 Credits
Open to advanced undergraduates who wish to submit theses in English. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 309 Interpretation: Critical Theory and Practice 3-4 Credits
Introduction to recent literary and cultural theory, such as New Criticism, Structuralism, Marxism, Psychoanalytic approaches, Reader-response Criticism, Deconstruction, Feminist Theory, New Historicism, and Cultural Criticism.
Attribute/Distribution: HU

ENGL 310 Introduction to Teaching English to Speakers of Other Languages 3,4 Credits
An introduction to Teaching English to Speakers of Other Languages (TESOL) including the theory and principles of second language acquisition, ESL methods, materials, and current trends. Students will learn to plan and teach an ESL/EFL class in the four skills as well as integrated skills, choose appropriate materials for varying age and proficiency levels, and identify key issues in the role of global Englishes. Required classroom observing hours and teaching demonstration(s).
Attribute/Distribution: HU

ENGL 311 (WGSS 311) Representations of Gender and Sexuality 3-4 Credits
This course explores constructions of gender and sexuality in literature from different historical periods, traditions, and nationalities. How do female and male writers envision what it means to be a “woman” or to be a “man” at various moments in history and from various places around the world? How have gendered (and sexed) identities been shaped in various constraining and empowering ways in the literary imagination? What specifically gendered issues (such as love and violence) have been represented in literature?
Repeat Status: Course may be repeated.
Attribute/Distribution: HU
ENGL 312 Studies in Literary and Cultural Theory 3,4 Credits
Study of a particular contemporary theoretical approach to literature, film, or other cultural texts.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 314 Teaching English as a Second Language: A Practicum 1-4 Credits
Companion to English 310 (Intro to Methods of English as a Second Language). This course will include class meetings that focus on guided discussions of the practical application of principles and practices of ESL pedagogy in a real-world environment. Supervised ESL classroom student teaching required.
Prerequisites: ENGL 310
Attribute/Distribution: ND

ENGL 315 (HMS 315) Topics in Literature, Medicine, and Health 3-4 Credits
Analyzing the stories people tell about health, illness and disability, this course engages cultural studies approaches in order to explore the way those stories are told. Topics may include: illness and the graphic novel, the changing image of the healer in literature, collaborative storytelling with Alzheimer’s patients, end of life narratives, tales from the ER, narrative ethics.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 316 Native American Literature 3-4 Credits
This course is a survey of the literary texts written by the indigenous inhabitants of what is now the United States, beginning with the myths and legends of the era before European contact and ending with the novels, poems, and films produced by Native Americans in the twentieth- and twenty-first centuries.
Attribute/Distribution: HU

ENGL 317 (REL 317) Topics in Jewish Literature 3-4 Credits
Selected topics in Jewish literature, which may include: Contemporary Jewish Literature, Philip Roth’s Complaint, and Jewish Women Writers.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 318 (AAS 318) African-American Literature and Culture 3,4 Credits
Topics in African-American culture and/or the cultures of the African diaspora. Topics may be focused by period, genre, thematic interest or interdisciplinary method including, for example, Nineteenth-century African-American Literature and Politics; African-American Folklore; Black Atlantic Literature; The Harlem Renaissance; and African-American Women Writers.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 319 (FILM 319) Advanced Studies in the Horror Film 3-4 Credits
Examination of the horror film from beginnings to the present, including classic horror of the 1930s, the slasher film in the 1970s, the self reflexive horror of the 1990s, the faux-documentary horror at the end of the 20th century, and the renaissance of the genre in our contemporary world, from so-called “torture porn” to the return of the “possession” film. The course will focus on U.S. film but will sometimes include the highly influential horror traditions of other countries.
Repeat Status: Course may be repeated.

ENGL 327 Major Medieval Writers 3-4 Credits
Study of major medieval writers. Titles include The Canterbury Tales; Early Chaucer and the Continental Tradition, and Langland’s Piers Plowman.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 328 (THTR 328) Shakespeare 3,4 Credits
An introduction to Shakespearean drama including comedies, histories, tragedies, and romances. Emphasis on textual study, cultural contexts, and performance strategies.
Attribute/Distribution: HU

ENGL 331 Milton 3-4 Credits
An introduction to John Milton’s poetry and prose emphasizing close reading and cultural contexts. Half of the course will be devoted to Paradise Lost, and particular attention will be paid to politics, religion, and gender.
Attribute/Distribution: HU

ENGL 342 Advanced Poetry Writing 3-4 Credits
An intensive writing workshop in which student poems and related literary texts receive close reading and analysis.
Repeat Status: Course may be repeated.
Prerequisites: ENGL 142
Attribute/Distribution: ND

ENGL 343 Advanced Creative Non-Fiction 3,4 Credits
Practice of the essay, including such forms as the personal, academic, or argumentative essay. Emphasis on developing a strong personal voice and learning to use other voices. Intensive revision. Permission of writing minor advisor.
Repeat Status: Course may be repeated.
Prerequisites: ENGL 143
Attribute/Distribution: ND

ENGL 344 Advanced Fiction Writing 3-4 Credits
An intensive writing workshop in which student stories and related literary texts receive close reading and analysis. Consent of writing minor advisor.
Repeat Status: Course may be repeated.
Prerequisites: ENGL 144
Attribute/Distribution: ND

ENGL 350 (LAS 350) Special Topics in Latino Studies 3-4 Credits
Selected works by Latinx Diaspora writers, poets, and artists. Course engages with an ethnic studies framework and approach to texts in terms of U.S. canon formation with attention to race, class, gender, language, and nationality. No prerequisite.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 360 Middle English Literature 3-4 Credits
Major literary works of the Middle English period by authors other than Chaucer. Emphasis on Piers Plowman, the Gawain/ Pearl Poet, and the metrical romances.
Attribute/Distribution: HU

ENGL 362 Early Modern Genres and Authors 3-4 Credits
An examination of a sixteenth- or seventeenth-century author (such as Edmund Spencer, Margaret Cavendish, John Webster, or Thomas Middleton) or an exploration of a literary genre (such as utopian fiction, epic poetry, sonnets, revenge drama or romantic comedy) in its historical and cultural context. See course schedule for specific descriptions and titles.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 364 Special Topics in Early Modern Literature 3-4 Credits
An exploration of a specific topic in sixteenth- and seventeenth-century literature, such as gender, sexuality, religion, race, popular culture, or politics. See course schedule for specific descriptions and titles.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 366 British Eighteenth-Century Literature 3-4 Credits
The poetry, drama, fiction, and non-fictional prose of the long eighteenth century (1660-1800), with particular attention to how writers are shaped by and engage with the cultural issues of their time.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 367 Transatlantic Eighteenth-Century Literature 3-4 Credits
The poetry, drama, fiction, and non-fictional prose written in Britain and the Americas during the long eighteenth century (1660-1800), with particular attention to the transatlantic circulation of texts and ideas.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU
ENGL 369 Romantic-Era Literature 3-4 Credits
This study of British Literature and Culture of the Romantic Era (1780-1830) will address specific questions of genre, theme or historical developments. Readings may cover issues such as slavery and abolition, the effect of the French Revolution on British Literature, the rights of women, scientific innovation, ethics, landscape aesthetics, and the gothic.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 372 Victorian Literature 3-4 Credits
This study of British Literature and Culture of the Victorian Age (1830-1901), including the Empire, will address specific questions of genre, theme, or historical developments. Readings may cover issues such as industry, imperialism, the cult of domesticity, aesthetics, the Woman Question, the Reform Acts, the place of the art and the artist, and modern nationalism.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 375 Major Authors 1-4 Credits
The works of one or more major literary figures studied in depth.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 376 Early American Literature 3-4 Credits
American literature from settlement until the 1820s, emphasizing fiction, poetry, and non-fiction that helped form and contest American identities and national consciousness.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 377 American Romanticism 3-4 Credits
Literature from the antebellum United States viewed through the literary practices of sentimentalism (an ethos that values sympathy, empathy, and human contact) and the sublime (an aesthetic that attempts to create within readers a sense of the awe-inspiring, otherworldly, and terrifying aspects of life), as well as social conflicts over race, class, and gender.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 378 American Realism 3-4 Credits
Topics in American literature from the Civil War to the early twentieth century. Topics may include the evolution of literary genres and movements, including realism and naturalism. Authors may include Twain, Davis, Howells, Harper, James, Chasenutt, Jewett, Chopin, Norris, Crane, Du Bois, Gilman, Wharton, Cahan, Olsen and Wright.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 379 Modern American Literature 3-4 Credits
Topics in American literature before World War II. Topics may be focused by genre, thematic interest, mode of theoretical inquiry or interdisciplinary method, including, for example, Modernism and Mourning; The Harlem Renaissance; Modernism and Social Justice.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 380 Contemporary American Literature 3-4 Credits
Topics in American literature since World War II. Lectures and class discussions of new writers and of recent works of established writers organized around various themes of import for the contemporary period.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 383 Modernism and Post-Modernism in Fiction 3,4 Credits
Topics in 20th and 21st century literature with a focus on the defining features of modernism and/or postmodernism.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 384 Contemporary World and Postcolonial Literature 3,4 Credits
Topics in contemporary world literature after 1960, engaging the history and legacy of European colonialism. Topics might include: African Literature; South Asian Literature; Caribbean Literature; and Literature of Globalization.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 385 Modern British and Irish Literature 3-4 Credits
Topics in British and Irish literature before World War II. Topics might include: British Modernism; James Joyce; Virginia Woolf and Bloomsbury; Modern Irish literature; East Meets West: British and Colonial Travel Writing; and Gender and Sexuality.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 386 Contemporary British Literature 3-4 Credits
Topics in post-1945 British literature, including postmodernism and multicultural writing. Topics may include Black British Writing; Immigrant Literature; Gender and Sexuality; Travel Writing; and British Postmodernism.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 387 (FILM 387) Film History, Theory, and Criticism 3-4 Credits
Study of film with the focus on particular genres, directors, theories, periods, or topics. Weekly film screenings. Cannot be taken pass/fail.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 388 Independent Study 1-4 Credits
Individually supervised study of a topic in literature, film, or writing not covered in regularly listed courses. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 389 Honors Project 1-8 Credits
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 391 Special Topics 1-4 Credits
A topic, genre, or approach in literature or writing not covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

ENGL 400 Supervised Teaching 1 Credit
Practical experience in teaching through assisting a faculty teacher in conduct of a regularly scheduled undergraduate course. Open only to graduate students with at least one semester of graduate course work at Lehigh University and a GPA of at least 3.5. Usually rostered in conjunction with 485. Consent of department required.
Repeat Status: Course may be repeated.

ENGL 411 (WGSS 411) Gender and Literature 3 Credits
This seminar explores constructions of gender and sexuality in literature from different historical periods, traditions, and nationalities. Content changes each semester.
Repeat Status: Course may be repeated.

ENGL 433 Medieval Genres and Authors 3 Credits
This course examines major Middle English authors (Chaucer, Langland, the Pearl-poet) or genres of Middle English writing (romance, dream vision, drama) in their historical and literary contexts. Individual titles include: Medieval Drama, Chaucer's Literary Circles, Langland: Tradition and Afterlife, and Dream Visions and Revelations.
Repeat Status: Course may be repeated.

ENGL 435 Topics in Medieval Literature 3 Credits
This course explores a thematic topic in medieval literature. Typically, this course challenges traditional conceptions of literary historical periods by spanning Anglo-Saxon and late-medieval texts or late-medieval and early modern texts. Individual titles include: Writing, Rebellion, and Reform; Medieval Literature of Dissent; Poverty and Property, 1350-1650; Sex, Gender, and Sexuality in the Middle Ages; Imagining this Island: Nation and Identity, 800-1400.
Repeat Status: Course may be repeated.
ENGL 439 Early Modern Genres and Authors 3 Credits
Examination of major sixteenth- and seventeenth-century authors or distinctive Renaissance genres in their historical and cultural contexts. Individual courses may focus on authors such as Shakespeare, Milton, Spenser, or Jonson, or genres such as utopian fiction, psalms and sonnets, or city comedy.
Repeat Status: Course may be repeated.

ENGL 441 Early Modern Literature 3 Credits
This course explores a thematic topic in sixteenth- and seventeenth-century English literature. Individual titles may include: Dealing with Difference in Early Modern England; Gender and Catholicism in Early Modern England; Literature of City and Court; Poetry, Politics, and Prophecy: Writing of the English Civil War.
Repeat Status: Course may be repeated.

ENGL 442 British Eighteenth-Century Literature 3 Credits
This course explores British poetry, drama, fiction, and non-fictional prose written during the long eighteenth century (1660-1800). Topics may be organized by period, genre, thematic interest or interdisciplinary method. Individual titles may include: Money, Sex, and Selves; The Rise of the Novel; Witchcraft and History; Conspiracy Theory and Eighteenth-Century Literature.
Repeat Status: Course may be repeated.

ENGL 443 Transatlantic Eighteenth-Century Literature 3 Credits
This course explores the transatlantic circulation of texts and ideas during the long eighteenth century (1660-1800). Topics may be organized by period, genre, thematic interest or interdisciplinary method. Individual titles may include: The Colonial Rise of the Novel; Writing for a Cause; Transatlantic Eighteenth-Century Paranoia.
Repeat Status: Course may be repeated.

ENGL 445 British Romantic-Era Literature 3 Credits
The seminar will explore a focused topic in British Literature and Culture of the Romantic Era (1780-1830) taking into account larger historical, aesthetic, and theoretical concerns. Topics may include slavery and abolition, the cult of childhood, women's writing, imperialism, the gothic, the Jacobin novel, poetic innovation, the Shelley circle, and travel literature.
Repeat Status: Course may be repeated.

ENGL 447 British Victorian Literature 3 Credits
The seminar will explore a focused topic in British Literature and Culture of the Victorian Age (1830-1901), including the Empire, taking into account larger historical, aesthetic, and theoretical concerns. Topics may include industry, imperialism, the cult of domesticity, aesthetics, the Woman Question, new sexual cultures, the Reform Acts, the emergence of photography and mass visual culture, the place of art and the artist, and modern nationalism.
Repeat Status: Course may be repeated.

ENGL 449 Modern British and Irish Literature 3 Credits
Topics in British and Irish literature before World War II. Topics may be organized by genre, theoretical mode of inquiry, or author. Topics might include: British Modernism; James Joyce and Modernism; Ireland; Virginia Woolf and Bloomsbury; East Meets West: British and Colonial Travel Writing; and Gender and Sexuality.
Repeat Status: Course may be repeated.

ENGL 451 Contemporary British Literature 3 Credits
Topics in post-1945 British literature, including postmodernism and multicultural writing. Topics may be organized by genre, theoretical mode of inquiry, or interdisciplinary method. Topics might include Black British Writing; Immigrant Literature; Gender and Sexuality; Travel Writing; and British Postmodernism.
Repeat Status: Course may be repeated.

ENGL 471 Early American Literature 3 Credits
This course explores topics in the literature of New England, the Middle Colonies, the South, the Southwest, and the Caribbean from Columbus to the close of the eighteenth century, emphasizing our cultural and artistic diversity. Titles may include The Literature of Justification. First Contact: Then and Now, America's Many Beginnings; and Literature of Revolution and the Early Republic.
Repeat Status: Course may be repeated.

ENGL 473 Antebellum American Literature 3 Credits
This course explores thematic topics in antebellum U.S. literature through readings in the expanded canon of American literature from approximately 1820-1865. Individual titles include: Class in Antebellum American Literature; Antebellum Literature and Transatlantic Reform; The Global Nineteenth Century; Print Culture and the Economics of Antebellum American Literature.
Repeat Status: Course may be repeated.

ENGL 475 Late Nineteenth-Century American Literature 3 Credits
This seminar will explore topics in American literature between the Civil War and the early twentieth century. Topics may be organized by genre, theoretical mode of inquiry, historical problematic, or interdisciplinary method. Topics might include, for example, Realism and Naturalism; Nineteenth-Century African American Literature and Politics.
Repeat Status: Course may be repeated.

ENGL 477 Modernism 3 Credits
This seminar will explore topics in literary modernism, including the formal innovations, political implications, historical configurations, and critical and theoretical approaches to the literatures of the early twentieth century. Topics may be organized around national literatures or transnational formations. Topics might include Modernism and Mourning; Transatlantic Modernism; The Harlem Renaissance; Modernism and Social Justice.
Repeat Status: Course may be repeated.

ENGL 478 Contemporary American Literature 3 Credits
Topics in American literature since World War II. Lectures and class discussions of new writers and of recent works of established writers organized around various themes of import for the contemporary period.
Repeat Status: Course may be repeated.

ENGL 479 Contemporary World and Postcolonial Literature 3 Credits
Topics in contemporary world literature after 1960, engaging the history and legacy of European colonialism. Topics may be organized by genre, theoretical mode of inquiry, or interdisciplinary method. Topics might include: African Literature; South Asian Literature; Caribbean Literature; and Literature of Globalization.
Repeat Status: Course may be repeated.

ENGL 480 Composition and Rhetoric 3 Credits
This course explores a topic in composition studies or rhetoric. Topics may be historical, pedagogical, theoretical, or thematic.
Repeat Status: Course may be repeated.

ENGL 481 Theory and Criticism 3 Credits
Topics might include: Theories of Gender and Feminism; Theories of Transnationalism and Globalization; and Historicism.
Repeat Status: Course may be repeated.

ENGL 482 Theories of Literature and Social Justice 3 Credits
This course introduces students to theories of literature and social justice, addressing the following broad (and frequently overlapping) questions: What is social justice? How are literary forms (and literary criticism) distinctive in the ways in which they grapple with questions of social justice? How do literary forms reinvent or challenge dominant ideologies? In what ways does literature critique social injustice and imagine new models of more perfect human flourishing?

ENGL 483 Creative Writing and Literary Studies 3 Credits
From the Inside: Creative Writing and Reading. A combination of seminar and workshop, this course uses instruction and practice in the techniques and genres of creative writing (prosody, narratology, characterization, etc.) to develop tools for studying literary texts. Consent of instructor required.
Repeat Status: Course may be repeated.

ENGL 485 Introduction to Writing Theory 2 Credits
Survey of major approaches and theoretical issues in the field of composition and rhetoric. Required of all new teaching assistants in the department. Usually rostered in conjunction with 400 or 486.

ENGL 486 Teaching Composition: A Practicum 1 Credit
Introduction to teaching writing at Lehigh. Bi-weekly discussions of practical issues and problems in the teaching of freshman composition. Required of all new teaching assistants in the department. Usually rostered in conjunction with English 485.
ENGL 487 Teaching with Technology: A Practicum 1 Credit
Hands-on introduction to the tools and skills necessary to teach with the computer, along with some attention to appropriate pedagogy. Consent of the graduate program coordinator required.

ENGL 488 Special Topics in Teaching Composition in College 1 Credit
A course that considers a pedagogical concept, instructional issue, special population, theoretical perspective, or mode of teaching that merits focused exploration. Sample topics include Teaching Developmental Writing in College, Teaching Writing to Students in Vocational Programs, Understanding Writing Assessment, Applied Rhetoric.
Repeat Status: Course may be repeated.

ENGL 489 Field Work or Research in the Teaching of Composition in College 1 Credit
A course that offers supervised field work or applied research projects for graduate students in the field of Composition and Rhetoric. These projects should include sustained investigation of the curricula, instructional methods, course materials, or pedagogical practices employed in college writing classes.
Repeat Status: Course may be repeated.

ENGL 490 Master’s Thesis 3 Credits
Writing master’s thesis papers.

ENGL 491 Special Topics 1-3 Credits
A topic, genre, or approach in literature or writing not covered in other courses. Consent of graduate program coordinator required.
Repeat Status: Course may be repeated.

ENGL 493 Graduate Seminar 3 Credits
Intensive study of the works of one or more authors, or of a type of literature.
Repeat Status: Course may be repeated.

ENGL 495 Independent Study 1-3 Credits
Individually supervised course in an area of literature, film or writing not covered in regularly listed courses. Consent of graduate program coordinator required.
Repeat Status: Course may be repeated.

ENGL 499 Dissertation 1-9 Credits
Research and study for comprehension exams.

Environmental Initiative, Environmental Studies & Environmental Policy

Director, Environmental Initiative: Donald Morris, Ph.D. (Colorado State University)
Email: dpm2@lehigh.edu | Phone: 610-758-5175

Associate Director, Environmental Initiative: Sharon M. Friedman, MA (The Pennsylvania State University)
Email: smf6@lehigh.edu | Phone: 610-758-4179

Website: http://ei.cas2.lehigh.edu/
Supported by the Office of Interdisciplinary Programs 610-758-3996; incasip@lehigh.edu
Williams Hall, 31 Williams Drive

The Environmental Initiative is a broadly interdisciplinary program of education, research, and outreach. The curricula include courses in four colleges and 10 departments in social sciences, humanities, education, science, mathematics and engineering. Earth and Environmental Sciences (http://www.ees.lehigh.edu) and Civil and Environmental Engineering (http://www.lehigh.edu/~incee) are core Departments in the program.

UNDERGRADUATE STUDIES
Undergraduate Director: Sharon M. Friedman, MA (The Pennsylvania State University)
Email: smf6@lehigh.edu | Phone: 610-758-4179

The Environmental Studies BA program examines a range of factors confronting humans as they struggle with complex problems and possible solutions to environmental questions. Using a social science perspective, the program includes cultural, communication, economic, health, historical, humanistic, political, science and social factors that influence local, national, international and global environmental issues and policies. The program has been designed so students will develop a broad understanding of social science environmental concerns, along with a basic familiarity at least one of five basic environmental areas: health; humanities; policy, planning & law; politics & society; and science & technology. Embedded in each of these areas are related skills courses to help students prepare for careers and in-depth studies of environmental topics related to the field and the concentration.

The B.A. program will prepare students for a variety of career options in fields such as environmental policy, environmental health, environmental communication, environmental education or environmental law. Careers can be found in federal, state and local government agencies, consulting companies, industries, nonprofit organizations, advocacy groups, online environmental communication sites and elsewhere. The program also will prepare students for graduate studies in a number of environmental policy and social science fields including law.

The B.A. is specifically designed to be broadly inclusive yet flexible enough to encourage double majors and minors in other fields. Double majors or minors in social science fields such as anthropology, health, medicine and society, history, international relations, journalism, political science, psychology, science and environmental writing or sociology could easily be accomplished. Double majors or minors in the humanities in English, art and architecture, philosophy and religion also could be easily completed. In particular, this degree complements existing B.A. and B.S. programs in Earth and Environmental Sciences and the B.S. program in Environmental Engineering. If students are not pursuing a double major, a minor in another field to complement the Environmental Studies major is highly recommended but not required.

The B.A. is considered a social science major and most of its courses fulfill college science distribution requirements.

Program Honors
To graduate with honors, a major in Environmental Studies must maintain a 3.2 overall average, attain a 3.5 average in the courses constituting the major program, and complete an honors thesis in the senior year.

ENVIRONMENTAL STUDIES MAJOR
The Environmental Studies (ES) major consists of four required courses (11 credits), two core courses selected from among five choices (8 credits), and seven courses (26-28 credits) in a selected concentration. Students should select their preferred concentration preferably by their junior year. Three 300-level courses (4 credits each) are required, with one in a content area of the student’s concentration. ES majors are encouraged to double major or minor in another discipline that complements their concentration or the Environmental Studies program in general.

Required Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES 001</td>
<td>Introduction to Environmental Studies</td>
<td>4</td>
</tr>
<tr>
<td>ES/EES 002</td>
<td>Introduction to Environmental Science</td>
<td>3</td>
</tr>
<tr>
<td>EES 022</td>
<td>Exploring Earth</td>
<td>1</td>
</tr>
<tr>
<td>EES 024</td>
<td>Climate Change</td>
<td>3</td>
</tr>
<tr>
<td>or EES 025</td>
<td>The Environment and Living Systems</td>
<td>3</td>
</tr>
<tr>
<td>or EES 026</td>
<td>Energy – Origins, Impacts, and Options</td>
<td>3</td>
</tr>
<tr>
<td>or EES 027</td>
<td>Natural Hazards: Impacts and Consequences</td>
<td>3</td>
</tr>
<tr>
<td>or EES 028</td>
<td>Conservation and Biodiversity</td>
<td>3</td>
</tr>
<tr>
<td>or EES 029</td>
<td>Human Health and the Environment</td>
<td>3</td>
</tr>
<tr>
<td>or another science course approved by the faculty advisor.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Core Courses 2
Select two of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES/POLS 105</td>
<td>US Environmental Policy and Law</td>
<td>4</td>
</tr>
<tr>
<td>ES/POLS 107</td>
<td>The Politics of the Environment</td>
<td>4</td>
</tr>
<tr>
<td>ES/POLS/HMS 110</td>
<td>Environmental Planning for Healthy Cities</td>
<td>4</td>
</tr>
<tr>
<td>ES/ANTH 121</td>
<td>Environment and Culture</td>
<td>4</td>
</tr>
</tbody>
</table>
There are five concentrations that are wide ranging in the Environmental Studies major. These five programs serve a variety of different interests and possible career choices that students bring to the program. Each concentration has skills, content and elective section. Preferably by their junior year, students will select one of these five concentrations for their major program: 1) Health, 2) Humanities, 3) Policy, Planning & Law, 4) Politics & Society, or 5) Science & Technology. Many courses are found in more than one concentration, and while switching between concentrations is discouraged, it is possible if needed. In special cases, courses can be substituted within concentrations with the permission of the faculty advisor or program director. At least three ES or ES-crosslisted courses must be taken in a concentration and one of them must be a 3-4 credit course in the required content area. Elective courses can be from the skills, content or elective areas within a concentration.

CONCENTRATION: HEALTH

The Health Concentration is geared toward students who are interested in learning about the interconnections between health and environmental impacts, particularly how environmental degradation can affect all age groups, races and countries. It includes mitigation of environmental pollution and degradation, impacts on food resources, and the effects that natural and built environments have on people’s mental and physical health.

Required Skills Courses (choose 2) 6-8

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES/JOUR 125</td>
<td>Environment, the Public and the Mass Media</td>
<td>4</td>
</tr>
<tr>
<td>ES/POLS 319</td>
<td>Mapping Data for Policymaking</td>
<td>4</td>
</tr>
<tr>
<td>ES/TLT 367</td>
<td>Environmental Education</td>
<td>3</td>
</tr>
<tr>
<td>CEE 272</td>
<td>Environmental Risk Assessment</td>
<td>2</td>
</tr>
<tr>
<td>HMS/SOC 120</td>
<td>Values and Ethics of Community-Engaged Research</td>
<td>4</td>
</tr>
<tr>
<td>JOUR 314</td>
<td>Technical Communication</td>
<td>4</td>
</tr>
<tr>
<td>SOAN 111</td>
<td>Research Methods and Data Analysis</td>
<td>4</td>
</tr>
</tbody>
</table>

Required Content Courses (choose 3) 11-12

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES/HMS/POLS 110</td>
<td>Environmental Planning for Healthy Cities</td>
<td>4</td>
</tr>
<tr>
<td>ES/HMS/JOUR 117</td>
<td>Environmental Health Risks and the Media</td>
<td>4</td>
</tr>
<tr>
<td>ES/POLS 314</td>
<td>Urban Agriculture Policy, Planning and Practice</td>
<td>4</td>
</tr>
</tbody>
</table>

Elective Courses (choose 2) 7-8

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES/POLS AAS 305</td>
<td>Residential Segregation: Policies and Practices</td>
<td>4</td>
</tr>
<tr>
<td>ES/HMS/POLS 320</td>
<td>Food Justice in Urban Environments</td>
<td>4</td>
</tr>
<tr>
<td>ART 004</td>
<td>Three-Dimensional Design</td>
<td>4</td>
</tr>
</tbody>
</table>

1. A science course taken as a required course cannot be used to fulfill a concentration requirement.

2. Selected core courses cannot be used to fulfill concentration requirements.

CONCENTRATION: HUMANITIES

The Humanities Concentration offers an opportunity for students to explore contemporary environmental problems from philosophical, historical, artistic and literary frameworks, with an emphasis on fostering out-of-the-box thinking that can cut through hyper-politicized policy debates.

Required Skills Courses (choose 2) 6-8

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES/JOUR 125</td>
<td>Environment, the Public and the Mass Media</td>
<td>4</td>
</tr>
<tr>
<td>ES/PHIL 301</td>
<td>Philosophical-Policy &amp; Legal Design: Methods &amp; Applications</td>
<td>4</td>
</tr>
<tr>
<td>ES/POLS 319</td>
<td>Mapping Data for Policymaking</td>
<td>4</td>
</tr>
<tr>
<td>ES/TLT 367</td>
<td>Environmental Education</td>
<td>3</td>
</tr>
<tr>
<td>ARCH/CEE 010</td>
<td>Engineering/Architectural Graphics and Design</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 100</td>
<td>Working with Texts</td>
<td>4</td>
</tr>
<tr>
<td>JOUR 314</td>
<td>Technical Communication</td>
<td>4</td>
</tr>
</tbody>
</table>

Required Content Courses (choose 3) 11-12

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>ES/POLS 106</td>
<td>Environmental Values and Ethics</td>
<td>4</td>
</tr>
<tr>
<td>ES/ASIA/REL/ETH 254</td>
<td>Buddhism and Ecology</td>
<td>4</td>
</tr>
<tr>
<td>ES/HIST 315</td>
<td>American Environmental History</td>
<td>4</td>
</tr>
<tr>
<td>ES/PHIL 333</td>
<td>International Environmental Law &amp; Philosophical-Policy Design</td>
<td>4</td>
</tr>
<tr>
<td>ES/PHIL 342</td>
<td>International Law &amp; Philosophical-Policy Design</td>
<td>4</td>
</tr>
<tr>
<td>ES/PHIL 343</td>
<td>Comparative Environmental Law &amp; Philosophical-Policy Design</td>
<td>4</td>
</tr>
<tr>
<td>ENGL 091</td>
<td>Special Topics</td>
<td>1-4</td>
</tr>
<tr>
<td>HMS/ENG 315</td>
<td>Topics in Literature, Medicine, and Health</td>
<td>4</td>
</tr>
<tr>
<td>ENGL 380</td>
<td>Contemporary American Literature</td>
<td>4</td>
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Elective Courses (choose 2) 7-8

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</tr>
</thead>
<tbody>
<tr>
<td>ES/POLS AAS 305</td>
<td>Residential Segregation: Policies and Practices</td>
<td>4</td>
</tr>
<tr>
<td>ES/HMS/POLS 320</td>
<td>Food Justice in Urban Environments</td>
<td>4</td>
</tr>
<tr>
<td>ART 004</td>
<td>Three-Dimensional Design</td>
<td>4</td>
</tr>
</tbody>
</table>

Total Credits 45-47

1. A science course taken as a required course cannot be used to fulfill a concentration requirement.

2. Selected core courses cannot be used to fulfill concentration requirements.
Energy – Origins, Impacts, and Options 3
Writing for Audiences 4
Histories of Globalization 4
Emerson, Thoreau, and Beyond: An Introduction to Philosophy 4
Free Will and Responsibility: An Introduction to Philosophy 4
Art, Beauty, and Aesthetic Experience 4
Philosophy Of Science 4
Religion and Ecological Crisis 4
Religion and Food 4

1 One course must be a 3-4 credit ES course.
2 Can include any required skills or content courses not taken in another part of the concentration or the core courses.

CONCENTRATION: POLICY, PLANNING & LAW
The Policy, Planning and Law Concentration is geared toward students who are interested in learning about local, national and international regulations and programs designed to conserve the natural environment, to ensure that cities and neighborhoods are built in sustainable ways, and to protect vulnerable groups from bearing the brunt of environmental hazards.

Required Skills Courses (choose 2) 6-8
ES/JOUR 125 Environment, the Public and the Mass Media 4
ES/POLS 311 Environmental Valuation for Policy Design 4
ES/POLS 319 Mapping Data for Policymaking 4
ES/TLT 367 Environmental Education 3
ECO 001 Principles of Economics 4
SOAN 111 Research Methods and Data Analysis 4

Required Content Courses (choose 3) 11-12
ES/POLS 106 Environmental Values and Ethics 4
ES/POLS 107 The Politics of the Environment 4
ES/POLS/AAS 305 Residential Segregation: Policies and Practices 4
ES/HIST 315 American Environmental History 4
ES/POLS/HMS 320 Food Justice in Urban Environments 4
ES/POLS 328 U.S. Politics and the Environment 4
ES 331 Environmental Law I: Pollution & Risk Abatement 4
ES/PHIL 343 Comparative Environmental Law & Philosophical-Policy Design 4

Elective Courses (choose 2 within one of the subconcentrations) 7-8

PLANNING SUBCONCENTRATION
ES/HMS/POLS 110 Environmental Planning for Healthy Cities 4
ES/HMS/JOUR 117 Environmental Health Risks and the Media 4
ES/POLS 311 Environmental Valuation for Policy Design 4
ES/POLS 312 Urban Environmental Policy Workshop 4
ES/POLS 314 Urban Agriculture Policy, Planning and Practice 4
ES/ANTH 321 Information Ecology 4
ES/POLS 355 Environmental Justice: From Theory to Practice 4
ES/PSYC 357 Psychology of Environmental Issues 4
EES 027 Natural Hazards: Impacts and Consequences 3
POLS 348 Land Use, Growth Management, and the Politics of Sprawl 4

POLICY AND LAW SUBCONCENTRATION
ES/ANTH 121 Environment and Culture 4
ES/POLS 311 Environmental Valuation for Policy Design 4
ES/POLS 312 Urban Environmental Policy Workshop 4
ES/POLS 314 Urban Agriculture Policy, Planning and Practice 4
ES/HMS/JOUR/STS 323 Health and Environmental Controversies 4
ES/POLS 328 U.S. Politics and the Environment 4
ES 331 Environmental Law I: Pollution & Risk Abatement 4
ES/PHIL 343 Comparative Environmental Law & Philosophical-Policy Design 4
ES/POLS 355 Environmental Justice: From Theory to Practice 4
EES 023 Weather and Climate: Past, Present, and Future 3

1 One course must be a 3-4 credit ES course.
2 Can include any required skills or content courses not taken in another part of the concentration or the core courses.
CONCENTRATION: SCIENCE & TECHNOLOGY

The Science and Technology Concentration is designed for students who seek to develop a more in-depth understanding of the science of environmental problems, and of the complex interactions between science, technology, the environment and society, which requires integrating knowledge across multiple disciplines.

A double major or minor is Earth and Environmental Sciences (EES) is strongly suggested for this concentration.

### Required Skills Courses (choose 2)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES/JOUR 125</td>
<td>Environment, the Public and the Mass Media (Writing Intensive)</td>
<td>4</td>
</tr>
<tr>
<td>ES/POLS 319</td>
<td>Mapping Data for Policymaking</td>
<td>4</td>
</tr>
<tr>
<td>ES/TLT 367</td>
<td>Environmental Education</td>
<td>3</td>
</tr>
<tr>
<td>CEE 272</td>
<td>Environmental Risk Assessment</td>
<td>2</td>
</tr>
<tr>
<td>CSE 002</td>
<td>Fundamentals of Programming</td>
<td>2</td>
</tr>
<tr>
<td>CSE 012</td>
<td>Survey of Computer Science</td>
<td>3</td>
</tr>
<tr>
<td>ECO 001</td>
<td>Principles of Economics</td>
<td>4</td>
</tr>
<tr>
<td>EES 318</td>
<td>Geographic Analysis in EES ¹</td>
<td>4</td>
</tr>
<tr>
<td>EES 325</td>
<td>Remote Sensing of Terrestrial and Aquatic Environments</td>
<td>4</td>
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</tbody>
</table>

### Required Content Courses (choose 3) ²

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES/EES 004</td>
<td>The Science of Environmental Issues</td>
<td>1</td>
</tr>
<tr>
<td>ES/POLS 106</td>
<td>Environmental Values and Ethics</td>
<td>4</td>
</tr>
<tr>
<td>ES/HMS/POLS 110</td>
<td>Environmental Planning for Healthy Cities</td>
<td>4</td>
</tr>
<tr>
<td>ES/CEE/CHE/EMC 171</td>
<td>Fundamentals of Environmental Technology</td>
<td>4</td>
</tr>
<tr>
<td>ES/POLS 328</td>
<td>U.S. Politics and the Environment</td>
<td>4</td>
</tr>
<tr>
<td>ES 331</td>
<td>Environmental Law I: Pollution &amp; Risk Abatement</td>
<td>4</td>
</tr>
<tr>
<td>EES 024</td>
<td>Climate Change</td>
<td>3</td>
</tr>
<tr>
<td>EES 025</td>
<td>The Environment and Living Systems</td>
<td>3</td>
</tr>
<tr>
<td>EES 028</td>
<td>Conservation and Biodiversity</td>
<td>3</td>
</tr>
<tr>
<td>EES 029</td>
<td>Human Health and the Environment</td>
<td>3</td>
</tr>
<tr>
<td>EES 152</td>
<td>Ecology</td>
<td>3</td>
</tr>
<tr>
<td>ES 250</td>
<td>Terrestrial Ecosystems</td>
<td>4</td>
</tr>
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</table>

### Elective Courses (choose 2 within one of the subconcentrations) ³

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>REL/GS 013</td>
<td>Religion and Food</td>
<td>4</td>
</tr>
<tr>
<td>HMS/REL/PHIL 116</td>
<td>Bioethics</td>
<td>4</td>
</tr>
<tr>
<td>HIST/STS 145</td>
<td>Introduction to the History of Science</td>
<td>4</td>
</tr>
<tr>
<td>HIST 308</td>
<td>Industrial America since 1945</td>
<td>4</td>
</tr>
<tr>
<td>HIST 336</td>
<td>Bethlehem and the Lehigh Valley</td>
<td>4</td>
</tr>
<tr>
<td>POLS 115</td>
<td>Technology As Politics</td>
<td>4</td>
</tr>
<tr>
<td>STS 011</td>
<td>Technology and Human Values</td>
<td>4</td>
</tr>
<tr>
<td>STS/JOUR 124</td>
<td>Politics of Science</td>
<td>4</td>
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</tbody>
</table>

### SCIENCE SUBCONCENTRATION

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES/ANTH 121</td>
<td>Environment and Culture</td>
<td>4</td>
</tr>
<tr>
<td>ES/HIST 315</td>
<td>American Environmental History</td>
<td>4</td>
</tr>
<tr>
<td>ES/HMS/JOUR/STS 323</td>
<td>Health and Environmental Controversies</td>
<td>4</td>
</tr>
<tr>
<td>EES 014</td>
<td>Lands of the Midnight Sun</td>
<td>3</td>
</tr>
<tr>
<td>EES 023</td>
<td>Weather and Climate: Past, Present, and Future</td>
<td>3</td>
</tr>
<tr>
<td>EES 026</td>
<td>Energy – Origins, Impacts, and Options</td>
<td>3</td>
</tr>
<tr>
<td>EES 027</td>
<td>Natural Hazards: Impacts and Consequences</td>
<td>3</td>
</tr>
<tr>
<td>EES 032</td>
<td>Oceanography</td>
<td>3</td>
</tr>
<tr>
<td>EES 042</td>
<td>The Natural History of Costa Rica</td>
<td>3</td>
</tr>
</tbody>
</table>

### TECHNOLOGY SUBCONCENTRATION

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES/ANTH 121</td>
<td>Environment and Culture</td>
<td>4</td>
</tr>
<tr>
<td>ES/ANTH 321</td>
<td>Information Ecology</td>
<td>4</td>
</tr>
<tr>
<td>ES/HMS/JOUR/STS 323</td>
<td>Health and Environmental Controversies</td>
<td>4</td>
</tr>
<tr>
<td>HIST/GS 107</td>
<td>Technology and World History</td>
<td>4</td>
</tr>
<tr>
<td>ES 401</td>
<td>Philosophical-Policy &amp; Legal Design: Methods &amp; Applications</td>
<td>4</td>
</tr>
<tr>
<td>ES/EES 402</td>
<td>Scientific Foundations for Environmental Policy Design</td>
<td>4</td>
</tr>
</tbody>
</table>

A minimum of 3 credits of fieldwork may include SDEV 201 Sustainable Development Solutions, I, SDEV 307 International Social Entrepreneurship or other course selected in consultation with the Program Director.

**MINOR IN SUSTAINABLE DEVELOPMENT**

The minor in Sustainable Development (SDEV) consists of a minimum of at least 15 hours of study that includes a combination of core courses and approved electives.

### Core Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDEV 010</td>
<td>Challenges of Sustainable Development</td>
<td>4</td>
</tr>
<tr>
<td>SDEV 201</td>
<td>Sustainable Development Solutions, I ¹</td>
<td>4</td>
</tr>
<tr>
<td>or SDEV 307</td>
<td>International Social Entrepreneur</td>
<td>4</td>
</tr>
</tbody>
</table>

### Electives

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Credits</td>
<td>8</td>
</tr>
</tbody>
</table>

**M.A. ENVIRONMENTAL POLICY**

**Graduate Director:** Karen Beck-Pooley, Ph.D. (Penn) [https://polisci.cas2.lehigh.edu/content/beck-pooley]

**Email:** kbp213@lehigh.edu | **Phone:** 610-758-1238

The Environmental Policy (EP) Master’s Program equips students with the tools necessary to design policy and programmatic responses to today’s environmental challenges. From diving into the theoretical roots of policymaking in the classroom, to exploring professional and personal ambitions through community outreach and internships, the program offers students an interdisciplinary perspective on these issues and graduates leave the program ready to positively affect existing challenges.

The program offers concentrations and graduate certificates in Environmental Policy and Law, Sustainable Development, Urban Environmental Policy, Environmental Health, and Environmental Justice, and students move through the program on one of three tracks. These tracks include thesis track, internship track, and the Community Fellows track where students are enrolled in the master's program and part of Lehigh’s Community Fellows program. The internship track and community fellows track are designed to prepare graduates careers in the discipline, and takes advantage of Lehigh’s relationship with a number of government and non-government organizations, including the UN’s Division for Sustainable Development.

Applicants for the MAEP will be placed into one of three tracks (Thesis, Internship or Community Fellows).
**Internship Track**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES 490</td>
<td>3</td>
</tr>
</tbody>
</table>

**Community Fellows Track**

1 Electives selected from approved list may include one additional course (up to a total of 6 credit hours) from the Skills/Methods category of required courses. Students are urged to select electives which allow for concentrated study in a particular area of academic interest.

2 Required courses (12 credits) + Elective courses (12-15 credits) + ES 490 Thesis (3-6 credits) = Total 27-33 credits

3 Required courses (12 credits) + Elective courses (15 credits) + ES 480 Internship in Environmental Policy (3-6 credits) = Total 30-33 credits

4 Required courses (12 credits) + Elective courses (12 credits) + POLS 464 Community Fellowship I (3 credits) + POLS 465 Community Fellowship II (3 credits) = 30 credits

### CONCENTRATIONS WITHIN EP

The EP program provides students the opportunity to explore and focus on a variety of areas of academic and/or professional interest. In the table below are examples of five possible concentrations that are especially suited to faculty expertise and program resources. A total of 12-15 credits of electives comprise each concentration, plus a related internship or thesis experience. Students are also eligible to receive a “Graduate Certificate” in any of these concentration areas (see certificate program below).

#### Concentration in Urban Environmental Policy and Planning

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES/POLS 405</td>
<td>3</td>
</tr>
<tr>
<td>ES/POLS 412</td>
<td>3</td>
</tr>
<tr>
<td>ES/POLS 414</td>
<td>3</td>
</tr>
<tr>
<td>ES/POLS 420/421/HMS 320</td>
<td>2</td>
</tr>
<tr>
<td>ES/SOC 421</td>
<td>3</td>
</tr>
<tr>
<td>ES/POLS 431</td>
<td>3</td>
</tr>
<tr>
<td>ES 433</td>
<td>3</td>
</tr>
<tr>
<td>ES 435</td>
<td>3</td>
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<tr>
<td>ES 442</td>
<td>3</td>
</tr>
<tr>
<td>ES 443</td>
<td>3</td>
</tr>
<tr>
<td>ES/POLS 455</td>
<td>3</td>
</tr>
<tr>
<td>ES/POLS 475</td>
<td>3</td>
</tr>
<tr>
<td>POLS/ENTP 310</td>
<td>3</td>
</tr>
<tr>
<td>POLS/GS/WGSS 342</td>
<td>3</td>
</tr>
<tr>
<td>POLS 348</td>
<td>3</td>
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<tr>
<td>POLS 416</td>
<td>3</td>
</tr>
<tr>
<td>POLS 468</td>
<td>3</td>
</tr>
<tr>
<td>SDEV/ENTP 307</td>
<td>3</td>
</tr>
<tr>
<td>SOC/GS 319</td>
<td>3</td>
</tr>
<tr>
<td>SOC/GS/HMS 322</td>
<td>3</td>
</tr>
<tr>
<td>SOC 419</td>
<td>3</td>
</tr>
<tr>
<td>SOC/WGSS 441</td>
<td>3</td>
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<tr>
<td><strong>Total Credits</strong></td>
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#### Concentration in Environmental Law and Policy (Domestic and International)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ES/POLS 411</td>
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<tr>
<td>ES/POLS 431</td>
<td>3</td>
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<tr>
<td>ES 433</td>
<td>3</td>
</tr>
<tr>
<td>ES 442</td>
<td>3</td>
</tr>
<tr>
<td>ES/POLS 443</td>
<td>3</td>
</tr>
<tr>
<td>ES/POLS 455</td>
<td>3</td>
</tr>
<tr>
<td>ES/POLS 475</td>
<td>3</td>
</tr>
<tr>
<td>POLS/ENTP 310</td>
<td>3</td>
</tr>
<tr>
<td>POLS/GS/WGSS 342</td>
<td>3</td>
</tr>
<tr>
<td>POLS 416</td>
<td>3</td>
</tr>
<tr>
<td>POLS 468</td>
<td>3</td>
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<tr>
<td>SDEV/ENTP 307</td>
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<tr>
<td>SOC/GS 319</td>
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<td>SOC/GS/HMS 322</td>
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<tr>
<td>SOC 419</td>
<td>3</td>
</tr>
<tr>
<td>SOC/WGSS 441</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td><strong>33</strong></td>
</tr>
</tbody>
</table>

#### Concentration in Sustainable Development

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTH 324</td>
<td>3</td>
</tr>
<tr>
<td>ECO 303</td>
<td>3</td>
</tr>
<tr>
<td>ES 410</td>
<td>3</td>
</tr>
<tr>
<td>ES/POLS 414</td>
<td>3</td>
</tr>
</tbody>
</table>

### Tracks

- **Thesis track**

- **Elective Courses**

  - **Globalization and Development in Africa**
    - ANTH/AAS/GS 324
  - **Economic Development**
    - ECO 303
    - ES/POLS 405
  - **Foundations of Sustainable Development Practice**
    - ES 410
  - **Environmental Valuation for Policy Design**
    - ES/POLS 411
  - **Urban Environmental Policy Workshop**
    - ES/POLS 412
  - **Urban Agriculture Policy, Planning and Practice**
    - ES/POLS 414
  - **Food Justice in Urban Environments**
    - ES/POLS 420/HMS 320
  - **Information Ecology**
    - ES/SOC 421
  - **U.S. Environmental Law I: Pollution and Risk Abatement**
    - ES/POLS 431
  - **International Environmental Law & Philosophical-Policy Design**
    - ES 433
  - **Environmental Valuation for Policy Design & Legal Analysis**
    - ES 435
  - **International Law & Philosophical-Policy Design**
    - ES 442
  - **Comparative Environmental Law & Philosophical-Policy Design**
    - ES 443
  - **Environmental Justice: From Theory to Practice**
    - ES/POLS 455
  - **Seminars: Green Polity**
    - ES/POLS 475
  - **Human-Climate Interactions**
    - EES 446
  - **Social Entrepreneurship: How to Change the World**
    - POLS/ENTP 310
  - **Gender and Third World Development**
    - POLS/GS/WGSS 342
  - **Land Use, Growth Management, and the Politics of Sprawl**
    - POLS 348
  - **American Environmental Policy**
    - POLS 416
  - **Political Economy**
    - POLS 468
  - **International Social Entrepreneurship**
    - SDEV/ENTP 307
  - **The Political Economy of Globalization**
    - SOC/GS 319
  - **Global Health Issues**
    - SOC/GS/HMS 322
  - **Global Food Systems**
    - SOC 419
  - **Gender and Health**
    - SOC/WGSS 441

### Community Fellowship Track

**Thesis**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES 480</td>
<td>3</td>
</tr>
<tr>
<td><strong>Internship in Environmental Policy</strong></td>
<td>3</td>
</tr>
</tbody>
</table>

### Certificate Program

To receive a “Graduate Certificate” in any of these concentration areas, a one year Master’s Program in which students work for 15 hours a week in a non-profit organization as part of their academic experience. Please see the program website at www.lehigh.edu/communityfellows.

**POLS 464**  Community Fellowship I

**POLS 465**  Community Fellowship II

1 Electives selected from approved list may include one additional course (up to a total of 6 credit hours) from the Skills/Methods category of required courses. Students are urged to select electives which allow for concentrated study in a particular area of academic interest.

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3 Required courses (12 credits) + Elective courses (15 credits) + ES 480 Internship in Environmental Policy (3-6 credits) = Total 30-33 credits

4 Required courses (12 credits) + Elective courses (12 credits) + POLS 464 Community Fellowship I (3 credits) + POLS 465 Community Fellowship II (3 credits) = 30 credits
### GRADUATE CERTIFICATE PROGRAMS

Each graduate certificate requires a minimum of 12 credit hours (4 courses) from the list of EP core and elective courses specific to each area of study. A graduate of the EP program is only eligible to receive ONE of the following certificates. Certificate courses can be counted towards the master’s, as appropriate and must be completed in a maximum of 3 years.

#### ENVIRONMENTAL LAW AND POLICY

<table>
<thead>
<tr>
<th>Core Course</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES 401</td>
<td>Philosophical-Policy &amp; Legal Design: Methods &amp; Applications</td>
</tr>
<tr>
<td>or ES 404</td>
<td>Socio-cultural Foundations of Environmental Policy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elective Courses</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select any three of the following:</td>
<td></td>
</tr>
<tr>
<td>ES/POLS 411</td>
<td>Environmental Valuation for Policy Design</td>
</tr>
<tr>
<td>ES/POLS 431</td>
<td>U.S. Environmental Law I: Pollution and Risk Abatement</td>
</tr>
<tr>
<td>ES 433/333</td>
<td>International Environmental Law &amp; Philosophical-Policy Design</td>
</tr>
</tbody>
</table>

#### URBAN ENVIRONMENTAL POLICY AND PLANNING

<table>
<thead>
<tr>
<th>Core Course</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES/SOC 404</td>
<td>Socio-cultural Foundations of Environmental Policy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elective Courses</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES/POLS 412</td>
<td>Urban Environmental Policy Workshop</td>
</tr>
<tr>
<td>ES/POLS 414</td>
<td>Urban Agriculture Policy, Planning and Practice</td>
</tr>
<tr>
<td>ES/POLS 455</td>
<td>Environmental Justice: From Theory to Practice</td>
</tr>
<tr>
<td>EES 446</td>
<td>Human-Climate Interactions</td>
</tr>
<tr>
<td>POLS 348</td>
<td>Land Use, Growth Management, and the Politics of Sprawl</td>
</tr>
<tr>
<td>POLS 416</td>
<td>American Environmental Policy</td>
</tr>
</tbody>
</table>

#### SUSTAINABLE DEVELOPMENT

<table>
<thead>
<tr>
<th>Core Courses</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES/SOC 404</td>
<td>Socio-cultural Foundations of Environmental Policy</td>
</tr>
<tr>
<td>ES 410</td>
<td>Foundations of Sustainable Development Practice</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elective Courses</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTH/GS/AAS 324</td>
<td>Globalization and Development in Africa</td>
</tr>
<tr>
<td>ECO 303</td>
<td>Economic Development</td>
</tr>
<tr>
<td>ES/POLS 414</td>
<td>Urban Agriculture Policy, Planning and Practice</td>
</tr>
<tr>
<td>EES 446</td>
<td>Human-Climate Interactions</td>
</tr>
<tr>
<td>POLS/ENTP 310</td>
<td>Social Entrepreneurship: How to Change the World</td>
</tr>
<tr>
<td>POLS/GS/WGSS 342</td>
<td>Gender and Third World Development</td>
</tr>
<tr>
<td>POLS 348</td>
<td>Land Use, Growth Management, and the Politics of Sprawl</td>
</tr>
<tr>
<td>SDEV/ENTP 307</td>
<td>International Social Entrepreneurship</td>
</tr>
<tr>
<td>SOC/GS/HMS 322</td>
<td>Global Health Issues</td>
</tr>
<tr>
<td>SOC/GS 319</td>
<td>The Political Economy of Globalization</td>
</tr>
<tr>
<td>SOC 419</td>
<td>Global Food Systems</td>
</tr>
<tr>
<td>SOC/WGSS 441</td>
<td>Gender and Health</td>
</tr>
</tbody>
</table>

Total Credits | 12 |
### ENVIRONMENTAL HEALTH

**Core Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES 404 &amp; SOC 416</td>
<td>Socio-cultural Foundations of Environmental Policy and Social Epidemiology</td>
<td>6</td>
</tr>
</tbody>
</table>

**Elective Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES/HMS/JOUR/STS 323</td>
<td>Health and Environmental Controversies</td>
<td>6</td>
</tr>
<tr>
<td>ES/POLS 414</td>
<td>Urban Agriculture Policy, Planning and Practice</td>
<td>6</td>
</tr>
<tr>
<td>ES/POLS 420/HMS 320</td>
<td>Food Justice in Urban Environments</td>
<td>6</td>
</tr>
<tr>
<td>ES 455</td>
<td>Environmental Justice: From Theory to Practice</td>
<td>12</td>
</tr>
<tr>
<td>ES/POLS 475</td>
<td>Seminar: Green Polity</td>
<td>6</td>
</tr>
<tr>
<td>EES 446</td>
<td>Human-Climate Interactions</td>
<td>6</td>
</tr>
<tr>
<td>POLS 473</td>
<td>Globalization and Social Well-Being</td>
<td>6</td>
</tr>
<tr>
<td>SOC 419</td>
<td>Global Food Systems</td>
<td>6</td>
</tr>
<tr>
<td>SOC/WGSS 441</td>
<td>Gender and Health</td>
<td>6</td>
</tr>
<tr>
<td>SOC 443</td>
<td>Race, Ethnicity, and Health</td>
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</tr>
<tr>
<td>SOC 476</td>
<td>Issues In Health Policy Analysis</td>
<td>6</td>
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</table>

**Total Credits**: 12

1. Additional courses selected in consultation with the program adviser may fulfill program requirements. No more than 6 credits can be taken at the 300 level.

### ENVIRONMENTAL JUSTICE

**Core Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES 401 &amp; ES 455</td>
<td>Philosophical-Policy &amp; Legal Design: Methods &amp; Applications and Environmental Justice: From Theory to Practice</td>
<td>6</td>
</tr>
</tbody>
</table>

**Elective Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>POLS/AAS 230</td>
<td>Social Movements From the 1960s to Present</td>
<td>6</td>
</tr>
<tr>
<td>POLS/ENTP 310</td>
<td>Social Entrepreneurship: How to Change the World</td>
<td>6</td>
</tr>
<tr>
<td>POLS 358</td>
<td>Interest Groups, Power, and Democracy in American Politics</td>
<td>6</td>
</tr>
<tr>
<td>ES/POLS 411</td>
<td>Environmental Valuation for Policy Design</td>
<td>6</td>
</tr>
<tr>
<td>ES/POLS 475</td>
<td>Seminar: Green Polity</td>
<td>6</td>
</tr>
<tr>
<td>EES 446</td>
<td>Human-Climate Interactions</td>
<td>6</td>
</tr>
<tr>
<td>POLS 416</td>
<td>American Environmental Policy</td>
<td>6</td>
</tr>
<tr>
<td>POLS 426</td>
<td>Organizing For Democracy</td>
<td>6</td>
</tr>
<tr>
<td>POLS 473</td>
<td>Globalization and Social Well-Being</td>
<td>6</td>
</tr>
</tbody>
</table>

**Total Credits**: 12

1. Additional courses selected in consultation with the program adviser may fulfill program requirements. No more than 6 credits can be taken at the 200/300 level.

**Courses**

**ES 002 (EES 002) Introduction to Environmental Science 3 Credits**

Focuses on natural and human-induced drivers and consequences of environmental change. Exploring options for mitigating and adapting to environmental change in ecosystems, physical and social systems, the course examines such topics as biogeochemical cycles, population pressure, ecosystem diversity, productivity and food security, energy, water resources, climate change, pollution, ozone, urban issues and sustainability. Stresses interactions using case studies. Intended for any student with an interest in the environment. May be combined with EES 022 or EES 004 for 4 credits.

**Attribute/Distribution**: NS

**ES 004 (EES 004) The Science of Environmental Issues 1 Credit**

Analysis of current environmental issues from a scientific perspective. The focus on the course will be weekly discussions based on assigned readings. May be combined with other EES 3 credit courses for 4 credits.

**Attribute/Distribution**: NS

**ES 010 Environment and the Consumer Society 4 Credits**

Is there such a thing as sustainable consumption, or will life on Earth become increasingly imbalanced? Will our grandchildren accuse us of “devouring” their future? This multidisciplinary course investigates these issues, both locally and globally from the perspectives of anthropology, history, communication and politics. Topics include cultural causes of and responses to past environmental disasters; biological and cultural limits to growth; overfishing the commons; resources and land use issues; communication in a consumer culture; and politics and governmental regulations. Team projects researching the environmental impacts of campus consumption will be included.

**Attribute/Distribution**: SS

**ES 104 Political and Environmental Geography 4 Credits**

Geographical foundations of political phenomena and human impacts on the environment. Global focus on geographic influences on growth and development of states and empires, the nature and impact of borders, how people have altered pattern of climate, hydrology, land forms soils, and biota.

**Attribute/Distribution**: SS

**ES 105 (POLS 105) US Environmental Policy and Law 4 Credits**

Analysis of the framework that has been established to protect the environment and promote sustainable growth. Focus on the roles of the different branches of the U.S. government and the relative responsibilities of state and local governments within this framework. Consideration of the political nature of environmental issues and the social forces influencing environmental protection in different areas of domestic environmental policy, such as climate change, toxic waste disposal and natural resources conservation.

**ES 106 (POLS 106) Environmental Values and Ethics 4 Credits**

An introduction to the ethical perspectives and values that shape human relationships to the natural environment in contemporary society. What are the moral implications of these relationships for justice and human collective action? Given these implications, what policy responses to environmental problems are morally or politically justifiable? In answering these questions, the course explores ethical ideas developed in different schools of environmental thought, such as deep ecology and eco-feminism, in addition to ideas that emerge from social movements, such as environmental justice and bioregionalism.

**Attribute/Distribution**: SS

**ES 107 The Politics of the Environment 4 Credits**

A survey of the major environmental, resource, energy and population problems of modern society, focusing on the United States. The politics of people’s relationship with nature, the political problems of ecological scarcity and public goods, and the response of the American political system to environmental issues.

**Attribute/Distribution**: SS
ES 110 (HMS 110, POLS 110) Environmental Planning for Healthy Cities 4 Credits
An introduction to the topic of environmental planning, the course will review the roles of citizens, other stakeholders, political interests, and local governments in determining the use of land; unpack the meaning of "sustainability," and grapple with the challenge of balancing communities' demand for development with the need to protect valuable natural resources. Students will be introduced to examples of successful and unsuccessful instances of environmental planning both at home and abroad.
Attribute/Distribution: SS

ES 111 Introduction to Environmental Economics 4 Credits
An examination of the interactions between our economic systems and the environment. Pollution as a consequence of human activity within a framework for analyzing the relationships between environmental quality, scarcity of resources and economic growth. How to develop appropriate public policies to deal with these issues.
Attribute/Distribution: SS

ES 115 (JOUR 115) Communicating about the Environment 4 Credits
Introduction to the need for and ways to communicate about environmental issues to laypersons, government officials, journalists, members of the judiciary and technical experts. Explores case studies of good and bad communication about environmental issues. Internet communication, including the efficacy of placing governmental reports and databases on the Web for public consumption, will be evaluated.
Attribute/Distribution: SS

ES 117 (HMS 117, JOUR 117) Environmental Health Risks and the Media 4 Credits
This course explores the risks and effects of environmental contamination on human health and behavior as well as the role of the mass media in alerting citizens to potential environmental health risks. Environmental topics vary but usually include air and water pollution, endocrine disrupters and radioactive waste.
Attribute/Distribution: SS

ES 121 (ANTH 121) Environment and Culture 4 Credits
Impact of environment upon cultural variability and change. Comparative study of modern and past cultures and their environments as well as current theories of human/environmental interaction.
Attribute/Distribution: SS

ES 123 Sustainability in Action I 1-4 Credits
First half of a year-long experiential learning program for students to engage with sustainability in both general theory and applied practices. Students will learn the political, economic and social effects of changing earth systems through a global, national and local lens. Students will explore the multitude of challenges posed by increasing natural resource consumption, inequitable distribution of wealth and rapid uneven globalization. Most importantly, students will engage the Lehigh community and broader community in developing and implementing practical solutions to creating a more sustainable and just world. Offered in coordination with the Campus Eco-Reps program. Instructor permission required.
Repeat Status: Course may be repeated.

ES 124 Sustainability in Action II 1-4 Credits
Continuation of ES 123 Sustainability in Action I; second half of a year-long experiential learning program for students to engage with sustainability in both general theory and applied practices. Students will learn the political, economic and social effects of changing earth systems through a global, national and local lens. Students will explore the multitude of challenges posed by increasing natural resource consumption, inequitable distribution of wealth and rapid uneven globalization. Most importantly, students will engage the Lehigh community and broader community in developing and implementing practical solutions to creating a more sustainable and just world. Students in ES 124 expanded the scope and scale of sustainability projects and activities piloted in ES 123. Offered in coordination with the Campus Eco-Reps program. Instructor permission required.
Repeat Status: Course may be repeated.

ES 125 (JOUR 125) Environment, the Public and the Mass Media 4 Credits
Extensive exploration of local, national and international environmental problems and their social, political and economic impacts. Analysis of mass media coverage of complex environmental issues and the media's effects on public opinion and government environmental policies. Examination of environmental journalism principles and practices in the United States and around the world.
Attribute/Distribution: SS

ES 170 Special Topics 1-4 Credits
Intensive, research-oriented study of a subject or issue in Environmental Studies not covered in other courses. For students of demonstrated ability and adequate preparation. Consent of program director required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

ES 171 (CEE 171, CHE 171, EMC 171) Fundamentals of Environmental Technology 4 Credits
Pollution control technologies and how they work for water, air and solid wastes. Assessment and management of risk as applied to remediation of contaminated wastes. Role of life cycle analysis of products in risk reduction. Emphasis on technologies leading to sustainable environment. Government policies and regulations, including litigation and Best Engineering Practices. Must have completed a course designated as NS. Not available to students in RCEAS.

ES 181 Independent Study 1-4 Credits
This course can be 1) directed readings or research on an Environmental Studies topic, or 2) a project-based experience that puts students' understanding of environmental justice, environmental health, or environmental planning into practice. Consent of program director required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

ES 223 Advanced Sustainability in Action I 1-4 Credits
Leadership and coordination of Sustainability in Action projects and activities for students in ES 123. Experienced students who have completed the year-long Sustainability in Action sequence (ES 123 and ES 124) continue in course coordination role. Offered in coordination with the Campus Eco-Reps Program. Consent of instructor required.
Repeat Status: Course may be repeated.
Prerequisites: ES 123 and ES 124

ES 224 Advanced Sustainability in Action II 1-4 Credits
Continuation of ES 223. Leadership and coordination of Sustainability in Action projects and activities for students in ES 124. Experienced students who have completed the year-long Sustainability in Action sequence (ES 123 and ES 124) continue in course coordination role. Offered in coordination with the Campus Eco-Reps Program. Consent of instructor required.
Repeat Status: Course may be repeated.
Prerequisites: ES 123 and ES 124 and ES 223

ES 254 (ASIA 254, ETH 254, REL 254) Buddhism and Ecology 4 Credits
Buddhism's intellectual, ethical, and spiritual resources and reexamined in light of contemporary environmental problems. Is Buddhism the most green of the major world religions? What are the moral implications of actions that affect the environment?
Attribute/Distribution: HU

ES 294 Practicum in Environmental Studies 1-4 Credits
Practical experience on or off campus in local, state or national environmental activities. Students must present a work plan that describes the activities included in the practicum, the activity's sponsor, expected outcomes and the number of credits requested. Must have program director's approval.
Repeat Status: Course may be repeated.
Prerequisites: (ES 001 or ES 002) and (ES 105 or ES 107 or ES 110 or ES 121 or ES 125)
Can be taken Concurrently: ES 001, ES 002, ES 105, ES 107, ES 110, ES 121, ES 125
ES 301 (PHIL 301) Philosophical-Policy & Legal Design: Methods & Applications 4 Credits
A basic class on the idea of policy design, as opposed to standard economic analysis of public policy and its application to various domestic and international areas of law, including environmental law. The course will introduce Philosophical-Policy Methods, or the protocol employing integrated philosophical systems to justify specific policy-legal design arguments, through the use of a variety of distinct policy paradigms.

ES 305 (AAS 305, POLS 305) Residential Segregation: Policies and Practices 4 Credits
This course is an introductory planning course, with an emphasis on housing and community development policy. It will examine historical and contemporary aspects of urban politics; the economic, demographic, and spatial evolution of American cities; and various urban problems, such as the spatial mismatch between people and jobs, housing quality and affordability, and residential segregation. Finally, the course will review how planners have addressed conditions in cities and regions over time.

Attribute/Distribution: SS

ES 310 (SDEV 310) Foundations of Sustainable Development Practice 4 Credits
The broad goal of this course is to introduce students to the foundations of key sectoral and thematic knowledge for important challenges to sustainable development: food and nutritional security, social service delivery, energy policy, water resource management, urbanization, infrastructure, human rights, biodiversity, adaption to climate change, mitigating GHGs, sustainable business, good governance, and more. Through the Global Classroom we will do this together virtually with academic partners from around the world.

Attribute/Distribution: SS

ES 311 (POLS 311) Environmental Valuation for Policy Design 4 Credits
Seminar on how to value the environment for the purpose of designing and analyzing environmental policies. Review of the "contingent valuation method" currently used to price environmental resources, and assessment of this method's empirical and normative strengths and weaknesses. Evaluation of "deliberative monetary valuation" as an improved method for environmental assessment. Consideration of non-monetary approaches to environmental valuation as alternatives to understanding the environment's relationship to human well-being in policy contexts.

Attribute/Distribution: SS

ES 312 (POLS 312) Urban Environmental Policy Workshop 4 Credits
An urban environmental planning and policy course in which students explore an issue affecting the local community, evaluate current policy responses and possible alternatives, and present recommendations to public officials, local organizations, and community members. Student research and analysis will draw on primary and secondary data, as well as feedback from conducting individual interviews, focus groups, and community meetings. Prior projects include determining how Bethlehem's new City Revitalization Improvement Zone (CRIZ) might best benefit the South Side of Bethlehem, PA.

Attribute/Distribution: SS

ES 314 (POLS 314) Urban Agriculture Policy, Planning and Practice 4 Credits
Review of urban agriculture and greening programs in growing social movement to strengthen neighborhoods, promote healthier living, and create localized and sustainable food economies. Students consider these programs in relation to national farm policy and develop urban agriculture projects with community partners. Case studies illustrate how improving food access, beautifying vacant land, and reducing farm-to-table distances, are creatively and successfully combined. Students will receive hands-on gardening and farming experience at a community garden.

Attribute/Distribution: SS

ES 315 (HIST 315) American Environmental History 3-4 Credits
Relationship between Americans and their natural environment from the colonial period to the present: impact of European settlement, attributes toward wilderness, role of technological development, rise of preservation and conservation movements, establishment of national parks, recent environmental protection legislation.

Attribute/Distribution: SS

ES 319 (POLS 319) Mapping Data for Policymaking 4 Credits
This research methods course teaches students to highlight important conditions and trends – ones that warrant policymakers' attention – using publicly available data sources (like the Census). Conveying information in a clear and persuasive way, one that motivates decision-makers to act, is a key step in any policymaking process. Students will become familiar with these databases and proficient at generating charts, graphs and maps using Microsoft Excel, Microsoft Access, and ArcMAP (three programs central to most jobs in policy-related fields).

ES 320 (HMS 320, POLS 320) Food Justice in Urban Environments 4 Credits
This course will review how urban agriculture and city greening programs and policies are part of a growing movement working to strengthen neighborhoods, promote healthier living, and create more localized and sustainable food economies. This class will explore research and readings from multiple disciplines on these programs and policies, and will also delve into individual case studies that illustrate how efforts to improve food access, beautify vacant land, and reduce farm-to-table distances get creatively and successfully combined.

Attribute/Distribution: SS

ES 321 (ANTH 321) Information Ecology 4 Credits
Information theory, critical social theory, and ecological principles are combined to model how information organizes human ecosystems. These concepts are applied to environmental policy analysis using case studies.

ES 323 (HMS 323, JOUR 323, STS 323) Health and Environmental Controversies 4 Credits
Exploration of health and environmental controversies from the perspectives of scientific uncertainty and mass media coverage. Examines genetic engineering, biotechnology, environmental health risks, and nanotechnology. Includes discussion of ethical and social responsibilities and interactions with the public.

Attribute/Distribution: SS

ES 328 (POLS 328) U.S. Politics and the Environment 4 Credits
An examination of contemporary American politics and policy dealing with environmental issues. Current controversies in the legislative and regulatory areas will be covered to examine environmental issues and the political process. Significant portions of the course readings will be taken from government publications.

Attribute/Distribution: SS

ES 331 Environmental Law I: Pollution & Risk Abatement 4 Credits
This course studies the practical reality of environmental regulation as codified law. It also aims at understanding the law's foundation in argument and justification as both existing law and proposed policy through the use of cases, statutes, and regulations on air, water, risk, waste and environmental impact. Utilizing two legal paradigms for charting the relationship between humanity and nature, it examines a wide range of environmental law as well as ethical, political, economic, scientific, and policy dimensions.

Attribute/Distribution: SS

ES 333 (PHIL 333) International Environmental Law & Philosophical-Policy Design 4 Credits
This course studies international law and the natural environment assuming that the superficial legal structure and policy dilemmas of globally regulating the natural world are the result of the more essential philosophical ideas and concepts that have created both the international legal system and humanity’s evolving interrelationship with nature. Learning the current structure of the international-environmental legal system we shall comparatively apply theory to practice to both explain existing law and justifying policy change.

Attribute/Distribution: HU
ES 338 Environmental Risk 4 Credits
Starting with the distinction between traditional pollution problems and environmental risk, this course examines the policy and legal implications of its unique characteristics.
Attribute/Distribution: SS

ES 342 (PHIL 342) International Law & Philosophical-Policy Design 4 Credits
Using the techniques of Philosophical-Policy and Legal Design we will examine the evolution of those fundamental ideas from the 16th to the 19th centuries that have shaped our current understanding of international law. To assess both what law is, and what it ought to be, we will contrast narrow theories of international law with more comprehensive philosophical arguments that place the evolution of legal practice within a more universal concern for practical reason and human nature.
Attribute/Distribution: HU

ES 343 (PHIL 343) Comparative Environmental Law & Philosophical-Policy Design 4 Credits
Globalization is changing our perception of environmental policy as a strictly “domestic” issue. Those interested in humanity’s future interaction with nature need to understand not only the comparative practice of law and policy but the various philosophical principles that inform distinct approaches to environmental regulation within different political systems. We will explore both the components of the generic legal system and the range of alternatives for environmental law and policy design as practiced in various parts of the world.
Attribute/Distribution: HU

ES 352 (ANTH 352) Environmental Archaeology 4 Credits
This course reviews the various categories of archaeological data used to examine the nature of past human-environmental relationships. We will explore how archaeologists use data to recognize anthropogenic and natural environmental changes, as well as cultural adaptations to local environments.
Attribute/Distribution: SS

ES 355 (POLS 355) Environmental Justice: From Theory to Practice 4 Credits
This course explores the various ways in which environmental law and policy can have discriminatory effects. It examines the rise and evolution of environmental justice movement, and the impact of environmental justice claims on administration policies, especially at the federal level. Considering the role of politics in the ongoing struggle for environmental justice, it reviews theories of substantive and procedural justice, and uses them to consider strategies for advancing equity in environmental law and policy.
Prerequisites: POLS 105 or ES 105
Attribute/Distribution: SS

ES 357 (PSYC 357) Psychology of Environmental Issues 4 Credits
Environmental problems and solutions begin with the thoughts, feelings, and behaviors of individual people. We will examine Western ways of relating to nature and the beliefs people hold about it, how they reason about environmental issues, and how they act. Students should collaborate with the supervising ES faculty member to develop a work plan that describes the activities included in the internship, the expected outcomes and the number of credits sought.
Repeat Status: Course may be repeated.
Prerequisites: PSYC 001
Attribute/Distribution: SS

ES 367 (TLT 367) Environmental Education 3 Credits
Introductory environmental education course designed to prepare students to implement environmental education opportunities in formal and non-formal education settings. Topics include history and philosophy of environmental education, environmental laws and regulations, GIS, environmental issues and decision making, curriculum integration and environmental education teaching methodologies. This is a Web enhanced containing both online and fieldwork components.

ES 368 (TLT 368) Teaching and Learning with Geospatial Tools 3 Credits
Exploration of geospatial tools, including but not limited to global positioning systems (GPS), geographic information systems (GIS), and related visualization tools (e.g., Google Earth). Application of these tools and techniques to instructional settings, including appropriate pedagogy and assessment.

ES 370 (GS 370, SOC 370) Globalization and the Environment 4 Credits
This course investigates globalization and the environment including how globalization has influenced society-nature relationships, as well as how environmental conditions influence the globalization processes. A key focus will be on the rapidly evolving global economic and political systems that characterize global development dynamics therefore resource use. Particular attention is paid to the role of multi-national corporations, international trade, and finance patterns and agreements. Questions related to consumption, population, global climate change, toxic wastes, and food production/distribution represent key themes.
Attribute/Distribution: SS

ES 371 Special Topics 1-4 Credits
Intensive, research-oriented study of a subject or issue in Environmental Studies not covered in other courses. For students of demonstrated ability and adequate preparation. Consent of program director required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

ES 375 (POLS 375) Seminar: Green Polity 4 Credits
Development of guidelines and applications for public policy and political action directed toward environmental sustainability and political feasibility. Focus on problem-solving and policy design, connecting sustainable environmental goals with workable and responsible institutional designs.
Attribute/Distribution: SS

ES 381 Senior Seminar: Issues in Environmental Studies 4 Credits
Advanced seminar focusing on discussion and research on specialized subjects in Environmental Studies. Subject matter varies from semester to semester. Intended for Environmental Studies majors and minors but open to others. Consent of program director.
Prerequisites: ES 001 or ES 002
Attribute/Distribution: SS

ES 391 Honors Thesis 1-4 Credits
Directed undergraduate research thesis required of students who apply and qualify for graduation with program honors. Consent of program director required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

ES 393 Supervised Internship 1-4 Credits
Experiential learning opportunities supervised by ES faculty including real-world experience with environmental organizations or governmental agencies, field work or research experience, all related to environmental studies. Students should collaborate with the supervising ES faculty member to develop a work plan that describes the activities included in the internship, the expected outcomes and the number of credits requested.
Repeat Status: Course may be repeated.
Prerequisites: ES 001 and ES 002 and (ES 105 or ES 107 or ES 110 or ES 121 or ES 125)
Attribute/Distribution: HU, NS, SS

ES 401 Philosophical-Policy & Legal Design: Methods & Applications 3 Credits
A basic class on the idea of policy design, as opposed to standard economic analysis of public policy and its application to various domestic and international areas of law, including environmental law. The course will introduce the idea of Philosophical-Policy Methods, or the protocol employing integrated philosophical systems to justify specific policy-legal design arguments, through the use of a variety of distinct policy paradigms.
ES 402 (EES 402) Scientific Foundations for Environmental Policy Design 3 Credits
This course explores the science behind the environmental issues that bear on the policy process at local, national and global scales. It delves into the science of selected environmental issues that have either arisen from anthropogenic activities, or that impact social systems, or that help policy makers understand the consequences of different policy options. The course will consist of readings and discussions of timely topics and one major project.
Attribute/Distribution: NS

ES 404 (SOC 404) Socio-cultural Foundations of Environmental Policy 3 Credits
This course is based on the premise that social and ecological sustainability require new policy approaches. Drawing on social, organizational, and behavioral theory, students will learn techniques for analyzing and critiquing existing environmental policies and designing more effective policies. Case studies highlight how cultural values, social norms, public opinion and politics shape policies and their outcomes. We examine the entire policy process from how environmental problems are defined, to how organizations implement policies and how policies are evaluated.

ES 405 (POLS 405) Residential Segregation: Policies and Practices 3 Credits
This course is an introductory planning course, with an emphasis on housing and community development policy. It will examine historical and contemporary aspects of urban politics; the economic, demographic, and spatial evolution of American cities; and various urban problems, such as the spatial mismatch between people and jobs, housing quality and affordability, and residential segregation. Finally, the course will review how planners have addressed conditions in cities and regions over time.

ES 410 Foundations of Sustainable Development Practice 3 Credits
The broad goal of this course is to introduce students to the foundations of key sectoral and thematic knowledge for important challenges to sustainable development: food and nutritional security, social service delivery, energy policy, water resource management, urbanization, infrastructure, human rights, biodiversity, adaption to climate change, mitigating GHGs, sustainable business, good governance, and more. Through the Global Classroom, an approach pioneered by Columbia University and the Global Masters of Development Practice Association (http://globalmdp.org/), we will do this together virtually with.

ES 411 (POLS 411) Environmental Valuation for Policy Design 3 Credits
Seminar on how to value the environment for the purpose of designing and analyzing environmental policies. Review of the “contingent valuation method” currently used to price environmental resources, and assessment of this method’s empirical and normative strengths and weaknesses. Evaluation of “deliberative monetary valuation” as an improved method for environmental assessment. Consideration of non-monetary approaches to environmental valuation as alternatives to understanding the environment’s relationship to human well-being in policy contexts.

ES 412 (POLS 412) Urban Environmental Policy Workshop 3 Credits
An urban environmental planning and policy course in which students explore an issue affecting the local community, evaluate current policy responses and possible alternatives, and present recommendations to public officials, local organizations, and community members. Student research and analysis will draw on primary and secondary data, as well as feedback from conducting individual interviews, focus groups, and community meetings. Prior projects include determining how Bethlehem’s new City Revitalization improvement Zone (CRIZ) might best benefit the South Side of Bethlehem, PA.

ES 414 (POLS 414) Urban Agriculture Policy, Planning and Practice 3 Credits
Review of urban agriculture and greening programs in growing social movement to strengthen neighborhoods, promote healthier living, and create localized and sustainable food economies. Students consider these programs in relation to national farm policy and develop urban agriculture projects with community partners. Case studies illustrate how improving food access, beautifying vacant land, and reducing farm-to-table distances, are creatively and successfully combined. Students will receive hands-on gardening and farming experience at a community garden.

ES 419 (POLS 419) Mapping Data for Policymaking 3 Credits
This research methods course teaches students to highlight important conditions and trends — ones that warrant policymakers’ attention — using publicly available data sources (like the Census). Conveying information in a clear and persuasive way, one that motivates decision-makers to act, is a key step in any policymaking process. Students will become familiar with these databases and proficient at generating charts, graphs and maps using Microsoft Excel, Microsoft Access, and ArcMAP (three programs central to most jobs in policy-related fields).

ES 420 (POLS 420) Food Justice in Urban Environments 3 Credits
This course will review how urban agriculture and city greening programs and policies are part of a growing movement working to strengthen neighborhoods, promote healthier living, and create more localized and sustainable food economies. This class will explore research and readings from multiple disciplines on these programs and policies, and will also delve into individual case studies that illustrate how efforts to improve food access, beautify vacant land, and reduce farm-to-table distances get creatively and successfully combined.

ES 421 (SOC 421) Information Ecology 3 Credits
Information theory, critical social theory, and ecological principles are combined to model how information organizes human ecosystems. The concepts are applied to environmental policy analysis using case studies.

ES 431 (POLS 431) U.S. Environmental Law I: Pollution and Risk Abatement 3 Credits
The study of bureaucracy and problems of public and nonprofit organization and management; executive leadership; personnel management systems and regulatory administration.

ES 433 International Environmental Law & Philosophical-Policy Design 3 Credits
This course studies international law and the natural environment assuming that the superficial legal structure and policy dilemmas of globally regulating the natural world are the result of the more essential philosophical ideas and concepts that have created both the international legal system and humanity’s evolving interrelationship with nature. Learning the current structure of the international-environmental legal system we shall comparatively apply theory to practice to both explain existing law and justify policy change.
Attribute/Distribution: SS

ES 435 Environmental Valuation for Policy Design & Legal Analysis 3 Credits
Reviewing the history and legal context that gave rise to the current use of the “contingent valuation method” for pricing environmental resources, this course assesses empirical and normative strengths of this method, as well as the weaknesses that challenge its effectiveness and political legitimacy. Students will evaluate the recent turn to “deliberative” methods of resource valuation and consider empirical and normative problems that deliberative methods address.

ES 442 International Law & Philosophical-Policy Design 3 Credits
Using the techniques of Philosophical-Policy and Legal Design we will examine the evolution of those fundamental ideas from the 16th to the 19th centuries that have shaped our current understanding of international law. To assess both what law is, and what it ought to be, we will contrast narrow theories of international law with more comprehensive philosophical arguments that place the evolution of legal practice within a more universal concern for practical reason and human nature.
ES 443 Comparative Environmental Law & Philosophical-Policy Design 3 Credits
Globalization is changing our perception of environmental policy as a strictly “domestic” issue. Those interested in humanity’s future interaction with nature need to understand not only the comparative practice of law and policy but the various philosophical principles that inform distinct approaches to environmental regulation within different political systems. We will explore both the components of the generic legal system and the range of alternatives for environmental law and policy design as practiced in various parts of the world.

Attribute/Distribution: SS

ES 455 (POLS 455) Environmental Justice: From Theory to Practice 3 Credits
This course explores the various ways in which environmental law and policy can have discriminatory effects. It examines the rise and evolution of environmental justice movement, and the impact of environmental justice claims on administrative rule making at state and federal level. Reviewing the history of case law concerning environmental justice suits filed under the 1964 Civil Rights Act, it also examines the future of environmental justice in environmental law and policy.

ES 475 (POLS 475) Seminar: Green Polity 3 Credits
Development of guidelines and applications for public policy and political action directed toward environmental sustainability and political feasibility. Focus on problem-solving and policy design, connecting sustainable environmental goals with workable and responsive institutional designs.

ES 480 Internship in Environmental Policy 3 Credits
Students will gain practical experience working with governmental or non-governmental organizations or public officials formulating and/or implementing environmental policies at local, regional, national or international levels. Requires submission of a formal proposal drafted in collaboration with a faculty advisor and the professional mentor who will oversee the student’s internship. Upon completion of the internship, students will report project outcomes in oral presentation, written, or digital media format.

Repeat Status: Course may be repeated.
ES 483 Independent Study 1-3 Credits
Repeat Status: Course may be repeated.

ES 490 Thesis 1-6 Credits
Thesis.

Ethics

Program Director: Robin S. Dillon, Ph.D.
Email: (rsd2@lehigh.edu) | Phone: 610-758-3776
Website: www.ethicscenter.cas2.lehigh.edu

Support by the Office of Interdisciplinary Programs 610-758-3996; incasip@lehigh.edu
Williams Hall, 31 Williams Drive

The interdisciplinary academic Center for Ethics (http://catalog.lehigh.edu/graduatestudyandresearch/researchcentersandinstitutes/centerforethics) promotes rigorous inquiry into, probing reflection on, and responsible engagement with the ethical dimensions of life from the personal to the global.

Ethics has to do with issues of action, character, and governing values, with questions about right and wrong, good and evil, worthiness and unworthiness, justice and injustice, with matters of individual and collective responsibility, respect and discrimination, war and peace, and with the norms, habits, and systems that make the persons we are, the lives we live, and the societies in which we live together, better or worse. Ultimately, ethics concerns how we ought to live, individually and collectively. Ethical concepts, issues, questions, norms, and systems can be studied philosophically, psychologically, sociologically, anthropologically, historically, politically; ethical inquiry engages the natural and applied sciences and engineering and addresses concerns in economics and business; ethical questions are explored in religion and literature and through artistic expression.

The Center’s organizing perspective is that there is no aspect of human beings, no space in human lives, that does not have ethical dimensions—our intrapersonal lives, our interpersonal relations, as well as the educational, professional, familial, social, cultural, religious, artistic, political, economic, environmental, scientific, and global dimensions of our lives together. The ethics domain thus encompasses all aspects of Lehigh University.

For more information, visit our web site. (https://ethicscenter.cas2.lehigh.edu)

ETHICS MINOR

The most important personal, professional, and social questions cannot be resolved through empirical research or technological innovation alone; they require disciplined engagement with the fundamental values at stake in private and public life. Lehigh’s Minor in Ethics prepares students for this engagement, enabling them to think carefully and critically about a wide variety of controversial issues, from the use of military drones and self-driving cars to the protection of our environment and personal data; from issues of human well-being and justice (e.g. in healthcare, immigration, and the economy) to the social problems of racism, sexism, and Islamophobia. The ethical knowledge and skills students develop in Lehigh’s Minor in Ethics are personally enriching and directly contribute to good decision-making in professional and civic life.

The interdisciplinary Minor in Ethics requires a core course that provides students with a robust foundation and critical reasoning tools for identifying and addressing ethical issues and challenges. Elective courses enable student to apply the skills of ethical inquiry and reasoning to specific issues arising in a wide variety of areas and professional fields (e.g. legal, medical, business).

The minor in Ethics consists of 16 credits, including a core course and electives. At least one course must be at the 200-level or above. A maximum of 4 credits of independent study can count for the minor. Senior theses and honors capstone courses or projects may be eligible. Each semester a complete list of courses eligible for the Ethics minor can be found on the Center for Ethics website (http://ethicscenter.cas2.lehigh.edu) or in the Office of Interdisciplinary Programs, Williams Hall 101. Students considering minoring in Ethics should consult with the Director of the Center for Ethics in the Office of Interdisciplinary Programs (incasip@lehigh.edu).

Required core course (select one) 4
ETH/PHIL 105 Ethics
ETH/REL/PHIL 003

Electives (select three) 11-12
ETH/REL 002
ETH/PHIL 005
ETH/PHIL 006 Conduct and Character: An Introduction to Philosophy
REL 006 Religion and Ecological Crisis
POLS/GS/PHIL 100 Introduction to Political Thought
POLS/ES 106 Environmental Values and Ethics
ETH/PHIL/REL/HMS 116 Bioethics
PHIL/AAS 117 Race, Racism, and Philosophy
ETH/SOAN/HMS 120 Values and Ethics of Community-Engaged Research
ETH/REL 125
PHIL 125 Social & Political Philosophy
PHIL/CLSS 131 Ancient Philosophy
ETH/REL 149
HIST/REL/JST 154 The Holocaust: History and Meaning
ETH 171 Independent Reading and Research
PHIL 172 Philosophy of Economics
ETH 191 Special Topics in Ethics
ETH/PHIL 205
ETH/PHIL 206
ETH/REL/HMS 226
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<tr>
<td>ETH/REL/ASIA/ES 254</td>
<td>Computers, the Internet, and Society</td>
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<td>ETH 271</td>
<td>Independent Reading and Research</td>
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<td>ETH 291</td>
<td>Special Topics in Ethics</td>
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<tr>
<td>PSYC 311</td>
<td>The Psychology of Stereotyping, Prejudice, and Discrimination</td>
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<td>ES/JOUR/HMS/STS 323</td>
<td>Health and Environmental Controversies</td>
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<td>PSYC 332</td>
<td>The Psychology of Morality</td>
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<td>PSYC 350</td>
<td>The Psychology of Evil</td>
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<td>PSYC 353</td>
<td>Social Justice and Social Change</td>
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<td>HIST 354</td>
<td>History of Fascism</td>
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<td>POLS/ES 355</td>
<td>Environmental Justice: From Theory to Practice</td>
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<td>PSYC 375</td>
<td>Development of Good and Evil</td>
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<td>CEE/EES 379</td>
<td>Environmental Case Studies</td>
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<td>ETH 391</td>
<td>Special Topics in Ethics</td>
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**Total Credits:** 15-16

**Courses**

**ETH 002 (HMS 002, REL 002) Death and Dying: Religious and Ethical Perspectives 4 Credits**
Introductory course in death and dying. Attention will be given to issues of death, dying, and ethics through an exploration of death and dying. Rituals, practices and texts focused on death provide the basis for comparative study of Asian and Western religious approaches to the meaning and mystery of death as it confronts individuals and communities. Attention will also be given to moral justification for deaths brought about by human actions (i.e., killings). Specific issues include suicide, war deaths, abortion, euthanasia and state-sponsored execution.

**Attribute/Distribution:** HU

**ETH 003 (PHIL 003, REL 003) Global Religion, Global Ethics 4 Credits**
Introduction to philosophical and religious modes of moral thinking, with attention given to ethical issues as they arise cross-culturally and through religious traditions. The course will reference the United Nations Millennium Goals to consider family life and the role of women, social justice, the environment, and ethical ideals. Particular focus varies but may include one or more of the following: abortion and reproductive health, the death penalty, religiously motivated violence, and problems of personal disorder (heavy drinking, anorexia, revenge).

**Attribute/Distribution:** HU

**ETH 005 (PHIL 005) Contemporary Moral Problems: An Introduction to Philosophy 4 Credits**
An examination of contemporary issues that raise questions about right and wrong, good and bad, both for individuals and for social policy, using the methods, theories, and concepts of moral philosophy. Course not open to seniors.

**Attribute/Distribution:** HU

**ETH 006 (PHIL 006) Conduct and Character: An Introduction to Philosophy 4 Credits**
How should we live our lives? How should we act? What kinds of persons should we be? What should we care about? These are among the central questions of philosophy because they are among the most central questions of human existence. This explores answers that have been proposed by thinkers throughout history and across cultures. Course not open to seniors.

**Attribute/Distribution:** HU

**ETH 105 (PHIL 105) Ethics 4 Credits**
Examination of right and wrong, good and bad, from classic sources such as Plato, Aristotle, Hume, Kant, Mill and Nietzsche.

**ETH 116 (HMS 116, PHIL 116, REL 116) Bioethics 4 Credits**
Moral issues that arise in the context of health care and related biomedical fields in the United States today, examined in the light of the nature and foundation of moral rights and obligations. Topics include: confidentiality, informed consent, euthanasia, medical research and experimentation, genetics, and the distribution of health care.

**Attribute/Distribution:** HU

**ETH 120 (HMS 120, SOAN 120) Values and Ethics of Community-Engaged Research 4 Credits**
The many dimensions of community-engaged research and learning are explored, with special attention to ethical practices, values, research methods, and critical reflection. Experiential and service aspects of the course provide opportunities for students to build skills for social and community change, as well as build capacity for research and critical inquiry.

**Attribute/Distribution:** SS

**ETH 149 (REL 149) Modern Islamic Ethics 4 Credits**
This course will focus on developments in Islamic thinking and ethics that emerge from the modern encounter between Muslim societies and the West. We will discuss Islamic modernism and fundamentalism through short primary texts from a variety of modern Muslim thinkers.

**Attribute/Distribution:** HU

**ETH 171 Independent Reading and Research 1-4 Credits**
Independent study of selected topics designated and executed in close collaboration with a member of the Center for Ethics Program faculty. May be repeated for elective credit. Consent of program director required. Repeat status: May be repeated.

**Repeat Status:** Course may be repeated.

**ETH 191 Special Topics in Ethics 1-4 Credits**
Intensive study of a topic of special interest not covered in other courses. May be crosslisted with relevant offerings in major department or other programs. Consent of program director required.

**Repeat Status:** Course may be repeated.

**ETH 205 (PHIL 205) Contemporary Ethics 4 Credits**
Examination of significant questions addressed by contemporary moral philosophers. Topics vary, but might include: What is a good person? What kind of life is worth living? What moral issues are raised by gender, race, and class? Is morality relative or absolute? Is morality all that important?

**Repeat Status:** Course may be repeated.

**Attribute/Distribution:** HU

**ETH 206 (PHIL 206) Figures/Themes in Ethics 4 Credits**
This semester course will involve in-depth focus on a major figure in ethics (e.g., Plato, Aristotle, Hume, Kant, Mill, etc.) or on a theme such as relativism, free will, the intersection of religion and ethics, or war.

**Repeat Status:** Course may be repeated.

**Attribute/Distribution:** HU

**ETH 226 (HMS 226, REL 226) From Black Death to AIDS:Plague,Pandemic,Ethics and Religion 4 Credits**
An investigation into the way religion and morality shape interpretations of plague and pandemics. Three specific pandemics are examined: the bubonic plague of the 14th century, the 1918 influenza pandemic, and the current global AIDS crisis. Moral issues provoked by institutional, political and social responses to pandemic disease are also considered.

**Attribute/Distribution:** HU

**ETH 254 (ASIA 254, ES 254, REL 254) Buddhism and Ecology 4 Credits**
Buddhism’s intellectual, ethical, and spiritual resources are reexamined in light of contemporary environmental problems. Is Buddhism the most green of the major world religions? What are the moral implications of actions that affect the environment?

**Attribute/Distribution:** HU

**ETH 271 Independent Reading and Research 1-4 Credits**
Independent study of selected topics designated and executed in close collaboration with a member of the Center for Ethics Program faculty. May be repeated for elective credit. Consent of program director required.

**Repeat Status:** Course may be repeated.
Lehigh’s Film and Documentary Studies Program offers interdisciplinary training in the diverse fields of visual culture, storytelling, and documentary studies. Students explore film traditions from various nations and historical eras, learn to interpret visual narratives, and produce their own filmic projects. Our course offerings help students learn to appreciate the complexities of communicating in different mediums. Faculty emphasize the importance of learning to convey effective messages visually, audibly, and through written texts, and the study of film helps us appreciate the power of synthesizing these mediums.

Film and Documentary Studies prepares students for careers in the film, television, and visual culture industries. Several of our students have also gone on to graduate study in film. Lehigh’s students have enjoyed success in innovative film and television companies, and many of them have become active filmmakers, documentarians, or creative storytellers.

Film and Documentary Studies also readiness individuals to convey stories and meanings in various ways. Our courses teach students to message visually as well as audibly, providing multiple avenues to reach potential audiences and clients. This training has become extremely valuable for today’s careers in business, including jobs in advertising and marketing, where professionals must communicate to clients in diverse manners and with various tools.

Training in Film and Documentary Studies, moreover, prepares students to analyze numerous visual and audible scenarios, helping us to read our increasingly multimodal culture in our day-to-day lives. Our students become conscious of complex meanings within visual and auditory situations and stories, and this skill translates extremely well into careers in journalism, education, engineering, politics, and various health care professions.

The program includes three degree offerings: (1) a minor in Film Studies, (2) an LVAIC minor in Documentary Storymaking, and (3) a Graduate Certificate in Documentary Filmmaking. As the different components of the program suggest, Film and Documentary Studies privileges both the critical study of film and visual culture as well as the practice of producing film and storytelling. We specifically encourage all our students to build professional portfolios of their filmic projects.

Students from across the University enroll in our programs, benefiting from an interdisciplinary and international faculty. The minor will consist of four courses (15-16 credits) and will include FILM 001 Introduction to Film, a course on non-English-language film, and two electives, one of which may be a course in the production of visual images or film.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>FILM 001</td>
<td>Introduction to Film</td>
<td>4</td>
</tr>
<tr>
<td>One course focused on non-English-language film/film traditions</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Electives</td>
<td></td>
<td>7-8</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td></td>
<td>15-16</td>
</tr>
</tbody>
</table>

1. Students must take FILM 001 Introduction to Film prior to completing 300-level coursework.
2. At least 4 elective credits must be at the 300 level.
3. Courses taken during study abroad may fulfill elective requirement with Program Director approval.

**ELECTIVES**

<table>
<thead>
<tr>
<th>Elective</th>
<th>Credits</th>
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<tbody>
<tr>
<td>FILM/ART 007</td>
<td>Digital Photography I</td>
</tr>
<tr>
<td>FILM/ART 052</td>
<td>Introduction to Video Recording and Editing</td>
</tr>
<tr>
<td>FILM/MILL 100</td>
<td>The Sports Documentary</td>
</tr>
<tr>
<td>FILM/COMM/DOC 102</td>
<td>Introduction to the Horror Film</td>
</tr>
<tr>
<td>FILM/ENGL 119</td>
<td>Philosophy and Film</td>
</tr>
<tr>
<td>FILM/DOC 150</td>
<td>Introduction to Documentary Storymaking</td>
</tr>
<tr>
<td>FILM/ENGL 163</td>
<td>Topics in Film Studies</td>
</tr>
<tr>
<td>FILM/SPAN/LAS 213</td>
<td>New German Cinema</td>
</tr>
<tr>
<td>FILM/MILL/GERM 231</td>
<td>The Harem in French and Francophone Literature and Film</td>
</tr>
<tr>
<td>FILM/FREN 242</td>
<td>Legal and Ethical Issues in Documentary Practice</td>
</tr>
<tr>
<td>FILM/DOC 250</td>
<td>Spanish and Latin American Cinema</td>
</tr>
<tr>
<td>FILM/SPAN/LAS 265</td>
<td>Digital Photography II</td>
</tr>
<tr>
<td>FILM/ART 277</td>
<td>Advanced Studies in the Horror Film</td>
</tr>
<tr>
<td>FILM/MILL/GERM/ WGSS/ENGL 303</td>
<td>Contemporary French Films</td>
</tr>
<tr>
<td>FILM/ENGL 319</td>
<td>Illegal immigration in Francophone Literature and Film</td>
</tr>
<tr>
<td>FILM/FREN 322</td>
<td>Capstone in Documentary Storymaking</td>
</tr>
<tr>
<td>FILM/FREN 325</td>
<td>FILM/DOC 370</td>
</tr>
<tr>
<td>FILM 387 FILM 387/ ENGL 387</td>
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</table>

**Sophomore Credits**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>FILM 001</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td><strong>16</strong></td>
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</table>

**Junior Credits**

<table>
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<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>One course focused on non-English-language film/film traditions</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
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</tr>
</tbody>
</table>

**Senior Credits**

<table>
<thead>
<tr>
<th>Elective</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elective</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td><strong>16</strong></td>
</tr>
</tbody>
</table>

**DOCUMENTARY STORYMAKING MINOR (LVAIC)**

The Documentary Storymaking minor is a collaborative effort between Lehigh University, Lafayette College and Muhlenberg College, and is open to students pursuing any major across the University. The Documentary Storymaking minor offers students the opportunity to produce their own documentaries while learning about documentary research, ethics and practices. It emphasizes hands-
on experience and engagement with the diverse communities of the Lehigh Valley. Students can take courses in documentary filmmaking offered by any of the participating institutions for credit towards the minor. For help with cross-registration through the LVAIC website, please visit: http://lvaic.org/for-students/cross-registration/ (https://lvaic.org/for-students/cross-registration). For more information or to declare a Documentary Storymaking Minor, contact Professor Michael Kramp, dmk209@lehigh.edu or Program Director, Professor Lora Taub-Pervizpour, ltau@muhlenberg.edu.

The LVAIC minor in Documentary Storymaking is a multicampus, multidisciplinary program that provides students an opportunity to integrate documentary making into their undergraduate studies. The study of documentary histories, theories, and practices is a way for students with diverse academic interests to develop digital literacies that complement the research and writing skills they are developing in their majors. It is designed to provide a foundation in the theory, ethics, and practice of documentary storytelling.

Courses in the minor provide students hands-on experience in documentary storytelling methods, tools and practices that will develop their capacity to communicate to broad audiences. While it develops students’ individual capacities for creative and artistic expression, it is also deeply community-based and therefore connects students’ learning to the issues, concerns, and stories of broader community life within the Lehigh Valley.

A minimum of five courses are required, including a sequence of three core courses and a minimum of two electives.

Core course sequence ¹

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit</th>
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</thead>
<tbody>
<tr>
<td>DOC/FILM 150</td>
<td>Introduction to Documentary Storymaking</td>
<td>3</td>
</tr>
<tr>
<td>DOC/FILM 250</td>
<td>Legal and Ethical Issues in Documentary Practice</td>
<td>3</td>
</tr>
<tr>
<td>DOC/FILM 370</td>
<td>Capstone in Documentary Storymaking</td>
<td>3</td>
</tr>
</tbody>
</table>

Electives (choose two) ²

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOC/FILM/COMM 102</td>
<td>The Sports Documentary</td>
<td>3</td>
</tr>
<tr>
<td>HIST 337</td>
<td>History and Community Memory</td>
<td>3</td>
</tr>
<tr>
<td>JOUR 024</td>
<td>Visual Communication</td>
<td>3</td>
</tr>
<tr>
<td>JOUR 141</td>
<td>Photojournalism</td>
<td>3</td>
</tr>
<tr>
<td>JOUR 230</td>
<td>Multimedia Storytelling</td>
<td>3</td>
</tr>
<tr>
<td>COM 231</td>
<td>Documentary Research (Muhlenberg)</td>
<td>3</td>
</tr>
<tr>
<td>COM 344</td>
<td>Documentary Film &amp; Social Justice (Muhlenberg)</td>
<td>3</td>
</tr>
<tr>
<td>COM 389</td>
<td>Documentary Photography (Muhlenberg)</td>
<td>3</td>
</tr>
<tr>
<td>COM 431</td>
<td>Documentary Field Work (Muhlenberg)</td>
<td>3</td>
</tr>
<tr>
<td>FAMS 201</td>
<td>Making Media I (Lafayette)</td>
<td>3</td>
</tr>
<tr>
<td>FAMS 202</td>
<td>Making Media II (Lafayette)</td>
<td>3</td>
</tr>
<tr>
<td>FAMS 340</td>
<td>Documentary Film (Lafayette)</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits: 18-20

¹ Core courses are to be taken in sequential order.
² Chosen in consultation with Program Adviser.

GRADUATE CERTIFICATE IN DOCUMENTARY FILM

The Graduate Certificate in Documentary Film is designed to augment students’ education and provide practical experience for opportunities inside and outside the academy. This certificate program covers (1) the historical development and distinctive attributes of documentary film; (2) documentary planning, producing, and editing; and (3) ethical concerns surrounding documentary research and practice.

The program is open to graduate students in any department and has been especially useful for students in English, History, American Studies, Sociology, and Education. Students and faculty in the program collaborate with colleagues in the Center for Innovation in Teaching and Learning and the Digital Media Studio.

Completion of 12 credits, no more than 6 credits at the 300-level.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOC 425</td>
<td>Documentary Film Seminar</td>
<td>3</td>
</tr>
<tr>
<td>DOC 433</td>
<td></td>
<td>3</td>
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</tbody>
</table>

Two courses in consultation with Film and Documentary Studies Program Director; possible courses include:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Attribute/Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIST 438</td>
<td>Techniques in Public History</td>
<td>HU</td>
</tr>
<tr>
<td>HIST 305</td>
<td>Public History</td>
<td>HU</td>
</tr>
<tr>
<td>HIST 336</td>
<td>Bethlehem and the Lehigh Valley</td>
<td>HU</td>
</tr>
<tr>
<td>HIST 337</td>
<td>History and Community Memory</td>
<td>HU</td>
</tr>
</tbody>
</table>

Total Credits: 9

Documentary Storymaking Courses

DOC 102 (COMM 102, FILM 102) The Sports Documentary 4 Credits

The sports documentary has become an increasingly important form of media. Through the sports documentary, some of society’s most significant concerns are portrayed and discussed, including issues of race, gender, terrorism, inequality and more. Too, the sports documentary has adapted to various media, from film to television to online, from the multi-volume work of Ken Burns to ESPN’s “30 for 30." This course examines and critiques the social, cultural, political and economic implications of the sports documentary in contemporary culture.

Attribute/Distribution: HU

DOC 150 (FILM 150) Introduction to Documentary Storymaking 4 Credits

An introduction to digital documentary storytelling, merging critical study of documentary media with hands-on construction of documentary stories. Working with tools of the documentary arts—video, still images, audio, writing—students will acquire foundational skills of media production and effective storytelling while absorbing and analyzing rich examples of documentary storytelling over time and place. The course surveys traditions and issues in documentary media and introduces documentary practices and methods.

Attribute/Distribution: HU

DOC 250 (FILM 250) Legal and Ethical Issues in Documentary Practice 4 Credits

Explores the legal and ethical issues associated with documenting people, places, events, and situations. In so doing, we will consider how documentary filmmakers construct and represent truth, the nature of documentarians’ relationships with, and ethical obligations towards, their subjects, and how these questions inform other documentary practices. Topics discussed will include the impact of copyright law on documentary practice and best practices in fair use for documentary filmmakers.

Prerequisites: DOC 150 or FILM 150

Attribute/Distribution: HU

DOC 370 (FILM 370) Capstone in Documentary Storymaking 4 Credits

Synthesizes course of study across the Documentary Storymaking Minor and solidifies learning in a collaborative documentary project. Course is required to complete Documentary Storymaking Minor. The Capstone is a workshop-based experience that guides students through the design, planning, field research, production, and completion of a substantial documentary media project that results in a public presentation of their most advanced work. Production will be informed and enhanced by class discussion of selected readings, screenings, relevant theories and practices in documentary.

DOC 425 Documentary Film Seminar 3 Credits

This course examines documentary film and its power to interpret and represent our contemporary world and its past. An exploration of the genre’s origins and its development into a powerful medium for public history and protest, this course will focus on documentary filmmaking’s strong social justice tradition. Through assigned readings, film screenings, and postings, we will explore the forms, strategies and conventions of documentary film.

DOC 433 (AMST 433) Documentary Film Production 3 Credits

An independent study mode of course awarding credit for the production of a 30-minute documentary film that meets two standards: 1) high production value, and 2) scholarly content based on detailed research and driven by critical analysis.
Film Studies Courses

FILM 001 Introduction to Film 4 Credits
Introduction to historical, technical, aesthetic, and cultural elements of film. We will consider issues of filmic production and film history and devote specific attention to different filmic techniques and critical approaches to mise-en-scene, cinematography, editing, and film sound. Students should develop a critical vocabulary for talking about film and various critical tools/strategies for analyzing film. Our primary goal is to enhance our enjoyment of film by learning to think about the filmic industry and its aesthetic productions more critically. 
Attribute/Distribution: HU

FILM 007 (ART 007) Digital Photography I 4 Credits
Intensive work in photography as fine art using digital input and output. Lectures, demonstrations, critiques. 
Attribute/Distribution: HU

FILM 052 (ART 052) Introduction to Video Recording and Editing 4 Credits
We will consider the interaction of image, sequence, motion, time and audio with video to create associative, abstract, documentary and narrative videos. Workshops in camera use, editing, concept development, lighting, sound and DVD authoring. 
Attribute/Distribution: HU

FILM 100 (MLL 100) Introduction to International Film 4 Credits
An introduction to international film traditions and theory. We look at the importance of cinema as both art and entertainment and consider the social, political, and economic role of film in national and global contexts. 
Attribute/Distribution: HU

FILM 102 (COMM 102, DOC 102) The Sports Documentary 4 Credits
The sports documentary has become an increasingly important form of media. Through the sports documentary, some of society’s most significant concerns are portrayed and discussed. We will attempt a comparative study between the French and Francophone traditions and will be looking at the harem as a visual as well as textual feminine space from which narratives emerge and the extent to which they constitute a counter-discourse that questions dominant power structures. 
Attribute/Distribution: HU

FILM 119 (ENGL 119) Introduction to the Horror Film 4 Credits
Examination of the horror film from beginnings to the present, including classic horror of the 1930s, the slasher film in the 1970s, the self-reflexive horror of the 1990s, the faux-documentary horror at the end of the 20th century, and the renaissance of the genre in our contemporary world, from so-called “torture porn” to the return of the “possession” film. The course will focus on U.S. film but will sometimes include the highly influential horror traditions of other countries. 
Repeat Status: Course may be repeated. 
Attribute/Distribution: HU

FILM 120 (PHIL 120) Philosophy and Film 4 Credits
This seminar course will explore a variety of themes, genres, and movements within cinema from a philosophical perspective. Regular screenings of films from silent era to present. Content may vary depending upon instructor. 
Attribute/Distribution: HU

FILM 150 (DOC 150) Introduction to Documentary Storymaking 4 Credits
An introduction to digital documentary storymaking, merging critical study of documentary media with hands-on construction of documentary stories. Working with tools of the documentary arts—video, still images, audio, writing—students will acquire foundational skills of media production and effective storytelling while absorbing and analyzing rich examples of documentary storytelling over time and place. The course surveys traditions and issues in documentary media and introduces documentary practices and methods. 
Attribute/Distribution: HU

FILM 163 (ENGL 163) Topics in Film Studies 4 Credits
History and aesthetics of narrative film. May be repeated for credit as subject varies. 
Repeat Status: Course may be repeated. 
Attribute/Distribution: HU

FILM 213 (LAS 213, SPAN 213) Introduction to Hispanic Literature and Film 4 Credits
An introduction to the analysis of Latin American and Spanish cultural productions. 
Prerequisites: SPAN 141 
Attribute/Distribution: HU

FILM 231 (GERM 231, MLL 231) New German Cinema 4 Credits
Viewing, discussion, and written analysis of selected German films. 
Attribute/Distribution: HU

FILM 242 The Harem in French and Francophone Literature and Film 4 Credits
Explore representations of this forbidden and secret feminine space, the harem, starting with French theater from the 17th century all the way to 20th-21st century Francophone North African novels and film. We will attempt a comparative study between the French and Francophone traditions and will be looking at the harem as a visual as well as textual feminine space from which narratives emerge and the extent to which they constitute a counter-discourse that questions dominant power structures. 
Attribute/Distribution: HU

FILM 250 (DOC 250) Legal and Ethical Issues in Documentary Practice 4 Credits
Explores the legal and ethical issues associated with documenting people, places, events, and situations. In so doing, we will consider how documentary films construct and represent truth, the nature of documentarians’ relationships with, and ethical obligations towards, their subjects, and how these questions inform other documentary practices. Topics discussed will include the impact of copyright law on documentary practice and best practices in fair use for documentary filmmakers. 
Prerequisites: FILM 150 or DOC 150 
Attribute/Distribution: HU

FILM 265 (LAS 265, SPAN 265) Spanish and Latin American Cinema 4 Credits
Prerequisites: SPAN 141 
Attribute/Distribution: HU

FILM 277 (ART 277) Digital Photography II 4 Credits
An opportunity to produce a unified body of work and to explore digital photography on a deeper level with an emphasis on conceptually driven images. Experimental process encouraged. 
Repeat Status: Course may be repeated. 
Prerequisites: ART 007 or FILM 007 
Attribute/Distribution: HU

FILM 319 (ENGL 319) Advanced Studies in the Horror Film 3-4 Credits
Examination of the horror film from beginnings to the present, including classic horror of the 1930s, the slasher film in the 1970s, the self-reflexive horror of the 1990s, the faux-documentary horror at the end of the 20th century, and the renaissance of the genre in our contemporary world, from so-called “torture porn” to the return of the “possession” film. The course will focus on U.S. film but will sometimes include the highly influential horror traditions of other countries. 
Repeat Status: Course may be repeated. 

FILM 322 (FREN 322) Contemporary French Films 4 Credits
French Films from the late 1950s to the present. Introduction to cinematographic language and exploration of the issues of gender, power, and madness. Films by Truffaut, J-L Godard, C. Denis, A. Varda, J-J Beineix, E. Rohmer, and others. 
Attribute/Distribution: HU
FILM 325 (FREN 325) Illegal immigration in Francophone Literature and Film 4 Credits
This course examines representations of illegal immigrants in postcolonial francophone literature and film. We will be looking at visual and textual narratives from and about those who decided to leave their African homeland to seek a better future in Europe despite the very restrictive policies adopted by most of the European Union on illegal immigration. The course will explore issues of postcolonial identity, the notions of borders, displacement, exile, trauma and how they relate to the act of writing.

Attribute/Distribution: HU

FILM 370 (DOC 370) Capstone in Documentary Storymaking 4 Credits
Synthesizes course study across the Documentary Storymaking Minor and solidifies learning in a collaborative documentary project. Course is required to complete Documentary Storymaking Minor. The Capstone is a workshop-based experience that guides students through the design, planning, field research, production, and completion of a substantial documentary media project that results in a public presentation of their most advanced work. Production will be informed and enhanced by class discussion of selected readings, screenings, relevant theories and practices in documentary.

FILM 387 (ENGL 387) Film History, Theory, and Criticism 3-4 Credits
Study of film with the focus on particular genres, directors, theories, periods, or topics. Weekly film screenings. Cannot be taken pass/fail.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

Global Studies

Program Director: Kelly Austin, PhD (North Carolina State)
Email: kellyaustin@lehigh.edu (kellyaustin@lehigh.edu) | Phone: 610-758-2103
Website: http://global.cas2.lehigh.edu/
Supported by the Office of Interdisciplinary Programs 610-758-3996; incasip@lehigh.edu
Williams Hall, 31 Williams Drive

Global Studies majors are “global thinkers” in every sense. The Global Studies (GS) program provides students with the chance to understand the complex processes of globalization and the multifaceted nature of current global social problems, such as climate change, disease epidemics, refugee crises, and increasing economic inequality. GS is an interdisciplinary program, where students learn directly from professors across fields of history, political science, language, sociology, anthropology, and beyond. The Global Studies major is built around intellectual curiosity, not disciplinary walls.

With a diverse array of courses to choose from, Global Studies is highly flexible, allowing students to tailor the program to match their interests. GS majors and minors acquire analytical skills, research experience, and a breadth of knowledge that enable them to contribute to the rapidly evolving global community. GS has a strong track record of placing graduates in a wide range of exciting positions and graduate programs, including in placements in international business and finance, international organizations, public policy, and research and academia.

Professors. Marie-Helene Chabut, PHD (University of California, San Diego); John F. Lule, PHD (University of Georgia)
Associate Professors. Kelly F Austin, PHD (North Carolina State University); William Bulman, PHD (Princeton University); Vera L. Fennell, PHD (University of Chicago); John Savage, DEA (fcole des hautes Žtudes en sciences sociales); Bruce Whitehouse, PHD (Brown University)
Assistant Professor. Allison J. Mickel, PHD (Stanford University)

GLOBAL STUDIES MAJOR
The BA in Global Studies requires a total of 36-40 credits, the structure is outlined below.

Introductory Course
GS 001 Introduction to Global Studies

Core Courses
Select one course from each core area that explores how globalization shapes and is shaped by social, cultural, historical, and political factors.

Attribute/Distribution: HU

Arts and Humanities Core
GS/MLL 128 World Stories Literary Expressions
GS/REL 140 Globalization and Religion

History Core
GS/HIST 101 Histories of Globalization

Culture Core
ANTH 011 Cultural Diversity and Human Nature
GS/ANTH 106 Cultural Studies and Globalization

Politics Core
IR 010 Introduction to World Politics
GS/POLS 003 Comparative Politics
GS/POLS/PHIL 100 Introduction to Political Thought

Elective Coursework
Select four elective courses (see list below). 1,2,3

Senior Seminar
GS 319 The Political Economy of Globalization (Writing Intensive)

Collateral Requirements

Language Study
Global Studies majors are required to complete the equivalent of four semesters of language study in a language other than English. This requirement can be fulfilled using credits from courses taken at Lehigh, from high school AP language tests reported to Lehigh's registrar, from courses taken elsewhere, or some combination of these. If the student is already a fluent speaker in a second language besides English, then the language requirement is waived; fluency will be determined in consultation with faculty from the MLL department.

or
Students may complete a minor in Chinese, Japanese, French, German, Russian or Spanish.

Study Abroad or International Internship
Students should complete 12 credits of study abroad, which can be used to fulfill elective or core course requirements when appropriate. Students may also substitute an international internship for study abroad; the internship must include a minimum of 100 hours over at least six weeks (presumably during the summer) and must be at an organization connected to global issues. If extended time abroad is a hardship, GS students may also petition the program director to undertake a U.S.-based internship directly involved in international and global issues.

Total Credits 36-40

1 These courses may be taken during study abroad experience with permission of the program director.
2 In consult with the Global Studies adviser, students can choose from a wide variety of Global Studies courses each semester, including but not limited to the courses listed.
3 At least two electives must be 200-level or above.

ELECTIVES
GS/REL 013 Religion and Food
GS/HIST 013 Three English Revolutions
GS/HIST 016 The Rise and Fall of Britain and Its Empire
GS/HIST 017 Democracy's Rise and Fall
GS/REL 044 Religious Fundamentalism in Global Perspective
GS/HIST/LAS 049 The True Road to El Dorado: Colonial Latin America
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<thead>
<tr>
<th>Course Code</th>
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<tr>
<td>GS/HIST/LAS 050</td>
<td>Heroes, Dictators, and Revolutionaries: Latin America since Independence</td>
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<td>GS/REL 062</td>
<td>Explorations in Dialogue</td>
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<td>GS/HIST 107</td>
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<td>GS/JST/SOC 116</td>
<td>Jewish Community and Identity</td>
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<td>GS/ASIA/REL 119</td>
<td>The Podcast and the Lotus</td>
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<td>GS/AAS/ART 124</td>
<td>Arts of the Black World 16th-20th Centuries</td>
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<td>GS/AAS/ART 125</td>
<td>Art and Architecture of Africa from Colonial to Contemporary Times</td>
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<td>GS/MLL 129</td>
<td>The Global Workplace: Preparing to Work around the World</td>
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<td>GS/REL 140</td>
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<td>Religious Nationalism in a Global Perspective</td>
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<td>GS/ASIA/REL 145</td>
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<td>GS/REL/ASIA 147</td>
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<td>GS/REL 148</td>
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<td>GS/HMS/ANTH 155</td>
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<td>GS/JST/REL 161</td>
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<td>GS/ASIA/REL 166</td>
<td>Religious Nationalism in South Asia</td>
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<td>GS/ART/HIST 183</td>
<td>France from Medieval to Modern: Soc., Pol. &amp; Art</td>
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<tr>
<td>GS/ASIA/POLS 201</td>
<td>Democracy and Dictatorship in South Asia</td>
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<td>GS/ENGL/LAS/MLL 202</td>
<td>Latin America In Fact, In Fiction</td>
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<td>GS/AAS/ART 221</td>
<td>Global Contemporary: Recent Art Movements Around the World</td>
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<td>GS/ASIA 339</td>
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<td>GS 394</td>
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**GLOBAL STUDIES MINOR**

A minor in Global Studies consists of four courses with at least one core course and at least one class at the 200 level or above. Visits to the UN as well as study abroad or Lehigh Abroad are strongly recommended.

Total Credits: 15-16

1. One class must be 200 level or above.
2. Core courses may substitute for elective courses.
3. With the approval of the program director, Global Studies minors may identify other courses not included on the elective list to satisfy the elective requirement including those taken as during study abroad.

**Courses**

**GS 001 Introduction to Global Studies 4 Credits**

Globalization - the historical and continuing integration of peoples, cultures, markets and nations is the defining characteristic of our century. It brings with it advantages and disadvantages, survival and suffering. In this interdisciplinary course, the foundation of the Global Studies major, students will be introduced to a variety of historical, critical and analytical perspectives, methods and vocabularies for continued study of globalization and social change. Priority given to CAS freshmen and sophomores.

Attribute/Distribution: SS

**GS 003 (POLS 003) Comparative Politics 4 Credits**

The political systems of foreign countries; approaches to the study of comparative politics.

Attribute/Distribution: SS

**GS 011 (REL 011) Introduction to World Religions 4 Credits**

Living and working in a globalizing 21st century requires an understanding of diverse religious and cultural identities. In this course, students will be introduced to the history, ideas, and practices from a wide variety of the world’s religious traditions.

Attribute/Distribution: HU

**GS 013 (REL 013) Religion and Food 4 Credits**

This course explores the complex connections between religion and food. We will examine food-related rituals, including Jewish Passover seders, Christian communion, and Hindu puja; the role of gastronomy in forming religious and ethnic identity; and the global ethics of food and sustainability. We will also probe the notion of food itself as sacred. Are “foodies” engaging in their own sort of sacred actions? How does food connect with the sublime? The class will include tastings and outings as scheduling permits.

Attribute/Distribution: HU

**GS 015 (HIST 015) Three English Revolutions 4 Credits**

The Protestant Reformation, the Civil Wars, and the Glorious Revolution, from Henry the Eighth to John Locke. Examines how three bloody conflicts gave birth to the first modern society. Explores the origins of empire, capitalism, secularization, nationalism, and democracy.

Attribute/Distribution: HU

**GS 016 (HIST 016) The Rise and Fall of Britain and Its Empire 4 Credits**

Charts the rise of the world’s first global superpower in the 18th and 19th centuries, and its decline and disintegration in the 20th and 21st. Topics include the Enlightenment, the first party system, the Industrial Revolution, imperialism, globalization, the World Wars, neo-liberalism, and punk rock.

Attribute/Distribution: HU, SS
GS 017 (HIST 017) Democracy's Rise and Fall 4 Credits
The promise and perils of democracy from the ancient world to the present.
Attribute/Distribution: SS

GS 044 (REL 044) Religious Fundamentalism in Global Perspective 4 Credits
This course will explore the rise of fundamentalist religious movements and their involvement in violent conflicts. Topics to be considered will include the relationship between fundamentalist religious ideologies and terrorism, and the kinds of responses that fundamentalist religious movements present to the development of a global marketplace and the spread of secular nationalism.
Attribute/Distribution: HU

GS 049 (HIST 049, LAS 049) The True Road to El Dorado: Colonial Latin America 4 Credits
Examines the initial encounters of peoples of Iberian and African origins with the indigenous civilizations of the Western Hemisphere. Explores the development of a colonial economy and its global reach. Focuses on the birth of a distinctive Latin American society and culture, with attention to the Latin American patriots who fought for their freedom. No prior knowledge of Latin American history required.
Attribute/Distribution: SS

GS 050 (HIST 050, LAS 050) Heroes, Dictators, and Revolutionaries: Latin America since Independence 4 Credits
Examines the 200-year-long struggle of Latin American peoples to gain political representation, economic equality, and social justice. Explores key historical events in Latin America from the movement for independence in the early nineteenth century to today's modern societies. Topics include the wars of independence, the rule of caudillos, foreign military interventions, export economies, populism, social revolutions, the Cold War era, state terror and military dictatorships, and the war on drugs.
Attribute/Distribution: SS

GS 062 (REL 062) Explorations in Dialogue 4 Credits
Course critically investigates inter-religious dialogue, an important issue in the contemporary academic study of religion. Focus will be on the problem of inter-religious encounter; religion and globalization; different models of dialogue; and the questions of power and identity. At least two traditions will be put into conversation for any proposed offering (e.g., Christian-Buddhist, Jewish-Muslim, Jewish-Christian).
Attribute/Distribution: HU

GS 077 (ASIA 077, REL 077) The Islamic Tradition 4 Credits
A thematic introduction to Islamic history, doctrine and practice. Topics include: Qur'an; prophecy and sacred history; ritual practices; community life; legal interpretation; art and aesthetics; mysticism; politics and polemics.
Attribute/Distribution: HU

GS 100 (PHIL 100, POLS 100) Introduction to Political Thought 4 Credits
A critical examination of political ideologies: Liberalism, Marxism, Fascism, and Islamism.

GS 101 (HIST 101) Histories of Globalization 4 Credits
Critical historical perspectives on current debates around “globalization” and the varied paths and responses to modernity, using recent scholarship associated with the New Global History. The "Rise of the West" paradigm, Industrial Revolution and modernization theory; creation of global financial markets, nation-building and New Imperialism; Great Depression and World Wars as global historical events; postwar decolonization, Cold War and emergence of North-South relations; impact of consumerism, movements for women's rights, ethnic nationalism and religious fundamentalist movements in tradition-bound societies.
Attribute/Distribution: HU

GS 106 (ANTH 106) Cultural Studies and Globalization 4 Credits
This course closely examines the complex relationship between culture and globalization. The impact of globalization on local culture is an essential topic. But the interaction of globalization and culture is not a one-way process. People around the world adapt globalization to their own uses, merging global cultural flows with local practices in transformative ways. The course will study the interaction of local culture with globalizing forces; immigration and culture; the localizing of mass culture; cultures of diasporic and migratory groups, and globalization, gender and identity.
Attribute/Distribution: SS

GS 107 (HIST 107) Technology and World History 4 Credits
Development of technology and its relationship to political, economic, military, and cultural aspects of world civilization from pyramids to the present period.
Attribute/Distribution: SS

GS 108 (ANTH 108) Not-so-Loely Planet: The Anthropology of Tourism 4 Credits
Love to travel? This course explores tourist attractions around the world to understand why people leave home, why they visit resorts, monuments, historical sites, memorials, parks, museums, and more. By reading anthropological scholarship and by visiting nearby attractions ourselves, we examine the politics and economics of the global tourism industry, the impact of tourism on local communities, and tourists' search for an 'authentic' experience. And we see how Disneyworld, of all places, provides insight into each of these topics.
Attribute/Distribution: SS

GS 116 (JST 116, SOC 116) Jewish Community and Identity 4 Credits
A century ago, large Jewish communities existed throughout the world, including North Africa, Europe, the Middle East, and South America. Today, over 80% of all Jews live in North America or Israel. This course focuses on these historical changes in Jewish communities and the transformation of Jewish identities and social life in recent years, particularly in the U.S. and in Israel.
Attribute/Distribution: SS

GS 119 (ASIA 119, REL 119) The Podcast and the Lotus 4 Credits
Buddhism is increasingly a global phenomenon. Contemporary Buddhist teachers stay in touch with students via podcasts, WeChat, Twitter and Facebook. Buddhists from Singapore, Tibet, Japan, Mexico, Taiwan or Pennsylvania now meet via new technology. This class asks, how is Buddhism now a global religion? what effect has this had? How is Buddhism a “modern” religion? Students explore issues of conversion, modernity, globalization, new technology, migration and travel. Sources include autobiography, film, travel writing, political essays, interviews, social media, ethnography.
Attribute/Distribution: HU

GS 124 (AAS 124, ART 124) Arts of the Black World 16th-20th Centuries 4 Credits
This course covers artistic practices originating in Africa that subsequently influenced countless world cultures. The material covers artistic production and theory of arts of the enslaved populations in the AnteBellum South, early African American painting through the Harlem Renaissance, the religious arts of Haiti (Vodou) and Cuba (Santería), and contemporary production from Black Brazilian, American and European artists. Students should be prepared to attend Museums/ galleries during the semester.
Attribute/Distribution: HU

GS 125 (AAS 125, ART 125) Art and Architecture of Africa from Colonial to Contemporary Times 4 Credits
This course is structured around case studies of art and architecture from early traditions up through the present. The focus is on cultural production, religious art and architecture (local as well as Christian and Muslim traditions), craftsmanship, style, materials, trade, and international exhibition of art objects in Museums. The literature draws from art historical, anthropological, and historical analyses as well as museum studies. Students should be prepared to attend Museums/ galleries during the semester.
Attribute/Distribution: HU
GS 135 (ANTH 155, HMS 155) Medical Anthropology 4 Credits
Medical Anthropology is the study of how conceptions of health, illness, and healing methods vary over time and across cultures. Students will examine the history of cooperation and conflict between the Muslim and Hindu communities in South Asia-from the movements for national independence to twenty-first century identity politics.
Attribute/Distribution: HU

GS 178 (AAS 178, HIST 178) Globalization and Health in Ghana 3 Credits
This 4-week field-based course fosters global engagement by introducing students to the historical, social, cultural, and political factors at the forefront of globalization and health processes in Ghana.
Attribute/Distribution: SS

GS 183 (ART 183, HIST 183) France from Medieval to Modern: Soc., Pol., & Art 3 Credits
France's artistic, cultural, social, artistic and political development from early kingship and dominance of the Church in the Middle Ages to the grandeur of Versailles in the Age of Absolutism; radical transformations of culture and society during the French Revolution and advent of the Modern Nation-State; to twentieth century developments including the two World Wars, imperialism and impact of post-war globalization. Offered in summer only through Lehigh Study Abroad Office as part of Lehigh in Paris program.
Attribute/Distribution: HU

GS 143 (REL 143) Religious Nationalism in a Global Perspective 4 Credits
Religion has become a renewed political force on the world stage in recent years. This course will focus on how religion has often provided both the ideological language and the organizing principles for many modern nationalisms. Our exploration of this topic will take the form of case studies from various parts of the world, including but not limited to Pakistan, Israel, No. Ireland, India, Iran and USA.
Attribute/Distribution: HU

GS 145 (ASIA 145, REL 145) Islam and the Modern World 4 Credits
Examines how numerous Muslim thinkers-religious scholars, modernists, and Islamists-have responded to the changes and challenges of the colonial and post-colonial eras. Special emphasis is placed on the public debates over Islamic authority and authenticity in contemporary South Asia.
Attribute/Distribution: HU

GS 147 (ASIA 147, REL 147) Pilgrims, Bandits, Traders, Nuns: Traveling Religious Identities in Asia 4 Credits
This course examines religious networks linking Chinese, Tibetan, Himalayan, and Inner Asian people, places, and institutions to Asia and the world. We explore examples of 19th, 20th century and present day transnational religious identities, emerging from trade, religious travel and pilgrimage, refugee migrations, labor migrations, and modern day leisure travel. We consider religious identity, nationalism, transnationalism, and globalization, using literary, historical, and ethnographic sources, and film, video, and popular media.
Attribute/Distribution: HU
GS 201 (ASIA 201, POLS 201) Democracy and Dictatorship in South Asia 4 Credits
Examines the politics of countries in South Asia (India, Pakistan, Bangladesh, Sri Lanka, Nepal, Bhutan, and the Maldives). Some of the key themes are 1) the lasting legacy of colonialism, 2) ways in which ethnic and religious diversity is managed, 3) distinctiveness of political institutions like parliament and constitutions in South Asia, and 4) how politics, economics, and culture relate to one another. The focus of the course changes each year in order to reflect current developments and student interest.
Attribute/Distribution: SS

GS 202 (ENGL 202, LAS 202, MLL 202) Latin America In Fact, In Fiction 4 Credits
This class couples a survey of Latin American literature in translation with an interdisciplinary approach to the study of Latin America. Departing initially from readings of literary and cinematographic works, our analyses will engage methodologies from multiple disciplines including history, sociology, and cultural studies. Accordingly, this course will examine critical developments in Latin American aesthetics along with the cultural climates in which they matured. This course assumes no prior study of Spanish, Portuguese, or Latin American culture.
Attribute/Distribution: HU

GS 221 (AAS 221, ART 221) Global Contemporary Art 4 Credits
Course examines artworks from around the world c. 1980s to the present. Topics include revolutionary arts, globalization, EcoArt, postcolonial arts, phenomenological, experiential and new media arts. Global feminist projects, design/build production, graffiti and popular arts are covered regularly. International Art Biennials, exhibitions and the built environment are featured. Art Theory is explored through iconographic, formal and contextual (political, social, financial) analysis. Movements are situated in historical frameworks as well as in their international scope and value. Writing Intensive.
Attribute/Distribution: HU

GS 246 (JOUR 246) International Communication 4 Credits
The subject matter is crucial to understanding modern life: the role of international news media in world affairs. The class studies the social, political and economic contexts that frame the reporting of international events by U.S. news media, such as politics, war, disasters, and other crises, as well as U.S. reporting on international issues, such as poverty, disease, and environmental change. The course also surveys reporting practices in nations around the world, including the varying systems of journalism and mass media and the brutal censorship and repression facing many foreign journalists.
Attribute/Distribution: SS

GS 247 (ASIA 247, REL 247) Islamic Mysticism 4 Credits
Sufism, the inner or 'mystical' dimension of Islam, has deep historical roots and diverse expressions throughout the Muslim world. Students examine Sufi doctrine and ritual, the master-disciple relationship, and the tradition's impact on art and music, poetry and prose.
Attribute/Distribution: HU

GS 248 (COMM 248) Global Communication 4 Credits
This class studies, from an historical and cultural perspective, how globalization shapes and is shaped by communication and media structures and processes, with special emphasis on transnational media corporations and their interaction with cultures around the globe. Topics include: globalization, media and culture; mass media and development; the flow of entertainment programs and debates on cultural imperialism; media and migration; the imbalanced flow of information in the world; the debate on the New World Information Order; and forms of resistance to transnational media from world governance institutions, such as UNESCO, state regulatory responses, and alternative media, such as citizen blogs and pirate radio.
Attribute/Distribution: SS

GS 253 (ARCH 253, HIST 253) Paris: Plan of Metropolis 3 Credits
The splendor of modern Paris is due in large part to bold, large scale modernization and changes in the city's patterns during the 19th century. This course, which is part of the Lehigh in Paris summer program, will cover a century of change and focus on the major accomplishments of its visionary planners.
Attribute/Distribution: HU

GS 259 (FREN 259) Contemporary France 3-4 Credits
How is France defining itself today as a European nation in a global world? Issues to be explored include: family, gender, race and religion, the education and social systems, immigration, and politics. Strongly recommended for students who plan to study abroad in France.
Attribute/Distribution: HU

GS 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

GS 302 (ENGL 302, LAS 302, MLL 302) Travel and Adventure in Latin American Fiction 4 Credits
Centering on a corpus of works presenting tales of travel and adventure, this class offers an overview of Latin American narrative genres (including "fantastic" narrative, magical realism, and postmodern fiction) from the mid 20th century to present day. Through close readings of works by Adolfo Bioy Casares and Roberto Bolaño, among others, and the analysis of filmic representations of travel in Latin America, we will examine differing modes of perceiving the region defined as Latin America.
Attribute/Distribution: HU

GS 314 (AAS 314, HUM 314, SOC 314) Infections and Inequalities: HIV, TB and Malaria in the Global South 4 Credits
This course will explore the social, economic, and environmental causes of HIV, TB, and malaria in developing nations, with a particular focus on the characteristics and causes of these diseases in Sub-Saharan Africa. Students will engage theories and perspectives on development, globalization, and social inequality to explain trends in HIV, TB, and malaria and to understand why certain groups are more vulnerable to infection than others. Prerequisite: Junior/senior standing with declared major/minor in SOC, ANTH, SOAN, HUM, GS, or AAS.
Attribute/Distribution: SS

GS 315 Seminar in Globalization and Culture 4 Credits
Advanced seminar that focuses on research and discussion of specialized topics in globalization and culture. Subjects vary by semester. Junior or senior standing and departmental Permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

GS 317 (ANTH 317) So You Want to Save the World: Anthropological Encounters with Humanitarianism and Development 4 Credits
We are often motivated by the desire to "give back"—feed the hungry, heal the sick, and help those less fortunate than ourselves. Anthropological research on humanitarian aid, development projects, and other interventions meant to improve human lives in various contexts shows us why these efforts often go awry. Focusing primarily on settings outside the U.S., students will consider the pitfalls of developmental and humanitarian interventions as well as the crucial role of local knowledge in addressing complex global problems.
Attribute/Distribution: SS

GS 318 Seminar in Globalization and Communication 4 Credits
Advanced seminar that focuses on research and discussion of specialized topics in globalization and communication. Subjects vary by semester. Junior or senior standing and departmental Permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

GS 319 (SOC 319) The Political Economy of Globalization 4 Credits
Course studies the relationship among economic, political and cultural forces in an era of globalization. Focus is on how global capitalism, the world market and local economies shape and are shaped by social, cultural and historical forces. Topics include political and cultural determinants of trade and investment; culture and the global economy; global capitalism, especially studied through the lens of culture; globalization and patterns of economic growth; cross-cultural study of consumerism; and poverty and inequality. Typically designated as Writing Intensive.
Attribute/Distribution: SS
GS 320 (ANTH 320) Global Capitalism 4 Credits
Anthropological approach to the forms and effects of global capitalism. Topics include the structure of contemporary global capitalism, including the growth of multinational corporations, flexible corporate strategies, overseas manufacturing, and global branding and marketing; the impact of global capitalism on the environment and on the lives of people in "Third World" countries; consumer culture and the diversity of non-Western consumption practices; alternative capitalist systems.
Attribute/Distribution: SS

GS 321 (MLL 321) Intercultural Communication 4 Credits
Language is ambiguous by nature and discourse is interpreted in cultural and linguistic contexts. This course covers different cultural and linguistic strategies individuals use to communicate with each other, essential concepts for interacting with individuals from other cultural and linguistic backgrounds, and different strategies of communication as defined by specific cultures. Covering the theory and practice of intercultural interaction, this examines assumptions about language and culture, and includes practical advice to help students develop the cultural sensitivity essential for communication today.
Attribute/Distribution: SS

GS 322 (HMS 322, SOC 322) Global Health Issues 4 Credits
Sociocultural dimensions of health, illness, and healing as they appear in different parts of the world. Focus on patterns of disease and mortality around the world; the relative importance of 'traditional' and 'modern' beliefs and practices with regard to disease and treatment in different societies; the organization of national health care systems in different countries; and the role of international organizations and social movements in promoting health.
Attribute/Distribution: SS

GS 324 (AAS 324, ANTH 324) Globalization and Development in Africa 4 Credits
Examines the challenges Africa presents to expectations of modernization and development. It poses these questions: Have African societies been left behind by globalization, shut out from it, or do they reflect an unexpected side of globalization processes? What is Africa's place in the neo-liberal world order? What role does "African culture" play in generating or blocking social change? How can anthropology illuminate prospects for change on what has long been regarded as the "dark continent"?
Attribute/Distribution: SS

GS 325 (POLS 325) Nationalism, Regionalism, and Populism 3,4 Credits
Examination of major theoretical and policy debates in the study of nationalism. Focus on the emergence and endurance of nationalist movements in the modern era, the spread of autonomy movements, and the recent rise of populist politics. Discussion of responses to nationalist claims and efforts to resolve nationalist conflict.
Prerequisites: POLS 003

GS 328 (SOC 328) Global Food Systems 4 Credits
Where does our food come from? How does it get to our tables? Why are there famines in some parts of the world and obesity epidemics in other parts of the world? This course will investigate these questions by focusing on food systems — the chains of social action that link food producers to food consumers. We will also explore a range of alternatives to global food systems that emphasize food democracy, security, and sustainability.
Attribute/Distribution: SS

GS 329 (SOC 329) Global Migration 4 Credits
International migration is transforming societies at both the global and national levels, and in both origin and destination areas. Why do people move? What are the consequences of these movements? We will investigate the political and economic explanations for international migration and explore how each act of migration contributes to the transnationalization of social relations, alters existing livelihoods, transforms economic production and social support arrangements, and recreates racial, ethnic, and national identities.
Attribute/Distribution: SS

GS 331 (SOC 331, WGSS 331) Gendered Experience of Globalization 4 Credits
Women and men experience globalization differently and globalization affects women in different cultural and national contexts. Gender stratification has been intensified by the transnational flow of goods and people, provides students with a survey of new development in feminist theories on globalization and on gender stratification and development, and links these theoretical frameworks to empirical research about gender issues that have become more prominent with globalization.
Attribute/Distribution: SS

GS 339 The Rise of the State in Modern East Asia 4 Credits
An examination of the role of Asian nationalism in the construction of the modern state form in Asia.
Attribute/Distribution: SS

GS 341 (AAS 341, HIST 341) Global Africa: Aid, Volunteerism, NGO's and International Studies 3,4 Credits
This course traces the origins of Aid to Africa, explores various volunteer activities, and investigates the role of NGOs, missionaries, philanthropists, medical practitioners, and global education. It examines the ways that cross-cultural interactions and exchanges between Africans and foreigners shaped African societies both positively and negatively.
Attribute/Distribution: SS

GS 342 (POLS 342, WGSS 342) Gender and Third World Development 3-4 Credits
Focus on gender implications of contemporary strategies for Third World economic growth, neo-liberalism. How do economic theories affect 'real people'? How do economic theories affect men vs. women? What is the role of people who want to 'help'? Some background in economic theories and/or Third World politics desired, but not required.
Prerequisites: POLS 001 or WGSS 001
Attribute/Distribution: SS

GS 343 (AAS 343, ASIA 343, POLS 343) Global Politics of Race: Asia and Africa 4 Credits
An examination of the concept of "race" and its impact on domestic and international politics.
Attribute/Distribution: SS

GS 347 (HIST 347) The French Revolution and Napoleon: A Global History 3,4 Credits
Global origins; breakdown of Absolute Monarchy; rise of Enlightenment culture and decadence of the court; storms of the Bastille and creation of republican government; invention of modern nationalism and Napoleonic military culture; women in political life; uses of mass propaganda, public festivals and transformation of the arts; political violence in the "Terror"; abolition of slavery and origins of Haitian Revolution; Napoleon's imperial system and warfare with Europe; impact on global imperial rivalries and revolutionary movements abroad.
Attribute/Distribution: HU

GS 348 (HIST 348) The British Empire and the Modern World 3-4 Credits
Examines the empire and its central role in the process of globalization between the 16th and 20th centuries. Topics include exploration, state-building, war, multinational corporations, industry, international finance, missionaries, racism, and independence movements.

GS 365 (PSYC 365) Human Development in Cross-Cultural Perspective 4 Credits
The formation of mind and personality is shaped in profound ways by the sociocultural contexts within which individuals develop. This course introduces students to basic theoretical and methodological issues and explores important examples of cross-cultural variation and diversity, using comparisons between different societies and between different subcultures within American society. Topics include cognition, language, personality, moral development, socio-emotional development, identity, attachment, and socialization. Materials drawn from anthropology, sociology and education in addition to psychology.
Prerequisites: PSYC 107 or PSYC 109 or PSYC 121
Attribute/Distribution: SS
GS 370 (ES 370, SOC 370) Globalization and the Environment 4 Credits
This course investigates globalization and the environment including how globalization has influenced society-nature relationships, as well as how environmental conditions influence the globalization processes. A key focus will be on the rapidly evolving global economic and political systems that characterize global development dynamics therefore resource use. Particular attention is paid to the role of multi-national corporations, international trade, and finance patterns and agreements. Questions related to consumption, population, global climate change, toxic wastes, and food production/distribution represent key themes. 
Attribute/Distribution: SS

GS 390 Readings in Global Studies 1-4 Credits
Directed course of readings for students with interests in Global Studies not fully explored in regular offerings. Junior or senior standing required. Departmental permission required. 
Repeat Status: Course may be repeated. 
Attribute/Distribution: HU

GS 391 Directed Research in Global Studies 1-4 Credits
Research and study for students with interests in Global Studies not fully explored in regular course offerings. Junior or senior standing required. Departmental permission required. 
Repeat Status: Course may be repeated. 
Attribute/Distribution: SS

GS 392 Internship in Global Studies 1-4 Credits
Supervised work relevant to global studies, including internships at the United Nations, nongovernment organizations (NGOs), government organizations, and other public and private agencies. Department permission required. 
Repeat Status: Course may be repeated. 
Attribute/Distribution: SS

GS 394 Honors Thesis 1-4 Credits
To graduate with honors in Global Studies, students need to attain a 3.5 grade point average in Global Studies classes; a 3.5 grade point average overall, and complete 4 credits of GS 394 Honors Thesis at the time of graduation. The four credits may be taken in one semester or split over two semesters. The honors thesis is an intensive project of original research, undertaken under the direct supervision of a faculty adviser. Senior standing required. Departmental permission required. 
Repeat Status: Course may be repeated. 
Attribute/Distribution: SS

Health, Medicine, and Society

Program Director: Jessiecae Marsh, Ph.D (Yale) (https://psychology.cas2.lehigh.edu/content/jessecae-marsh-0)
Email: jessecae.marsh@lehigh.edu | Phone: 610-758-2941
Website: http://hms.cas2.lehigh.edu/ 
Supported by the Office of Interdisciplinary Programs 610-758-3996; incasip@lehigh.edu (incasip@lehigh.edu) | Williams Hall, 31 Williams Drive

Interdisciplinary Health, Medicine, and Society major and minor programs are offered in the College of Arts and Sciences. A committee composed of faculty from several departments across the college developed and participate in the programs. Students interested in declaring a a major or minor in Health, Medicine, and Society should contact the Office of Interdisciplinary Programs (incasip@lehigh.edu).

The challenge of meeting the increasingly complex health needs of growing and aging populations is moving to the forefront of national and international concerns in the 21st century. The Health, Medicine, and Society field focuses on the social scientific and humanistic dimensions of health and medical care to develop an understanding of the impact of health, illness, and medical care on individuals, families, and societies. This program is intended to serve students who wish to be involved in some aspect of the health care industry or health policy and also students who are interested in communications, the pharmaceutical industry, law, business, agency work, and other careers where understanding health care is essential.

Emeritus Faculty
Judith N. Lasker, professor emerita of sociology and anthropology and health, medicine and society.

Professor. Elizabeth A. Dolan, PHD (University of North Carolina at Chapel Hill)
Associate Professors. Christopher T. Burke, PHD (New York University); Jessecae Marsh, PHD (Yale University)
Assistant Professors. Sirry M. Alang, PHD (University of Minnesota Minneapolis); Lucy Napper, PHD (University of Sheffield); Lorenzo Servitje, PHD (California State University)

Emeritus. Judith N. Lasker, PHD (Harvard University)

MAJOR REQUIREMENTS
In addition to the 32 required credits, all HMS majors are required to have a second major.
A minimum of 3 courses must be taken at the 300 level and may not include the Research Methods course.
No more than two courses for a maximum of 8 credits may be taken outside of Lehigh, including non-Lehigh study abroad.
The writing intensive requirement can be fulfilled with any course designated as Writing Intensive on the course schedule

CORE REQUIREMENTS 12

<table>
<thead>
<tr>
<th>Humanities</th>
<th>Social Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMS 170 or HMS 116</td>
<td>Introduction to Health Psychology</td>
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<tr>
<td></td>
<td>Medicine and Society</td>
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<tr>
<td></td>
<td>Introduction to Public Health</td>
</tr>
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</table>

Research Methods 1

| Values and Ethics of Community- Engaged Research |
| Participatory and Action Research in Psychology |
| Community Based Participatory Research Methodology |

CONCENTRATIONS 2, 3 12

Students must take a minimum of 3 courses outside of the core requirements in one of the following concentrations:

Health Humanities (HU) or Social Science Approaches to Health (SS)

ELECTIVE REQUIREMENTS 2, 3 8
At least one course must be taken outside of concentration area.

Total Credits 32

1 Research methods required course should be chosen in consultation with Advisor. Major dependent courses that may meet this requirement include SOAN 111 Research Methods and Data Analysis, SOC 391 Evaluation Research, PSYC 202 Research Methods and Data Analysis II and PSYC 210 Experimental Research Methods and Laboratory
2 No more than two courses outside of the core courses can come from cross-listed courses within the second major.
3 A maximum of 4 credits of HMS 221 Peer Health Adviser Training, HMS 291 Independent Study, HMS 292 Supervised Research, HMS 293 Internship, or HMS 294 Health Equity Internship may fulfill the major concentration or elective requirement.

CORE AND ELECTIVE COURSES
Each semester, a complete list of HMS course offerings can be found on the HMS web site or in the Office of Interdisciplinary Programs, Williams Hall, Suite 101. Other courses approved by the program director.

Social Science

<table>
<thead>
<tr>
<th>HMS 101</th>
<th>Special Topics in Health, Medicine and Society</th>
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<tbody>
<tr>
<td>HMS/POLS/ES 110</td>
<td>Environmental Planning for Healthy Cities</td>
</tr>
<tr>
<td>Code</td>
<td>Course Title</td>
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<tr>
<td>HMS/JOUR/ES 117</td>
<td>Environmental Health Risks and the Media</td>
</tr>
<tr>
<td>HMS/SOAN/ETH 120</td>
<td>Values and Ethics of Community-Engaged Research</td>
</tr>
<tr>
<td>HMS/HIST/WGSS 125</td>
<td>Does Sex have a History? The History of Sexuality in the United States</td>
</tr>
<tr>
<td>HMS/PSYC 130</td>
<td>Introduction to Health Psychology</td>
</tr>
<tr>
<td>HMS/PSYC 138</td>
<td>Abnormal Psychology</td>
</tr>
<tr>
<td>HMS/COMM 150</td>
<td>Alcohol, Science, and Society</td>
</tr>
<tr>
<td>HMS/ANTH/GS 155</td>
<td>Medical Anthropology</td>
</tr>
<tr>
<td>HMS/SOC 160</td>
<td>Medicine and Society</td>
</tr>
<tr>
<td>HMS/SOC 162</td>
<td>AIDS and Society</td>
</tr>
<tr>
<td>HMS 180</td>
<td>Introduction to Public Health</td>
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<tr>
<td>HMS 221</td>
<td>Peer Health Adviser Training</td>
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<tr>
<td>HMS 291</td>
<td>Independent Study</td>
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<td>HMS 292</td>
<td>Supervised Research</td>
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<td>HMS 293</td>
<td>Internship</td>
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<td>HMS 294</td>
<td>Health Equity Internship</td>
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<tr>
<td>HMS 301</td>
<td>Special Topics in Health, Medicine and Society</td>
</tr>
<tr>
<td>HMS/PSYC 302</td>
<td>Stress and Coping</td>
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<tr>
<td>HMS/POLS 307</td>
<td>The Politics of Mental Health Policy</td>
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<tr>
<td>HMS/AAS/GS/SOC 314</td>
<td>Infections and Inequalities: HIV, TB and Malaria in the Global South</td>
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<tr>
<td>HMS/SOC 316</td>
<td>Social Epidemiology</td>
</tr>
<tr>
<td>HMS/PSYC 319</td>
<td>The Psychology of Trauma</td>
</tr>
<tr>
<td>HMS/SOC/GS 322</td>
<td>Global Health Issues</td>
</tr>
<tr>
<td>HMS/JOUR/STS/ES 323</td>
<td>Health and Environmental Controversies</td>
</tr>
<tr>
<td>HMS/ES/POLS 320</td>
<td>Food Justice in Urban Environments</td>
</tr>
<tr>
<td>HMS/PSYC 327</td>
<td>Advanced Topics in Health Psychology</td>
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<tr>
<td>HMS 331</td>
<td>Latino Health</td>
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<tr>
<td>HMS/PSYC/WGSS 334</td>
<td>The Psychology of Body Image and Eating Disorders</td>
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<tr>
<td>HMS/SOC/WGSS 341</td>
<td>Women and Health</td>
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<tr>
<td>HMS/SOC 343</td>
<td>Race, Ethnicity, and Health</td>
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<tr>
<td>HMS/PSYC 344</td>
<td>Health Care Reasoning and Decision-Making</td>
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<tr>
<td>HMS/PSYC 348</td>
<td>Drugs and Behavior</td>
</tr>
<tr>
<td>HMS/PSYC 349</td>
<td>Participatory and Action Research in Psychology</td>
</tr>
<tr>
<td>HMS/POLS 354</td>
<td>U.S. Health Care Politics</td>
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<tr>
<td>HMS/EDUC 375</td>
<td>Community Based Participatory Research Methodology</td>
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<tr>
<td>HMS/PSYC 386</td>
<td>Pediatric Psychology</td>
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<tr>
<td>ECO 368</td>
<td>Health Economics</td>
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### Humanities

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<tr>
<th>Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>HMS/REL/ETH 002</td>
<td>Death and Dying: Religious and Ethical Perspectives</td>
</tr>
<tr>
<td>HMS 101</td>
<td>Special Topics in Health, Medicine and Society</td>
</tr>
<tr>
<td>HMS/ENGL 115</td>
<td>Topics in Literature, Medicine, and Health</td>
</tr>
<tr>
<td>HMS/PHIL/REL/ETH 116</td>
<td>Bioethics</td>
</tr>
<tr>
<td>HMS/STS/HIST 118</td>
<td>History of Modern Medicine</td>
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<tr>
<td>HMS 170</td>
<td>Medical Humanities</td>
</tr>
<tr>
<td>HMS/REL/ETH 226</td>
<td>From Black Death to AIDS: Plague, Pandemic, Ethics and Religion</td>
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<tr>
<td>HMS 291</td>
<td>Independent Study</td>
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<td>HMS 292</td>
<td>Supervised Research</td>
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<td>HMS 293</td>
<td>Internship</td>
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<td>Special Topics in Health, Medicine and Society</td>
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<tr>
<td>HMS/ENGL 315</td>
<td>Topics in Literature, Medicine, and Health</td>
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</tbody>
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### Natural Science

<table>
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<th>Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>BIOS 010</td>
<td>Bioscience in the 21st Century</td>
</tr>
<tr>
<td>EES 029</td>
<td>Human Health and the Environment</td>
</tr>
<tr>
<td>HMS/SDEV 123</td>
<td>Oceans and Human Health</td>
</tr>
</tbody>
</table>

To declare an HMS major, contact the Office of Interdisciplinary Programs, Williams Hall, Suite 101.

### Minor REQUIREMENTS

The minor in HMS consists of one core course and elective courses for a total of 16 credits. To declare a minor in HMS or for a complete list of HMS course offerings, visit the Office of Interdisciplinary Programs, Williams Hall, Suite 101. For study abroad course approval, see program director.

### Electives (select three courses from the list of core and elective courses) 2

<table>
<thead>
<tr>
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<th>Course Title</th>
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<tbody>
<tr>
<td>HMS/REL/PHIL 116</td>
<td>Bioethics</td>
</tr>
<tr>
<td>HMS/PSYC 130</td>
<td>Introduction to Health Psychology</td>
</tr>
<tr>
<td>HMS/SOC 160</td>
<td>Medicine and Society</td>
</tr>
<tr>
<td>HMS 170</td>
<td>Medical Humanities</td>
</tr>
<tr>
<td>HMS 180</td>
<td>Introduction to Public Health</td>
</tr>
</tbody>
</table>

### Total credits 3 16

1. If more than one core course is taken, core course may substitute for elective.
2. A maximum of 4 credits of HMS 221 Peer Health Adviser Training, HMS 291 Independent Study, HMS 292 Supervised Research, HMS 293 Internship, or HMS 294 Health Equity Internship may fulfill the minor elective requirement.
3. No more than one course for a maximum of 4 credits may be taken outside of Lehigh, including non-Lehigh study abroad.

### Courses

**HMS 002 (ETH 002, REL 002) Death and Dying: Religious and Ethical Perspectives 4 Credits**

Introduces students to the study of religion, world religious traditions and ethics through an exploration of death and dying. Rituals, practices and texts focused on death provide the basis for comparative study of Asian and Western religious approaches to the meaning and mystery of death as it confronts individuals and communities. Attention will also be given to moral justification for deaths brought about by human actions (i.e., killings). Specific issues include suicide, war deaths, abortion, euthanasia and state-sponsored execution.

**Attribute/Distribution:** HU

**HMS 101 Special Topics in Health, Medicine and Society 3-4 Credits**

Topics vary from semester to semester. Topics are presented at an introductory level.

**Repeat Status:** Course may be repeated.

**Attribute/Distribution:** HU, SS

**HMS 110 (ES 110, POLS 110) Environmental Planning for Healthy Cities 4 Credits**

An introduction to the topic of environmental planning, the course will review the roles of citizens, other stakeholders, political interests, and local governments in determining the use of land; unpack the meaning of “sustainability;” and grapple with the challenge of balancing communities’ demand for development with the need to protect valuable natural resources. Students will be introduced to examples of successful and unsuccessful instances of environmental planning both at home and abroad.

**Attribute/Distribution:** SS
HMS 115 (ENGL 115) Topics in Literature, Medicine, and Health 4 Credits
Largely focused on narratives about health, illness and disability, this course will examine individual experiences with attention to social context. Topics may include the physician/patient relationship, illness and deviance, plague literature, gender and medicine, autism, AIDS, mental illness, aging.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

HMS 116 (ETH 116, PHIL 116, REL 116) Bioethics 4 Credits
Moral issues that arise in the context of health care and related biomedical fields in the United States today, examined in the light of the nature and foundation of moral rights and obligations. Topics include: confidentiality, informed consent, euthanasia, medical research and experimentation, genetics, and the distribution of health care.
Attribute/Distribution: HU

HMS 117 (ES 117, JOUR 117) Environmental Health Risks and the Media 4 Credits
This course explores the risks and effects of environmental contamination on human health and behavior as well as the role of the mass media in alerting citizens to potential environmental health risks. Environmental topics vary but usually include air and water pollution, endocrine disrupters and radioactive waste.
Attribute/Distribution: SS

HMS 118 (HIST 118, STS 118) History of Modern Medicine 4 Credits
Introduction to Western medical history from the 18th century to the present day. Students will explore patient/practitioner relationships; examining changing ideas concerning health, sickness, and disease; chart changes in hospital care and medical education; and tackle topics such as eugenics, medical experimentation and health insurance.
Attribute/Distribution: HU

HMS 120 (ETH 120, SOAN 120) Values and Ethics of Community-Engaged Research 4 Credits
The many dimensions of community-engaged research and learning are explored, with special attention to ethical practices, values, research methods, and critical reflection. Experiential and service aspects of the course provide opportunities for students to build skills for social and community change, as well as build capacity for research and critical inquiry.
Attribute/Distribution: SS

HMS 123 (SDEV 123) Oceans and Human Health 4 Credits
The world’s oceans affect human health in many ways: they provide food and water to human populations; they are a point of exposure to pollutants, toxins, and diseases; and they provide pharmaceuticals and animals used in biomedical research. This course explores the interactions between oceans and human health by studying the ways in which they intersect. This summer study abroad course is based at the Bermuda Institute of Ocean Sciences (BIOS).
Attribute/Distribution: NS

HMS 125 (HIST 125, WGSS 125) Does Sex have a History? The History of Sexuality in the United States 4 Credits
Explores the history of sexuality in the United States from the colonial era to the present. While sexuality can appear timeless and stable, sexual ideologies, categories, and behaviors have consistently evolved and have transformed society in the process. The class pays special attention to relationships between sexuality, race, class, and the state, as well as how law, medicine, and the media have shaped sexual identities and experiences. In so doing, the class develops sophisticated readers of historical and contemporary cultures.
Attribute/Distribution: HU

HMS 130 (PSYC 130) Introduction to Health Psychology 4 Credits
This course explores the psychological processes that influence how people stay healthy, why people get sick, and how people respond to illness. The course also examines what the study of health psychology has to teach us about illness prevention and the provision of health care services.
Prerequisites: PSYC 001
Attribute/Distribution: SS

HMS 138 (PSYC 138) Abnormal Psychology 4 Credits
Examines research and theory on the patterns, causes, and treatment of various forms of abnormal behavior.
Prerequisites: PSYC 001
Attribute/Distribution: SS

HMS 150 (COMM 150) Health Communication 4 Credits
Knowledge of health communication is an essential foundation for anyone working in the field. Yet communicating about health is often complex and multi-faceted. To better understand health communication, we will explore the role of media and persuasion. We'll examine media coverage of health information; communications on risks and epidemics; theories and research of health behavior; effects of communication technologies on health communication; communicating about health data and information; health campaigns; engaging with individuals and communities with health messages and more.
Attribute/Distribution: SS

HMS 152 (SOC 152) Alcohol, Science, and Society 4 Credits
Alcohol use and abuse, its historical function in society, moral entrepreneurship, status struggles and conflict over alcohol. Current problems with attention to special population groups and strategies for prevention of alcohol abuse.
Attribute/Distribution: SS

HMS 155 (ANTH 155, GS 155) Medical Anthropology 4 Credits
Medical Anthropology is the study of how conceptions of health, illness, and healing methods vary over time and across cultures. Students will learn how social and cultural factors shape health outcomes in a variety of human contexts, and will study culturally specific approaches to healing, including Western bio-medicine. The course offers a broad understanding of the relationship between culture, health, and healing.
Attribute/Distribution: SS

HMS 160 (SOC 160) Medicine and Society 4 Credits
Sociological perspectives on health, illness, and medical care. Focus on social epidemiology, social psychology of illness, socialization of health professionals, patient-professional relationships, medical care organization and policies.
Attribute/Distribution: SS

HMS 162 (SOC 162) AIDS and Society 4 Credits
Impact of the AIDS epidemic on individuals and on social institutions (medicine, religion, education, politics, etc.); social and health policy responses; international experience; effect on public attitudes and policy on people affected directly by AIDS.
Attribute/Distribution: SS

HMS 170 Medical Humanities 4 Credits
The focus on individual voices and particular historical moments in the humanities disciplines has much to add to our understanding of health and illness. This course will take up ethical, historical, and literary approaches to health.
Attribute/Distribution: HU

HMS 176 (AAS 176, GS 176, HIST 176) Keeping Africa and Africans Healthy: A History of Illness and Wellness 4 Credits
What are the myths about diseases in Africa and how does the world respond to health crises there? What are the African healing traditions? What is the history of global health in Africa and its implications for illness and wellness? This course explores health interventions and initiatives by Africans and non-Africans including missionaries, colonial officials, and NGOs. Students' final papers will perform a "post-mortem" on Africa, critically tracing how efforts to control, manage and eradicate diseases have succeeded or failed.
Attribute/Distribution: HU

HMS 180 Introduction to Public Health 4 Credits
This course provides historical perspective on the contributions and roles of public health; introduces health status indicators of morbidity and mortality, concepts of rate, causation, and public health surveillance and vital statistics; and addresses determinants of health from an environmental, social, behavioral perspective. Aspects of health care delivery will be addressed from a population perspective and organizational structure.
Attribute/Distribution: SS
HMS 221 Peer Health Adviser Training 4 Credits
This applied course explores student health at Lehigh University and focuses on the development, implementation and evaluation of prevention strategies designed to make Lehigh a healthy and safe living, learning community by exploring student health-related data, examining campus-wide priority student health issues and developing evidence-based interventions. Peer Health Advisers are trained to provide peer-to-peer support, advice, resources and programming to promote healthy behaviors. Students completing the course are subsequently eligible to serve as Peer Health Advisers.
Attribute/Distribution: SS

HMS 226 (ETH 226, REL 226) From Black Death to AIDS: Plague, Pandemic, Ethics and Religion 4 Credits
An investigation of the role of religion and ethical analysis in constructing meaning around the idea of plague and pandemic. The role of religion in the European bubonic plague epidemic, the influenza pandemic of 1918, and the AIDS crisis will be examined, with attention given to ethical analysis of the institutional response to pandemic disease as distortions have occurred for political, social, and religious reasons.
Attribute/Distribution: HU

HMS 291 Independent Study 1-4 Credits
Independent research and reading with a faculty member. After receiving initial approval from the HMS director, the student must prepare an independent study proposal, with readings and assignments, in consultation with a professor who agrees to direct the independent study.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

HMS 292 Supervised Research 1-8 Credits
Research project under the direct supervision of an HMS faculty member. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

HMS 293 Internship 1-8 Credits
Student designed internship that provides practical experience in the application of health, medicine and society for both on- and off-campus organizations. Students must find the internship on their own and submit an application to the HMS program director. Upon approval, course will provide credit for supervised experiential learning experiences. Students are responsible for obtaining any clearances required by internship host agency. May be repeated for credit up to eight credits.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

HMS 294 Health Equity Internship 1-8 Credits
Students will work with a combination of staff and faculty from the Hispanic Center, St. Luke's, and Lehigh University to assist in developing programs at the Hispanic Center LV, the emerging Center for Integrative Health, and with other community agencies to promote health equity and reduce health disparities for the South Bethlehem community. Students may participate in activities related to data collection, program management, marketing, community/public health initiatives, outreach, and grant writing. Application and clearances required.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

HMS 298 1-4 Credits
Repeat Status: Course may be repeated.

HMS 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

HMS 301 Special Topics in Health, Medicine and Society 3-4 Credits
Topics vary from semester to semester. Topics are presented at an advanced level. Previous course work in HMS and consent of faculty sponsor is required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

HMS 302 (PSYC 302) Stress and Coping 4 Credits
How does stress affect the psychological system, and what psychological mechanisms are in place to help people overcome environmental stressors? This seminar examines classic and contemporary theories and research on stress, coping, and social support.
Prerequisites: PSYC 121 or PSYC 153 or HMS 160 or HMS 180
Attribute/Distribution: SS

HMS 307 (POLS 307) The Politics of Mental Health Policy 4 Credits
What is normal behavior, and how do we come to understand mental illnesses? How do the resulting policies, to address mental health, impact society? This course is designed to facilitate thoughtful discourse on the various ways in which society regulates access to opportunities, facilitates integration or alienation, and constructs the social world.

HMS 314 (AAS 314, GS 314, SOC 314) Infections and Inequalities: HIV, TB and Malaria in the Global South 4 Credits
This course will explore the social, economic, and environmental causes of HIV, TB, and malaria in developing nations, with a particular focus on the characteristics and causes of these diseases in Sub-Saharan Africa. Students will engage theories and perspectives on development, globalization, and social inequality to explain trends in HIV, TB, and malaria and to understand why certain groups are more vulnerable to infection than others. Prerequisite: Junior/senior standing with declared major/minor in SOC, ANTH, SOAN, HMS, GS, or AAS.
Attribute/Distribution: SS

HMS 315 (ENGL 315) Topics in Literature, Medicine, and Health 3,4 Credits
Analyzing the stories people tell about health, illness and disability, this course engages cultural studies approaches in order to explore the way those stories are told. Topics may include: illness and the graphic novel, the changing image of the healer in literature, collaborative storytelling with Alzheimer's patients, end of life narratives, tales from the ER, narrative ethics.
Attribute/Distribution: HU

HMS 316 (SOC 316) Social Epidemiology 4 Credits
Social epidemiology is the study of the distribution and social determinants of health and disease in human populations. This course introduces the basic principles of epidemiological study design, analysis and interpretation, covering topics such as how a disease spreads across populations and how public health interventions can help control or reduce the spread of disease. This course also reviews epidemiology as a social science by reviewing the social causes and consequences of health.
Attribute/Distribution: SS

HMS 319 (PSYC 319) The Psychology of Trauma 4 Credits
This course explores the nature of psychological trauma, including the physiological, emotional, cognitive, behavioral, interpersonal, and developmental impact of exposure to extreme stress and traumatic events. Historical and current perspectives on the individual and cultural effects of trauma will be examined, including consequences of relational trauma, traumatic loss, injury/illness, crime, combat exposure, terrorism, natural disasters, and vicarious traumatization. Posttraumatic Stress Disorder and related conditions will be explored, as will the nature of effective intervention techniques, recovery, adaptive coping, and resilience.
Prerequisites: PSYC 138 or HMS 138
Attribute/Distribution: SS

HMS 320 (ES 320, POLS 320) Food Justice in Urban Environments 4 Credits
This course will review how urban agriculture and city greening programs and policies are part of a growing movement working to strengthen neighborhoods, promote healthier living, and create more localized and sustainable food economies. This class will explore research and readings from multiple disciplines on these programs and policies, and will also delve into individual case studies that illustrate how efforts to improve food access, beautify vacant land, and reduce farm-to-table distances get creatively and successfully combined.
Attribute/Distribution: SS
HMS 322 (GS 322, SOC 322) Global Health Issues 4 Credits
Sociological dimensions of health, illness, and healing as they appear in different parts of the world. Focus on patterns of disease and mortality around the world; the relative importance of 'traditional' and 'modern' beliefs and practices with regard to disease and treatment in different societies; the organization of national health care systems in different countries; and the role of international organizations and social movements in promoting health.

Attribute/Distribution: SS

HMS 323 (ES 323, JOUR 323, STS 323) Health and Environmental Controversies 4 Credits
Exploration of health and environmental controversies from the perspectives of scientific uncertainty and mass media coverage. Examines genetic engineering, biotechnology, environmental health risks, and nanotechnology. Includes discussion of ethical and social responsibilities and interactions with the public.

Attribute/Distribution: SS

HMS 327 (PSYC 327) Advanced Topics in Health Psychology 4 Credits
This course provides an overview of the psychological study of health. The course explores psychological theories that aim to explain health behavior (e.g., why do people smoke?) and the role of psychology in understanding the experience of illness. This course also examines how psychological research and theory can be applied to promote health behavior (e.g., how can we design interventions to promote physical activity).

Prerequisites: PSYC 130

Attribute/Distribution: SS

HMS 331 Latino Health 4 Credits
The course is designed to provide a rich understanding of the factors at the individual, health care provider, institution, and policy that affect Latino health and health-seeking behaviors in the United States. Research in the disciplines of social and behavioral sciences, epidemiology, health promotion, environmental health, minority health and health disparities, and public policy will be reviewed and discussed.

Attribute/Distribution: SS

HMS 334 (PSYC 334, WGSS 334) The Psychology of Body Image and Eating Disorders 4 Credits
The course addresses the psychosocial aspects of the development of healthy and unhealthy body image and eating disorders. The roles of personality traits/individual factors, family and interpersonal functioning, and cultural factors will be examined, as will the impact of representations of body image in mass media. Public health and psychological interventions for prevention and treatment will be explored. Personal accounts/memoirs, clinical case presentations, and documentary and dramatic films will be incorporated in the presentation of topics.

Attribute/Distribution: SS

HMS 341 (SOC 341, WGSS 341) Gender and Health 4 Credits
Relationships of sex differences and gender norms to disease and longevity in the U.S. and around the world. Influence of medical systems on men's and women's lives and the impact of gender-based consumer health movements on health and medical care. Focus on specific topics, e.g., medicalization and commercialization of women's bodies, the politics of reproductive choices, masculinity and health, and gender and mental health.

Attribute/Distribution: SS

HMS 343 (SOC 343) Race, Ethnicity, and Health 4 Credits
People who belong to racial and ethnic minority groups are exposed to more health risks, have disproportionately high levels of sickness and excess deaths, and have limited access to good quality healthcare. This course provides students with theoretical and empirical insights into the intersection of race, ethnicity, and health in the U.S. Historical and contemporary patterns in U.S. demography, race relations, residential segregation, environmental justice, and social stratification will be explored in the context of health and health care.

Attribute/Distribution: SS

HMS 344 (PSYC 344) Health Care Reasoning and Decision Making 4 Credits
Health care professionals diagnose physical and mental illnesses and create treatment plans to improve their patients' health. How do these professionals make decisions related to these important issues? We will explore the literature on how medical and mental health professionals reason and make decisions about health care issues. Topics to be covered include diagnosis, treatment decisions, access to care, and how these reasoning processes are swayed. Consideration will be given to patient decision-making as well.

Prerequisites: PSYC 117 or COGS 117 or COGS 007 or HMS 160 or HMS 180

Attribute/Distribution: SS

HMS 348 (PSYC 348) Drugs and Behavior 4 Credits
Why are some people more vulnerable to substance use problems than others? How can we effectively address substance abuse in our society? This course explores theories and research on the complex psychological, social, and biological factors that contribute to substance use and disorders. Topics include theories of addiction, characteristics of illegal and legal drugs, risk and protective factors, and research on substance abuse prevention.

Prerequisites: PSYC 001 or HMS 160 or HMS 180

Attribute/Distribution: SS

HMS 349 (PSYC 349) Participatory and Action Research in Psychology 4 Credits
Action research is used to understand important real-world social problems and promote social action. Participatory research engages community members as equals to help identify areas of focus and to design studies and interventions. This course provides an overview of the rich history of these approaches in psychology, an in-depth look at how they can be used effectively, and an opportunity to gain hands-on experience.

Prerequisites: PSYC 121 or PSYC 153 or HMS 160 or HMS 180

Attribute/Distribution: SS

HMS 354 (POLS 354) U.S. Health Care Politics 4 Credits
Explores a range of health care programs and policies and their impacts on American society. Topics include the development of the U.S. approach to health care; public sector plans (Medicare and Medicaid); the role of managed care; the employer-sponsored system; the situation of the medically uninsured; the health care vested interests and lobbyists; movements for national health care; and options for change.

Attribute/Distribution: SS

HMS 373 (SOC 373) Seminar In Sociology: Purposeful Curiosity 4 Credits
To be curious is to be engaged. This course will explore collaborative and purposeful curiosity and the inquiry-based model of learning as it relates to sociological phenomena and social good, specifically around health and humanity. Through research approaches such as humanistic inquiry and community-engaged research, learners will explore techniques that value the expertise of diverse stakeholders, identify collaborators, design and conduct imaginative research, and understand the importance of curiosity in fueling creative work and intellectual problem solving.

Repeat Status: Course may be repeated.

Attribute/Distribution: SS

HMS 375 (EDUC 375) Community Based Participatory Research Methodology 3-4 Credits
The course provides an introduction to the core concepts of community based participatory research (CBPR) methodology applied to social science research to address public health issues. The course will equip students with strategies for developing community academic partnerships as well as to strengthen skills in research methods.

Attribute/Distribution: SS

HMS 386 (PSYC 386) Pediatric Psychology 4 Credits
Focuses on developmental research and theory related to health and wellness issues in children and adolescents. Topics include children's understanding of biology and disease, disease management, medical consent, education and policy efforts to promote children's health.

Prerequisites: PSYC 107

Attribute/Distribution: SS
History majors are uniquely equipped for understanding our ever-changing world and the diversity of the human experience. Our majors study the causes and consequences of change and learn to see the world from the perspectives of others.

As History majors practice the arts of explanation and empathy, they also cultivate a broad set of research, communication, and critical thinking skills. These skills include the location and analysis of texts, data, and evidence; the mastery and synthesis of large bodies of written and visual media; the furnishing of written and oral arguments and descriptions; the evaluation of the arguments of others; and the application of interpretive, quantitative, and digital tools.

Our majors are encouraged to hone all these skills in the process of independent research conducted under faculty guidance, either in the Capstone Experience (HIST 302) or the more ambitious Honors Thesis (HIST 391, 392). They are also encouraged to craft the major to their own particular interests, either by pursuing a geographically broad independent research conducted under faculty guidance, either in the

In all of these ways, History majors acquire a unique blend of social-scientific and humanistic knowledge. They assemble a wider body of applicable skills and knowledge than is possible in any other major. These skills serve our students well in an almost limitless variety of careers, from law, education, journalism, and public affairs to business and medicine. Accordingly, the major also positions students well for graduate training in history, law, public policy, business, and medicine. History majors get what they need to thrive in a rapidly changing workplace, to be active and informed citizens, and to cultivate lifelong learning.

Professor. Richard K. Matthews, PHD (University of Toronto)

Associate Professors. William Bulman, PHD (Princeton University); Gail A. Cooper, PHD (University of California Santa Barbara); Nitzan Lebovic, PHD (University of California Los Angeles); Michelle LeMaster, PHD (Johns Hopkins University); Monica Najar, PHD (University Wisconsin-Madison); John Savage, DEA (Facole des hautes Études en sciences sociales); John Keny Smith, Jr., PHD (University of Delaware)

Assistant Professors. Natanya Duncan, PHD (University of Florida); Kwame Essien, PHD (University of Texas at Austin); Ugur Z. Pece, PHD (Stanford University); Emily Pope-Obeda, PHD (University Illinois Up Urbn); Mar'a B‡rbara Zepeda CortŽs, PHD (University of California, San Diego)

Emeriti. Michael G. Baylor, PHD (Stanford University); Ian P. Duffy, PHD (Oxford University); Charles Robert Phillips, II, PHD (Brown University); James S. Saeger, PHD (Ohio State University); Roger D. Simon, PHD (University Wisconsin-Madison); Jean R. Soderlund, PHD (University of Wisconsin-Madison); John Savage, DEA (Facole des hautes Études en sciences sociales); John Keny Smith, Jr., PHD (University of Delaware)

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MAJOR REQUIREMENTS

Students have two options in pursuing a History Major: one emphasizes geographic breadth and the other a thematic track. With departmental approval students may also pursue History Honors.

**Option 1: History Major - Geographic Breadth**

Overview:

- A minimum of 35 Credits (typically 9 courses) in History
- HIST 001: Time Travel: How to Make History required (4 credits)
- HIST 302: The Capstone Experience required (4 credits)
- From the 35 credits, majors must have 12 credits (3 courses) at 303 and above; and 4 credits (1 course) in the pre-1800 period.
- One course from each of 4 categories below, for a total of 4 courses (16 credits):
  - North America (041, 042, 043, 105, 110, 117, 120, 124, 125, 126, 130, 135, 136, 179, 180, 308, 315, 319, 320, 323, 325, 328, 332, 336, 351, 360, 367)
  - Europe (011, 012, 015, 016, 021, 022, 150, 154, 162, 163, 183, 253, 312, 314, 347, 348, 350, 354)
  - Latin America (049, 050, 149, 368)
  - Africa (005, 127, 130, 134, 330, 335, 341)
- Asia (075, 076, 170, 340)
- Transnational (017, 025, 101, 107, 112, 149, 312, 314, 330, 331, 341, 348, 352, 354)

**Option 2: History Major - Thematic Track**

Overview:

- A minimum of 35 Credits (typically 9 courses) in History
- HIST 001: Time Travel: How to Make History required (4 credits)
- HIST 302: The Capstone Experience required (4 credits)
- From the 35 credits, majors should have 12 credits (3 courses) at 303 and above (excepting HIST 306); 4 credits (1 course) in the pre-1800 period; and 4 credits (1 course) in Latin American, African or Asian History.
- 3 courses in a specific Track (see below)

**TRACKS (3 courses / 12 credits in one of the following):**


b) Women, Gender, and Sexuality (041, 042, 043, 117, 124, 125, 126, 127, 135, 136, 325)

c) War, Empire, and Revolution (012, 015, 016, 017, 041, 043, 049, 050, 101, 110, 120, 154, 162, 170, 183, 315, 319, 347, 348, 352)

d) Race, Ethnicity, and Diasporas (005, 041, 042, 043, 049, 096, 126, 127, 130, 135, 136, 179, 320, 330, 332, 335, 341, 351)

e) Religion, Thought, and Culture (015, 041, 042, 043, 096, 105, 134, 145, 150, 154, 179, 180, 183, 253, 323, 328, 337, 351, 354, 356)

f) Medicine, Science, Technology, and Environment (007, 008, 025, 107, 117, 118, 145, 315)

g) Public and Digital History (154, 303, 305, 306, 336, 337, 338)

h) Build Your Own Track (department approval is required)
With Department approval, majors may take one relevant course outside of History to fulfill track requirements. For descriptions of tracks and region and time period designations, and for additional courses that might qualify for tracks or geographical focus, see the History Department website.

**REQUIREMENTS FOR HONORS**
- fulfillment of Major requirements
- minimum of 3.5 GPA in courses presented for the Major
- HIST 391 (4 credits) and HIST 392 (2 credits): Honors Thesis

*With departmental approval these courses may substitute for the 302 The Capstone Experience.*

**HISTORY MINOR REQUIREMENTS**
Each student's minor program is prepared in consultation with the advisor of minors in the history department. Advanced placement credit may not be used for the minor program.

- 15 credits
- at least 4 credits at 200 or 300 level
- maximum of one course (4 credits) of transfer or cross-listed courses may count toward minor.

**CONCENTRATION IN PUBLIC HISTORY**
History majors may earn a concentration in Public History by completing a total of 16 hours in the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>HIST 305</td>
<td>Public History (required)</td>
<td>4</td>
</tr>
<tr>
<td>HIST 306</td>
<td>Internship in Public History (required)</td>
<td>4</td>
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</tbody>
</table>

Select at least two of the following:

<table>
<thead>
<tr>
<th>Course</th>
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</tr>
</thead>
<tbody>
<tr>
<td>ART 175</td>
<td>Introduction to Museum Work</td>
<td>2</td>
</tr>
<tr>
<td>ART 275</td>
<td>Museums: Research, Collections Management and Exhibition Planning</td>
<td>3-4</td>
</tr>
<tr>
<td>ART 370</td>
<td>Special Topics in Museum and Curatorial Studies</td>
<td>2-3</td>
</tr>
<tr>
<td>ART 375</td>
<td>Museum Internship</td>
<td>2</td>
</tr>
<tr>
<td>HIST 336</td>
<td>Bethlehem and the Lehigh Valley</td>
<td>3</td>
</tr>
<tr>
<td>HIST 338</td>
<td>Techniques in Public History (2-4 credits, may be repeated for up to 8 credits)</td>
<td>2-8</td>
</tr>
<tr>
<td>HIST 393/370/ANTH 370</td>
<td>Managing Nonprofit Organizations</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Credits:** 15-21

**GRADUATE WORK IN HISTORY**
Lehigh University has been granting advanced degrees in history for more than seventy years. Its graduates have become university and college professors, secondary school teachers and administrators, museum directors, and public servants. The graduate program offers a wide range of courses that reflect strengths across the faculty, including 19th and 20th century US History; Latin American, Caribbean, West African and Atlantic African-Diaspora history; British, French and Spanish Atlantic World Empires; and African-American history. Course offerings also reflect thematic approaches across time and space, including: Digital Humanities; Public History; Gender History; the History of Technology; American and European Intellectual History; and the Cultural History of Warfare.

The department has close ties with the Lawrence Henry Gipson Institute for Eighteenth Century Studies which sponsors yearly symposia and provides research support for both faculty and students. The history of technology program is closely tied to Lehigh's Science, Technology, and Society program. Lehigh's libraries are especially rich in materials for graduate research in history, including a rare books collection and an extensive collection of scholarly periodicals and monographs. Graduate programs provide intensive and specialized study, and the policy of limited enrollment permits close relations between faculty and students.

Admission to graduate study in history is competitive and dependent upon the applicant's undergraduate preparation and record, recommendations, and Graduate Record Examination scores. Besides general requirements for College of Arts and Sciences graduate programs, the following special requirements apply to graduate study in history.

**Master of Arts**
There are two masters programs. Under Plan I, a candidate may earn the degree by successfully completing 27 hours of approved course work and submitting a thesis of the length and quality that would make it suitable for publication as a scholarly article. The paper may build on work presented in a graduate research seminar in the program. Candidates continuing toward a doctorate should select Plan I. Candidates declaring Plan II take 30 hours of approved course work and pass examinations in two fields chosen from American, British, European, and Latin American history, and History of Technology. Candidates in either plan are required to maintain a 3.3 average in all graduate work.

**M.A. in History with Concentration in Public History**
Students may earn through either Plan I or Plan II (see above), an M.A. in History with a concentration in Public History by completing a total of 36 hours of approved course work, including a minimum of 10 credits and maximum of 12 credits in approved Public History courses.

<table>
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</tr>
</tbody>
</table>

**Doctor of Philosophy**
Students in the Ph.D. program in history must maintain a 3.50 average after two semesters of study. During the second semester, doctoral students select one major and three minor fields in which to take comprehensive written and oral examinations. The dissertation will be in the major field. The dissertation advisor will chair a special committee that will oversee the student's graduate program. The other members of the special committee will be those faculty who are examiners in the selected fields and one professor from another department relevant to the candidate's major field. No professor may direct more than one graduate in the direction of a field may involve two professors. An original dissertation is required, and it must be successfully defended to the examining committee.

All Ph.D. students must meet the University Concentrated Learning Requirement. They must take Historical Research (401). Students who enter the Ph.D. program with an M.A. from another university must also take either Readings in the History of the Atlantic World (HIST 404) or Readings in the History of Industrial America (HIST 405). Students are encouraged to take both seminars if appropriate to their course of study. All Ph.D. students must take at least 18 hours of directed readings courses (400 series) beyond the M.A.

**Major Fields**
Major fields are Technology, Modern Britain, Colonial America, Nineteenth Century United States, Twentieth Century United States. (The Nineteenth and Twentieth century fields may be divided topically rather than chronologically; for example, a Student may be examined in labor/social history 1800-present, and in political history 1800-present.)

**Minor Fields**
Any of the major fields listed above may also be minor fields. Examples of other minor fields are American Studies; Ancient History; Early Modern Europe; Modern Europe; Latin America; Environmental History; Japan; Public History; Science, Technology and Society studies.

**Language Requirements**
The student's dissertation committee determines whether proficiency in a foreign language or proficiency in statistical methods will be required for the doctoral degree.

**UNDERGRADUATE COURSES IN HISTORY**
Petitions are required for first-year students to take 100-level or higher courses, and for sophomores to take 200-level or higher courses.
HU fills humanities distribution requirements; SS fills social science requirements; ND not designated.

FOR ADVANCED UNDERGRADUATES AND GRADUATE STUDENTS
Graduate students may take 300 level courses, for which they receive 3 credits. Undergraduates must take them for 4 credits.

Courses

HIST 001 Time Travel: How to Make History 4 Credits
Students discover the power of historical analysis in a rapidly changing world by investigating a series of pressing contemporary problems. History emerges as a vital tool for confronting human diversity and understanding how societies are transformed. Skills acquired include causal analysis, empathy, interpretation, source criticism, information management, digital methods, public engagement, and argumentative writing. Themes addressed vary with instructor.
Attribute/Distribution: HU, SS

HIST 005 (AAS 005) African Civilization 4 Credits
Sub-Saharan Africa through the millennia of the ancient world to the present. Human origins, state and nonstate systems, the external slave trade, colonialism, resistance to European rule, independence movements, and neocolonialism.
Attribute/Distribution: SS

HIST 007 Technology in America’s Industrial Age 4 Credits
Traces the development of American technology from the preindustrial colonial era until America’s emergence as the world’s leading industrial power. The interactions between technology and culture, society, politics, and the economy will also be addressed.
Attribute/Distribution: SS

HIST 008 Technology in Modern America 4 Credits
Traces the evolution of modern American technology, including automobiles, aircraft, computers, nuclear weapons, television, space, pharmaceuticals, and biotechnology. Includes critiques of technology, such as environmentalism. The interactions of technology and culture, society, politics, and the economy will also be addressed.
Attribute/Distribution: SS

HIST 011 Building Traditional Europe: From the Romans to the Fracturing of Christian Culture 4 Credits
Development of European history from Rome to the 17th century. End of the ancient world, origins and growth of medieval civilization, the Renaissance and Reformation.
Attribute/Distribution: HU

HIST 012 Inventing the Modern World: Europe in Global Perspective, 1648-present 4 Credits
The rise of modern nation states; the scientific and industrial revolutions; social movements and the French and Russian revolutions; impact of Enlightenment philosophy, nationalism, liberalism, imperialism and fascism; the development of modern class structure and transformations in gender relations, art, popular culture and society.
Attribute/Distribution: HU

HIST 015 (GS 015) Three English Revolutions 4 Credits
The Protestant Reformation, the Civil Wars, and the Glorious Revolution, from Henry the Eighth to John Locke. Examines how three bloody conflicts gave birth to the first modern society. Explores the origins of empire, capitalism, secularization, nationalism, and democracy.
Attribute/Distribution: HU

HIST 016 (GS 016) The Rise and Fall of Britain and Its Empire 4 Credits
Charts the rise of the world’s first global superpower in the 18th and 19th centuries, and its decline and disintegration in the 20th and 21st. Topics include the Enlightenment, the first party system, the Industrial Revolution, imperialism, globalization, the World Wars, neo-liberalism, and punk rock.
Attribute/Distribution: HU, SS

HIST 017 (GS 017) Democracy’s Rise and Fall 4 Credits
The promise and perils of democracy from the ancient world to the present.
Attribute/Distribution: SS

HIST 021 (CLSS 021) Greek History 4 Credits
The development of civilization from paleolithic times to the world empire of Alexander the Great. The social, economic, religious, philosophic, artistic, and literary development of the ancient world; the origin of political institutions.
Attribute/Distribution: SS

HIST 022 (CLSS 022) Roman History 4 Credits
Rome from its origins to A.D. 476. Political, social and religious developments. Transformation of the late Roman Empire to the early medieval period.
Attribute/Distribution: SS

HIST 025 Pirates of the Caribbean and Other Rogues of the Atlantic World 4 Credits
Introduction to the history of the Atlantic World, through the lens of piracy and seafaring. Interactions between Europe, Africa, and North and South America, 1442-1825.
Attribute/Distribution: SS

HIST 041 The Making and Breaking of the United States 4 Credits
Native American cultures; European settlement; development of slavery and free labor systems; the Revolution; founding of the new nation; 19th century social, economic, cultural, and political development; Civil War.
Attribute/Distribution: SS

HIST 042 Big Dreams, Big Bucks, Big Trouble: United States, 1865-1941 4 Credits
America’s transformation into an industrial and global power from Reconstruction after the Civil War to the Great Depression; includes social, political, and cultural developments.
Attribute/Distribution: SS

HIST 043 The United States Since 1941 4 Credits
World War II; Cold War at home and abroad; Civil Rights movement; the 1960s: Vietnam, the welfare state and social upheavals; new forms of cultural expression; feminism; rise of neoconservatism.

HIST 049 (GS 049, LAS 049) The True Road to El Dorado: Colonial Latin America 4 Credits
Examines the initial encounters of peoples of Iberian and African origins with the indigenous civilizations of the Western Hemisphere. Explores the development of a colonial economy and its global reach. Focuses on the birth of a distinctive Latin American society and culture, with attention to the Latin American patriots who fought for their freedom. No prior knowledge of Latin American history required.
Attribute/Distribution: SS

HIST 050 (GS 050, LAS 050) Heroes, Dictators, and Revolutionaries: Latin America since Independence 4 Credits
Examines the 200-year-long struggle of Latin American peoples to gain political representation, economic equality, and social justice. Explores key historical events in Latin America from the movement for independence in the early nineteenth century to today’s modern societies. Topics include the wars of independence, the rule of caudillos, foreign military interventions, export economies, populism, social revolutions, the Cold War era, state terror and military dictatorships, and the war on drugs.
Attribute/Distribution: SS

HIST 071 (ASIA 071, MLL 071) Understanding Hong Kong 4 Credits
This course introduces Hong Kong, from its history as a vibrant British colony to its current status as a bustling territory mediating between China and the world. The learning objectives and outcomes consist not only of a knowledge of Hong Kong’s significance for global commerce and culture but also of the ability to analyze primary and secondary sources as well as to conduct independent research. All course materials are available in English.
Attribute/Distribution: HU

HIST 075 (ASIA 075, MLL 075) Chinese Civilization 4 Credits
The development of traditional Chinese thought, beliefs, technology, and institutions from a historical perspective.
Attribute/Distribution: HU, SS
HIST 076 (ASIA 076, MLL 076) Understanding Contemporary China 4 Credits
An overview of recent history, politics, economy, religion, problems of modernization, popular culture, and attitudes. Contemporary Chinese society viewed against the backdrop of tradition and the tumultuous history of 20th century China.
Attribute/Distribution: SS

HIST 101 (GS 101) Histories of Globalization 4 Credits
Critical historical perspectives on current debates around “globalization” and the varied paths and responses to modernity, using recent scholarship associated with the New Global History. The “Rise of the West” paradigm, Industrial Revolution and modernization theory; creation of global financial markets, nationbuilding and New Imperialism; Great Depression and World Wars as global historical events; postwar decolonization, Cold War and emergence of North-South relations; impact of consumerism, movements for women's rights, ethnic nationalism and religious fundamentalist movements in traditionbound societies.
Attribute/Distribution: HU

HIST 104 Themes in History 2-4 Credits
Seminar on a particular theme or topic not covered by a currently listed offering.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

HIST 105 Sports in Modern America 4 Credits
Surveys the social, cultural, and political role of sports in America since the Civil War. By addressing the development of sports and its relationship with race, class, ethnicity, gender, the media, popular culture, and government, this class will examine the impact of sports in making the America and Americans of the 20th century.
Attribute/Distribution: HU

HIST 107 (GS 107) Technology and World History 4 Credits
Development of technology and its relationship to political, economic, military and cultural aspects of world civilization from pyramids to the present.
Attribute/Distribution: SS

HIST 110 American Military History 4 Credits
The American military tradition from colonial times to the present, America's wars and the development and operation of military institutions within the political, economic, ideological, and technological milieu of American society.
Attribute/Distribution: SS

HIST 112 Takin’ It to the Streets: The Global Sixties 4 Credits
Welcome to the Days of Hope and Rage. The Global Sixties explores a watershed decade of unprecedented political activism and backlash, focusing on social movements (free speech, students, civil rights/Black Power, feminism, environmentalism), national liberation struggles, and global counterculture. We examine the ideologies, tactics, and meanings of 1960s movement culture and new subcultures related to Rock n Roll, sexual freedom, and illicit drugs. Course materials include the stuff of the 60s, including visual, textual, and audio sources.
Attribute/Distribution: HU

HIST 117 (STS 117, WGSS 117) Pioneering Women: Women in Science, Medicine and Engineering 4 Credits
This course analyses the careers of professional women in science, medicine and engineering, principally in the United States. It examines historical barriers to training and entry into these professions; cultural stereotypes that shape women’s options; women’s participation in innovation in their fields; their concern for work/life balance; and their contribution to clients and patients, both male and female. It focuses on three locations of professional work: the laboratory, the clinic, and the job site.
Attribute/Distribution: SS

HIST 118 (HMS 118, STS 118) History of Modern Medicine 4 Credits
Introduction to Western medical history from the 18th century to the present day. Students will explore patient/practitioner relationships, examining changing ideas concerning health, sickness, and disease, chart changes in hospital care and medical education, and tackle topics such as eugenics, medical experimentation, and health insurance.
Attribute/Distribution: HU

HIST 120 Revolutionary America 4 Credits
Origins and development of the American republic from 1750 through the adoption of the Federal Constitution.
Attribute/Distribution: SS

HIST 124 (WGSS 124) Women in America 4 Credits
Roles of women in American society from colonial to present times: attitudes toward women, female sexuality, women's work, and feminism.
Attribute/Distribution: SS

HIST 125 (HMS 125, WGSS 125) Does Sex have a History? The History of Sexuality in the United States 4 Credits
Explores the history of sexuality in the United States from the colonial era to the present. While sexuality can appear timeless and stable, sexual ideologies, categories, and behaviors have consistently evolved and have transformed society in the process. The class pays special attention to relationships between sexuality, race, class, and the state, as well as how law, medicine, and the media have shaped sexual identities and experiences. In so doing, the class develops sophisticated readers of historical and contemporary cultures.
Attribute/Distribution: HU

HIST 126 (AAS 126, WGSS 126) How Black Women Made Modern America 4 Credits
This course introduces students to the significant themes and events that have shaped the African American women's historical experience from slavery to the present. We examine the social, political, and economic meaning of freedom for women of African descent.
Attribute/Distribution: HU

HIST 127 Women, Gender, Sexuality and Race in African Societies 4 Credits
This course explore the various ways in which womanhood, gender, sexuality and race are defined, constructed and articulated in African societies. The interdisciplinary course draws from historical writings, novels, biography, anthropology, political science, health and other fields to examine diverse activities and contributions of African women from the pre-colonial period to the present.
Attribute/Distribution: HU

HIST 130 (AAS 130) African American History 4 Credits
Blacks in America from the first importation of Africans to the implementation of civil rights laws. West African origins, slave trade, slavery, free blacks and emancipation and study of Reconstruction, segregation, urbanization, and the struggle for racial equality.
Attribute/Distribution: SS

HIST 133 (AAS 133, FREN 133, LAS 133, MLL 133, POLS 133) Lehigh in Martinique: Globalization and Local Identity 3-4 Credits
Study Abroad. History, culture and politics of the French Caribbean island of Martinique, from its position as a key site of the 18th century Atlantic World economy to becoming an official French department and outpost of the European Union. Interdisciplinary perspectives on the complex nature of social identity, historical memory and impact of globalization. No French is required. Offered during winter inter-term through Lehigh Study Abroad.

HIST 134 (AAS 134) History and Cultures of Ghana 4 Credits
Overview of Ghana’s history and cultures from the fifteenth century, examining diversity among various ethnic groups and covering such themes as religion, literature, art, music/dance, gender, family and anti-colonial movements. The course will also explore how slave castles/forts contributed to the transatlantic slave trade, Pan-Africanism and global tourism.
Attribute/Distribution: HU

HIST 135 Era of Jefferson and Jackson 4 Credits
Colonial beginnings; the Articles of Confederation and the Constitution; the creation of a new nation; the development of American political parties; the antebellum American state.
Attribute/Distribution: SS

HIST 136 Era of the Civil War and Reconstruction 4 Credits
American abolitionism and the origins of the Civil War; the Second American Revolution; Reconstruction and its sequel.
Attribute/Distribution: SS
HIST 145 (STS 145) Introduction to the History of Science 4 Credits
The history of modern science, primarily physical and biological, with emphasis on the development of major theoretical models since the 17th century.
Attribute/Distribution: SS

HIST 149 (LAS 149) Narcos: The Global Drug Wars 4 Credits
Tobacco, sugar, coffee, opium, marijuana, cocaine. From Columbus's encounter with the New World to the rise and demise of Pablo Escobar and "El Chapo" Guzmán; drugs have been coveted global commodities. Through readings, discussions, and films, this course examines the history of drug production, drug trafficking, and the so-called "war on drugs" in Latin America.
Attribute/Distribution: SS

HIST 150 Medieval Civilization 4 Credits
Formation and development of western culture to about 1400. Rise of universities and towns, legal development and origins of representative government, origins of nationstates, scholasticism and decline of the medieval church.
Attribute/Distribution: HU

HIST 154 (JST 154, REL 154) The Holocaust: History and Meaning 4 Credits
The Nazi Holocaust in its historical, political and religious setting. Emphasis upon the moral, cultural and theological issues raised by the Holocaust.
Attribute/Distribution: HU

HIST 162 Contemporary Europe 4 Credits
Development of European States since 1945; European Community; Soviet influence and collapse.
Attribute/Distribution: HU

HIST 163 France since 1789 4 Credits
France's tumultuous transformation from an absolutist monarchy to a modern democratic republic. Explores major cultural, social and economic changes, with particular attention given to industrialization and urbanization, gender and class, church and state relations, the French Left and France's unique contribution to modern philosophy, art and culture.
Attribute/Distribution: SS

HIST 170 (ASIA 170) The Last Samurai 4 Credits
Explores the revolutionary character of the political upheaval in 1868 that led to the fall of the ruling shogan and the dissolution of the elite samurai class. Examines both the causes of these major political and social changes, and their continuing impact upon Japanese culture and society.
Attribute/Distribution: HU

HIST 176 (AAS 176, GS 176, HMS 176) Keeping Africa and Africans Healthy: A History of Illness and Wellness 4 Credits
What are the myths about diseases in Africa and how does the world respond to health crises there? What are the African healing traditions? What is the history of global health in Africa and its implications for illness and wellness? This course explores health interventions and initiatives by Africans and non-Africans including missionaries, colonial officials, and NGOs. Students' final papers will perform a "post-mortem" on Africa, critically tracing how efforts to control, manage and eradicate diseases have succeeded or failed.
Attribute/Distribution: HU

HIST 178 (AAS 178, GS 178) Globalization and Health in Ghana 3 Credits
This 4-week field-based course fosters global engagement by introducing students to the historical, social, cultural, and political factors at the forefront of globalization and health processes in Ghana.
Attribute/Distribution: HU

HIST 179 (AAS 179) Black Political Thought in America 4 Credits
Black leadership, organizations, and philosophy in America from Reconstruction to the Civil Rights Era; ideas and programs of Booker T. Washington, W.E.B. DuBois, Marcus Garvey, Malcolm X and Martin Luther King, Jr.
Attribute/Distribution: SS

HIST 180 (REL 180) Religion and the American Experience 4 Credits
The historical development of major religious groups in this country from colonial times to the present. Their place in social and political life, and the impact of the national experience upon them. Emphasis on religious freedom and pluralism, and the church/state relationship.
Attribute/Distribution: HU

HIST 183 (ART 183, GS 183) France from Medieval to Modern: Soc., Pol. & Art 3 Credits
France's artistic, cultural, social, artistic and political development from early kingship and dominance of the Church in the Middle Ages to the grandeur of Versailles in the Age of Absolutism; radical transformations of culture and society during the French Revolution and advent of the Modern Nation-State; to twentieth century developments including the two World Wars, imperialism and impact of post-war globalization. Offered in summer only through Lehigh Study Abroad Office as part of Lehigh in Paris program.
Attribute/Distribution: HU

HIST 253 (ARCH 253, GS 253) Paris: Plan of Metropolis 3 Credits
The splendor of modern Paris is due in large part to bold, large scale modernization and changes in the city's patterns during the 19th century. This course, which is part of the Lehigh in Paris summer program, will cover a century of change and focus on the major accomplishments of its visionary planners.
Attribute/Distribution: HU

HIST 300 Apprentice Teaching 3 Credits
Attribute/Distribution: ND

HIST 302 The Capstone Experience 4 Credits
Culmination of the major. Working collectively on a broadly-defined theme, students master the tools of historical inquiry by developing and completing individual research projects that engage primary and secondary sources. Theme varies with instructor. Departmental permission required.
Prerequisites: HIST 001
Can be taken Concurrently: HIST 001
Attribute/Distribution: HU, SS

HIST 303 Topics in History 3-4 Credits
Intensive study in a particular area of history for advanced students.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

HIST 305 Public History 3-4 Credits
An examination of the public role of history in modern society, with focus on issues facing historians in museums, historical societies, archives, historic preservation, the federal government, and other organizations in the public sphere.
Attribute/Distribution: SS

HIST 306 Internship in Public History 2-4 Credits
Professionally supervised work in a museum, historical society, archive, or other historical agency. Written journal or report evaluating the experience is required. Permission of department chair required. May be repeated for a maximum of six credits. May not be counted toward the major requirement of 12 hours of courses numbered 303 or higher.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

HIST 308 Industrial America since 1945 3-4 Credits
Explores efforts to achieve both prosperity and security in the postwar era. Among the topics discussed: new technologies, consumer culture, disposable products, advertising, defense spending, technical assistance, and multinational corporations.
Attribute/Distribution: SS

HIST 312 (CLSS 312) Decline and Fall of the Roman Empire 3-4 Credits
Political, social, and economic history of the Roman Empire, A.D. 117- A.D. 565. Romanization of the provinces, diffusion of Christianity, and special attention to transformation to medieval period. Includes readings in translation of primary sources.
Attribute/Distribution: SS
HIST 314 (CLSS 314) Age of Caesar and Christ 3,4 Credits
Roman history of the 1st century A.D. Political, cultural, and socioeconomic changes; special attention to the evolution of absolute power. Lectures, discussions, papers.
Attribute/Distribution: SS

HIST 315 (ES 315) American Environmental History 3-4 Credits
Relationship between Americans and their natural environment from the colonial period to the present: impact of European settlement, attitudes toward wilderness, role of technological development, rise of preservation and conservation movements, establishment of national parks, recent environmental protection legislation.
Attribute/Distribution: SS

HIST 319 Colonial America 3,4 Credits
Founding and growth of colonies in North America through 1763. Emphasis on motives for settlement, Native American-European relations, and the economic, social, and political development of the British West Indies, and mainland provinces.
Attribute/Distribution: SS

HIST 320 History of North American Indians 3,4 Credits
The history of American Indians from before European contact to the present. Emphasis will be placed on the diversity of native peoples of eastern North America and how patterns of interaction between native Americans and Euro-Americans have changed over time. Discussion format, research paper.
Attribute/Distribution: SS

HIST 323 American Cultural History since 1900 3-4 Credits
Development of American popular culture and media: popular press, Hollywood, radio, television, sports, and advertising, and the meanings these institutions have created in 20th-century United States.
Attribute/Distribution: HU

HIST 325 (SOC 325, WGSS 325) History of Sexuality and the Family in the U.S. 3-4 Credits
Changing conceptions of sexuality and the role of women, men, and children in the family and society from the colonial to the post-World War II era. Emphasis on the significance of socio-economic class and cultural background. Topics include family structure, birth control, legal constraints, marriage, divorce, and prostitution.
Attribute/Distribution: SS

HIST 328 American Intellectual History since 1900 3,4 Credits
Social, literary, and political thought in the 20th century with emphasis on pragmatism and progressivism, maturation of American literary culture, ideas of American exceptionalism at midcentury, civil rights movement and feminism, neoconservatism and recent trends.
Attribute/Distribution: HU

HIST 330 (AAS 330) Africans and the Atlantic World 3-4 Credits
This course chronicles the history of Africans and the Atlantic world from the fifteenth century. It explores cross-cultural interactions and exchanges between Africans and Europeans and covers major themes including trade, religion, slavery, abolition, identity, colonialism, gender, the “Back-to-Africa” movements and impact of Africans on Atlantic world history.
Attribute/Distribution: HU

HIST 331 (AAS 331) United States and Africa 3,4 Credits
Reciprocal relationships between North America and the African continent from the slave trade in the 17th century to the 20th century-Afrocentric movement; impact of Americans on the shaping of modern Africa, Pan-African relations; influence of African Americans on US policies toward Africa.
Attribute/Distribution: SS

HIST 332 (AAS 332) Slavery and the American South 3-4 Credits
The emergence and demise of the “peculiar institution” of African American slavery in British North America and the Old South. African background; colonial beginnings; 19th century-slave community; the ruling race and proslavery ideology; the death of slavery and its aftermath; slavery and freedom in a comparative context.
Attribute/Distribution: SS

HIST 335 Special Topics in African History and/or Diaspora 3-4 Credits
Special Topics in African History and/or African diaspora. Topics may be focused by period, genre, thematic interest or interdisciplinary method.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

HIST 336 Bethlehem and the Lehigh Valley 3-4 Credits
Local history focusing on Native American communities, Moravian settlement, natural resources, industrial firms, immigration and ethnic communities, organized labor, housing patterns and urban sprawl, high-tech industry, and tourism. Includes an analysis of techniques used in presenting these topics to the public.
Attribute/Distribution: SS

HIST 337 History and Community Memory 3,4 Credits
This public history course provides students with the opportunity to research the history of a community. The community focus of the course will change each year. We will explore what constitutes community, what historical memory means, and how history functions to build or divide a community. Students will use both documents and oral history methods, and practice will be a major component of this course.
Attribute/Distribution: SS

HIST 338 Techniques in Public History 2,4 Credits
Designed to introduce students to a variety of public history techniques. Instructor will focus on one of the following topics each term: archives, documentary film, exhibit design, historical editing, material culture, oral history.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

HIST 339 Managing Nonprofit Organizations 3-4 Credits
Addresses the effective management of nonprofit organizations, focusing on operations, administration, legal, marketing, finance and accounting issues in the nonprofit environment and emphasizing organizations such as museums and preservation organizations.
Attribute/Distribution: SS

HIST 340 (ASIA 340) Japanese Industrialization 3-4 Credits
Explores economic growth in the traditional economy, the rise of an entrepreneurial class, the importation of western technology, and the social, political and economic institutions which support industrial society since the early 19th century.
Attribute/Distribution: SS

HIST 341 (AAS 341, GS 341) Global Africa: Aid, Volunteerism, NGO’s and International Studies 3,4 Credits
This course traces the origins of Aid to Africa, explores various volunteer activities, and investigates the role of NGOs, missionaries, philanthropists, medical practitioners, and global education. It examines the ways that cross-cultural interactions and exchanges between Africans and foreigners shaped African societies both positively and negatively.
Attribute/Distribution: SS

HIST 347 (GS 347) The French Revolution and Napoleon: A Global History 3,4 Credits
Global origins; breakdown of Absolute Monarchy; rise of Enlightenment culture and decadence of the court; storming of the Bastille and creation of republican government; invention of modern nationalism and Napoleonic military culture; women in political life; uses of mass propaganda, public festivals and transformation of the arts; political violence in the “Terror”; abolition of slavery and origins of Haitian Revolution; Napoleon’s imperial system and warfare with Europe; impact on global imperial rivalries and revolutionary movements abroad.
Attribute/Distribution: HU

HIST 348 (GS 348) The British Empire and the Modern World 3-4 Credits
Examines the empire and its central role in the process of globalization between the 16th and 20th centuries. Topics include exploration, state-building, war, multinational corporations, industry, international finance, missionaries, racism, and independence movements.
HIST 350 19th Century Paris and the Invention of Modernity 3,4 Credits
This course considers the dramatic destruction and rebuilding of the city of Paris in the decades after 1850 and how changes in the built environment shaped social relations, political authority and cultural expression. Topics include the politics of city planning and architectural design; the history of the engineering profession, technology and the building trades; reactions to crime, disease and prostitution in the modern city; the 1848 Revolution, Paris Commune and political theory; the origins of photography, Impressionist painting and cinema. 
Attribute/Distribution: HU

HIST 352 History of Total War 3-4 Credits
This seminar examines the gradual rise of the idea of total war from the religious and civil wars of the 17th century, through the French Revolution, the Napoleonic War, the American Civil War, the two World Wars, the Cold War, and The War on Terror. We will examine the difference between war as political means and modern warfare as the very ends of politics, religion, and culture.
Attribute/Distribution: HU

HIST 354 History of Fascism 3-4 Credits
This course examines the historical and philosophical roots of European right-wing extremism, such as Italian and French Fascism, German Nazism, Austro-Hungarian Conservative Revolution, and other forms of radical nationalism.
Attribute/Distribution: HU

HIST 356 European Cultural History 3,4 Credits
Transformation of European culture from the 18th century to the present. The Enlightenment, cultural impact of the French and industrial revolutions, romanticism and ideologies of the 19th century, contemporary European thought.
Attribute/Distribution: HU

HIST 358 Empire, War, and Democracy in Modern Germany 3,4 Credits
Focus on one or more of the following topics: nationalism and unification, the Second Empire, World War I, the Weimar republic, the Nazi movement, the Third Reich, and postwar Germany.
Attribute/Distribution: HU, SS

HIST 360 American Legal History 3,4 Credits
The interrelationship between law and social development with emphasis on modern period. Founding of constitutional government and balance of power within the federal system, the problem of slavery, legal support and regulation of business, and the use of law in various reform and civil rights movements.
Attribute/Distribution: SS

HIST 367 Rise and Fall of the Old South 3,4 Credits
Explores the American South as a region from the era before European contact to the end of the Civil War. Emphasis will be placed on exploration and settlement, Native American-European relations, the pre-Revolutionary contest for empire, and the rise and development of the plantation complex and slavery.
Attribute/Distribution: SS

HIST 368 Seminar in Latin American History 3,4 Credits
Readings and individual investigation of selected topics.
Attribute/Distribution: SS

HIST 370 (ANTH 370) Historical Archeology 3-4 Credits
This course examines the unique nature of historical archeology of postcontact America. Topics include reconstructing the past through the archaeological and historical record, exhibiting past culture, and capturing the real or imagined past. Course includes fieldwork and visits to famous archaeological sites.
Attribute/Distribution: SS

HIST 371 Independent Study 1-4 Credits
Directed readings in a topic or area of history not covered by current course offerings. For students of demonstrated ability and adequate preparation. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

HIST 389 Honors Project 1-6 Credits
Attribute/Distribution: ND

HIST 391 Honors Thesis in History 4 Credits
Opportunity for undergraduate majors in history to pursue an extended project for senior honors. By department permission only.
Attribute/Distribution: ND

HIST 392 Honors Thesis in History 2 Credits
Continuation of History 391. By department permission only.
Prerequisites: HIST 391
Attribute/Distribution: ND

HIST 401 Historical Research 3 Credits
Techniques of research in history: training in the critical handling of documentary materials, in measuring the value of evidence, and in formal presentation of the results of research. Students will write an original research paper using primary materials. Required of all graduate students in history.

HIST 404 Readings in the History of the Atlantic World, 1500-1900 3 Credits
Core readings offering a comparative and integrative approach to studying the development of nations, economic systems and trade, colonization, and cultural encounters among the people of Europe, Africa, and the Americas.

HIST 405 Readings in the History of Industrial America 3 Credits
Core readings in the history of technology and the larger framework of intellectual, social, economic, and political history. Includes comparative studies in the history of industrializing Europe and Japan.

HIST 412 Readings in the American Revolutionary Era 3 Credits
Study in small groups under the guidance of a faculty member on the historiography of the era of the American Revolution.
Repeat Status: Course may be repeated.

HIST 421 Readings in Topics in the Atlantic World 3 Credits
Study in small groups under the guidance of a faculty member on a particular topic in the history of the Atlantic World.
Repeat Status: Course may be repeated.

HIST 426 Readings in Topics in American History 3 Credits
Study in small groups under the guidance of a faculty member on a particular topic in U.S. history across several centuries.
Repeat Status: Course may be repeated.

HIST 438 Techniques in Public History 2,3 Credits
Designed to introduce students to a variety of public history techniques. Instructor will focus on one of the following topics each term: archives, documentary film, exhibit design, historical editing, material culture, oral history.
Repeat Status: Course may be repeated.

HIST 440 Readings in Colonial American History 3 Credits
Study in small groups under the guidance of a faculty member of the literature of the 17th and 18th centuries.
Repeat Status: Course may be repeated.

HIST 441 Readings in Nineteenth Century American History 3 Credits
Study in small groups under the guidance of a faculty member of the literature of the 19th century.
Repeat Status: Course may be repeated.

HIST 442 Readings in Twentieth Century American History 3 Credits
Study in small groups under the guidance of a faculty member of the literature of the 20th century.
Repeat Status: Course may be repeated.

HIST 443 Readings in English History 3 Credits
Study in small groups, under the guidance of a faculty member, of the literature of a particular period, problem, or area of English history.
Repeat Status: Course may be repeated.

HIST 444 Readings in Latin American History 3 Credits
Study in small groups, under the guidance of a faculty member, of the literature of a particular period, problem, or area of Latin American history.
Repeat Status: Course may be repeated.
HIST 445 Readings in the History of Science 3 Credits
Study in small groups under the guidance of a faculty member on the history of science.
Repeat Status: Course may be repeated.

HIST 446 Readings in the History of Technology 3 Credits
Study in small groups under the guidance of a faculty member of the history of technology.
Repeat Status: Course may be repeated.

HIST 447 Readings in European History 3 Credits
Study in small groups, under the guidance of a faculty member, of the literature of a particular period, problem or aspect of European history.
Repeat Status: Course may be repeated.

HIST 448 (POLS 448) Land Use, Growth Management, and the Politics of Sprawl 3 Credits
Introduction to issues of Land Use Planning, Community, Growth Management, and Sprawl. Examination of history of urban development in America from earliest settlements to the auto suburbs; also such planning and development factors as comprehensive plans, zoning, and the influence of infrastructure on development. Concludes with an assessment of the revival of city centers, alternatives to sprawl, and comparisons to development patterns in other countries.
Repeat Status: Course may be repeated.

HIST 451 Readings in Topics in American History 3 Credits
Study in small groups under the guidance of a faculty member on a particular topic in U.S. history across several centuries. May be repeated for credit with permission of the instructor.
Repeat Status: Course may be repeated.

HIST 452 Research in American History 3 Credits
An intensive research seminar on a phase of American history.
Repeat Status: Course may be repeated.

HIST 453 Research in English History 3 Credits
An intensive research seminar on a phase of English history.
Repeat Status: Course may be repeated.

HIST 454 Research in Latin American History 3 Credits
An intensive research seminar on a phase of Latin American history.
Repeat Status: Course may be repeated.

HIST 455 Research in History of Science and Technology 3 Credits
An intensive research seminar on a phase or aspect of the history of science and technology.
Repeat Status: Course may be repeated.

HIST 457 Research in European History 3 Credits
An intensive research seminar on a phase of European history.
Repeat Status: Course may be repeated.

HIST 458 (WGSS 458) Readings in Gender History 3 Credits
Study in small groups under the guidance of a faculty member on the literature of an issue, period, country or culture within gender history.
Repeat Status: Course may be repeated.

HIST 471 Special Topics in History 1-3 Credits
Individual study under the direction of a faculty member of a topic in history.
Repeat Status: Course may be repeated.

HIST 472 Special Topics in History 1-3 Credits
Individual study under the direction of a faculty member of a topic in history.
Repeat Status: Course may be repeated.

HIST 473 Special Topics in History 1-3 Credits
Individual study under the direction of a faculty member of a topic in history.
Repeat Status: Course may be repeated.

HIST 482 Special Topics 3 Credits

HIST 490 Thesis 1-6 Credits
Repeat Status: Course may be repeated.

HIST 499 Dissertation 1-15 Credits
Repeat Status: Course may be repeated.

Humanities

Program Director: Suzanne M. Edwards, Ph.D. (University of Chicago)
sound manner without understanding how their decisions are shaped by what happens outside the boundaries of their homeland; moreover, their decisions often affect people who live far beyond those borders.

International Relations (IR) is the study of world politics in all of its aspects: International security covers issues related to war and peace, among and within societies. International political economy focuses on the political dimensions of trade, investment, development, and poverty. International law, organizations, and ethics and norms involve the study of how legal principles and agreements and moral values contribute to the creation of order, create the basis for stable expectations, and regulate transactions among states and other participants in world affairs. IR theory exposes students to the major explanatory frameworks that have been developed for the study of international relations.

IR investigates the gamut of economic, technological, social, and cultural and military forces that create the increasing interdependence that we call “globalization.” IR examines the ways in which globalization and other factors have sometimes contributed to the creation of order but also often to the breakdown of order, violence among and within states, and to assertions of particularity, whether based on ethnicity, nationalism, or on differences in culture, or wealth. Much of IR is devoted to explaining the behavior of states, but IR also encompasses many entities besides sovereign states. These include international organizations (such as the United Nations and its affiliated organizations); nongovernmental organizations; and intergovernmental organizations, such as the World Trade Organization, the European Union, the African Union, or Mercosur, the Latin American trading bloc.

Lehigh University has one of the few Departments of International Relations in the United States. At Lehigh, world politics is not simply a division of political science. The IR Department is, therefore, able to offer a concentrated and multifaceted program, and one that is truly interdisciplinary. Some IR faculty study world politics as scholars of particular geographic regions, others as theorists seeking to explain the major processes of world politics regardless of where and when they occur: for instance, the causes and consequences of different forms of warfare; the rise and decline of empires; the challenges posed by environmental degradation; and the forces that create both wealth and poverty. What we share is the dedication to teaching and scholarship and the commitment to encouraging our students to engage new ideas and to subject familiar ones to thorough scrutiny.

Judging by the number of students who choose IR as their major, it is one of the most popular disciplines at Lehigh. Moreover, as befits a field that cuts across so many disciplines, we draw students who also pursue coursework, minors, or “double majors” in fields ranging from Religion Studies, Modern Languages and Literatures, Economics, and History to Computer Science, Biology, Engineering, and Environmental Policy.

THE CURRICULUM

Students considering coursework in international relations are strongly encouraged to visit the International Relations website (http://ir.cas2.lehigh.edu). Prospective International Relations majors should enroll in IR 010 and ECO 001 as early as possible. We recommend that IR majors fulfill the mathematics portion of their college distribution requirement with MATH 012 (Basic Statistics), although this course is not required for the major.

DEPARTMENTAL HONORS

To graduate with Departmental Honors, a major in international relations must:

1. successfully complete a two-semester honors thesis (IR 388) in the senior year;
2. attain a GPA of at least 3.5 in the courses constituting the IR major program at the time of graduation. See the department website for additional information.

BEYOND THE IR CURRICULUM

In close cooperation with the international education office, the department assists students interested in study abroad programs. In addition, Lehigh has an array of summer programs, which involve coursework and/or internships in such countries as China, the Czech Republic, and the United Kingdom.

Every semester speakers with expertise on various aspects of world affairs visit Lehigh. Featured speakers have included Dr. Madeline Albright, former U.S. Ambassador to the United Nations; Dr. Shashi Tharoor, former U.N. Under-Secretary-General for Communications and Public Information; Dr. Ernesto Zedillo, former President of Mexico and Director of the Yale Center for the Study of Globalization; and General Anthony Zinni, 40 year Marine Corps veteran and U.S. peace envoy to the Middle East.

The student-run World Affairs Club sponsors a number of activities each year, including student-faculty socials, guest speakers, and related programs. In 2004, Lehigh became the 6th university in the world to gain Non-Governmental Organization (NGO) status with the United Nations. The University’s unique partnership with the UN has allowed for many International Relations majors to serve as UN NGO Youth representatives over the years.

The department has an active program in conjunction with Career Services to help place students in internships. We strongly encourage students to obtain an internship. Most of these internships are likely to be in New York or Washington, D.C.

UPON GRADUATING

While a degree in international relations does not lead to a specific career in the way that, for example, accounting or engineering does, a major in international relations, by emphasizing clarity in speech and writing, analytical skills, and a detailed knowledge of world politics prepares students for careers in international business, government, journalism, law, nongovernmental organizations, and teaching and research. Recent IR graduates currently work in all of these fields. Some have gone directly into careers upon graduating; others have enrolled in graduate school prior to employment.

Professors. Henri J. Barkey, PHD (University of Pennsylvania); Norrin M. Ripsman, PHD (University of Pennsylvania)

Associate Professors. Dinissa Duvanova, PHD (Ohio University); Yinan He, PHD (Massachusetts Institute of Technology); Chaim D. Kaufmann, PHD (Columbia University); Kevin Narizny, PHD (Princeton University)

Assistant Professors. Arman Grigoryan, PHD (Columbia University); Mary Anne Madeira, PHD (University of Washington)

Emeriti. Rajan M. Menon, PHD (University of Illinois at Urbana-Champaign); Bruce E. Moon, PHD (Ohio State University); Oles M. Smolansky, PHD (Columbia University); Raymond F. Wylie, PHD (University of London)

MAJOR IN INTERNATIONAL RELATIONS

The major consists of eleven courses for a total of 40 credits, plus one collateral course. This is the minimum requirement, however, and we strongly urge students to enrich their educations by going further. The courses required are:

Collateral requirements

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<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>ECO 001</td>
<td>Principles of Economics</td>
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Introductory courses

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<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>IR 010</td>
<td>Introduction to World Politics</td>
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Core courses (4 courses, 16 credits)

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<thead>
<tr>
<th>Course</th>
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<tr>
<td>IR 100</td>
<td>Methods and Research Design</td>
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Select one course each from three of the following functional groups:

Theory and Policy

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>IR 105</td>
<td>Theories of International Relations</td>
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<tr>
<td>IR 210</td>
<td>Foreign Policy</td>
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International Political Economy

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<tr>
<th>Course</th>
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<tr>
<td>IR 220</td>
<td>Globalization and World Politics</td>
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<tr>
<td>IR 225</td>
<td>International Political Economy</td>
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International Security Studies

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<th>Course</th>
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<tr>
<td>IR 234</td>
<td>Great Power Politics</td>
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<td>IR 235</td>
<td>International Security</td>
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<tr>
<td>IR 236</td>
<td>Causes of War</td>
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<td>IR 237</td>
<td>National Security: The Military Instrument of Foreign Policy</td>
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International Governance
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<th>MINOR IN INTERNATIONAL RELATIONS</th>
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<tr>
<td>The minor consists of 16 credits:</td>
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<tr>
<td>IR 010 Introduction to World Politics</td>
<td>4</td>
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<tr>
<td>Select IR electives other than IR 002, IR 019, IR 090 or IR 391 (normally two 4-credit courses).</td>
<td>8</td>
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<tr>
<td>Select one advanced IR elective numbered 300-387 (except IR 307) or IR 393</td>
<td>4</td>
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<tr>
<td>Total Credits</td>
<td>16</td>
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</tbody>
</table>

**Attribute/Distribution:** SS

<table>
<thead>
<tr>
<th>JOINT INTERNATIONAL RELATIONS AND ECONOMICS MAJOR</th>
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<tbody>
<tr>
<td>Please click here: Joint IR/Eco Major (p. 177)</td>
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<tr>
<td>JOINT INTERNATIONAL RELATIONS AND MODERN LANGUAGES AND LITERATURES MAJOR</td>
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<tr>
<td>Please click here: Joint IR/MLL Major (p. 178)</td>
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<tr>
<td>Courses</td>
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<tr>
<td>IR 002 Current Issues in World Affairs 3 Credits</td>
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<tr>
<td>This is a survey course designed primarily for non-IR majors or minors. The purpose is to acquaint students with some of the concepts and historical facts behind current global issues. The content of this course will, in part, be dictated by international events as they unfold.</td>
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<td><strong>Attribute/Distribution:</strong> SS</td>
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<tr>
<td>IR 010 Introduction to World Politics 4 Credits</td>
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<tr>
<td>Introduction to the major principles, concepts, and theories of international relations, along with a historical background focusing on the 19th and 20th centuries. Topics to be covered include the nature of power, balance of power theories, national interest, decision-making in foreign policy, theories of war and expansion, patterns of Cooperation, and international political economy.</td>
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<td><strong>Attribute/Distribution:</strong> SS</td>
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<tr>
<td>IR 011 International Relations in Popular Culture 4 Credits</td>
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<tr>
<td>International politics inspires all forms of cultural response, including novels, poetry, art, and film. These media are as or even more influential in shaping public views of international relations, and often policy, than is social science research. This course examine international politics through the artistic lens, juxtaposing artistic interpretations with social science explanations.</td>
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<td><strong>Attribute/Distribution:</strong> SS</td>
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<tr>
<td>IR 015 Authoritarianism 4 Credits</td>
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<tr>
<td>Authoritarianism has been the dominant form of government throughout history, and more than half of the world lives under it today. This course addresses its various forms and central dynamics. Learn how rulers organize coups, repress societal opposition, create cults of personality, enrich cronies, and avoid being overthrown by rivals. Use real-world case studies from the Mideast, Africa, Asia, Europe, and Latin America to find out how authoritarian regimes have dealt with technological change and Western democracy promotion.</td>
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<td><strong>Attribute/Distribution:</strong> SS</td>
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<tr>
<td>IR 026 Political Economy of Corruption I 4 Credits</td>
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<tr>
<td>This course examines causes and consequences of various forms of corruption from the political-economic perspective; helps students better understand various sources, types, patterns, and consequences of corruption; considers corruption that exists in both the public and private sectors; evaluates how corruption affects economic growth and resource allocation; and assesses global and national strategies to reduce corruption. Students may not receive credit for both IR 026 and IR 226.</td>
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<td><strong>Attribute/Distribution:</strong> SS</td>
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<tr>
<td>IR 030 The Nuclear Revolution 4 Credits</td>
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<tr>
<td>The invention of nuclear weapons has revolutionized international politics more profoundly than anything since the invention of agriculture. States can now destroy each other without defeating each other militarily or even if defeated themselves, leading to elaborate concerns about nuclear deterrence, nuclear proliferation, and custody of fissile material. Some credit nuclear deterrence with making the Cold War into the Long Peace. This course explores these and related questions, including whether we can expect the Long Peace to continue.</td>
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<td><strong>Attribute/Distribution:</strong> SS</td>
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<tr>
<td>IR 034 Society, Technology and War 4 Credits</td>
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<td>This course explores the links between war and society in both directions: the impact of social, economic, and technological change on how wars are fought and the purposes for which they can be fought; as well as the impact of war mobilization needs and of war itself on how societies develop, including the rise of capitalism, democratization, economic planning and other modern institutions, and emancipation of disadvantaged groups in society, such as blacks and women in the United States.</td>
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<td><strong>Attribute/Distribution:</strong> SS</td>
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<tr>
<td>IR 036 International Terrorism 4 Credits</td>
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<td>Has global terrorism peaked, or is the worst still to come? This course examines psychological, religious, and political explanations of terrorism; legal and moral statuses of terrorism; explanations for the increasing scale of terrorism and the more frequent targeting of Americans; major terrorist organizations, structures, and means of operation; suicide terrorism; threats and vulnerabilities facing the United States and Western countries today; means of coping with terrorism as an individual and through national policy; possible future developments.</td>
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<tr>
<td>IR 040 The United Nations 4 Credits</td>
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<tr>
<td>Provides overview of key issues and debates in the United Nations and helps students understand the formal and informal operations of this global organization. We will explore two major questions. First, what are the major obstacles to effective international cooperation in the United Nations? Second, what does globalization mean for UN efforts to promote democracy, development, and human rights? Includes a trip to UN Headquarters in NY and an in-class UN simulation exercise.</td>
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<td>IR 041 U.N. Practicum 1 Credit</td>
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<td>Only students participating in the U.N. Youth Representative program are eligible to register for this course. In addition to their regular activities in that program, students are required to maintain a journal of their experiences and write a brief reflective essay on how these experiences have affected their view of international activism, the UN, and the importance on international NGOs. Consent of department required.</td>
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<td>IR 052 Ukraine at the Crossroads: Regime Change and International Politics 4 Credits</td>
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<td>This course investigates Ukraine’s Orange Revolution, Euromaidan protests, Russia’s annexation of Crimea, and the armed conflict in Eastern Ukraine. It will analyze domestic and international causes and consequences of these events through the lenses of news reports, social media, and scholarly publications. The course will introduce students to some basic concepts in the study of domestic and international conflict and facilitate a better understanding of current international events.</td>
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<td><strong>Attribute/Distribution:</strong> SS</td>
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IR 056 European International Relations 4 Credits
Examines the evolution of the modern states system in Europe. Conceptual, theoretical and historical topics include the transition from feudalism to the Westphalian system, nationalism, imperialism, the causes of war and attempted peace settlements, the Cold War, the European Union, and the impact of the collapse of the USSR on the political and strategic structure of Europe.
Attribute/Distribution: SS

IR 057 Political Economy of Post-Communist Transitions and European Integration 4 Credits
Central and Eastern Europe, which was once ruled by communist regimes supported by the Soviet Union, underwent radical political and economic transformations in the 1990s. For the first time after decades of communism, East European countries held competitive elections, introduced market principles in their economies, and joined European institutions. This course focuses on the analysis of post-communist economic transitions and the region’s economic integration with the European Union.
Attribute/Distribution: SS

IR 061 (ASIA 061) East Asian International Relations 4 Credits
Introduction to East Asian international relations, with emphasis on post-1945 period: historical background of Asian international system; Cold War conflicts; China's rise and regional responses; Japan's changing international role; the two Koreas; ASEAN and Asian regionalism; U.S. and Russian policies; current and future issues.
Attribute/Distribution: SS

IR 063 (ASIA 063) U.S.-China Relations 4 Credits
Introduction and analysis of the historical context and key aspects of contemporary US-China relations: Cold War US containment, rapprochement and diplomatic normalization; American arms sale and the Taiwan controversy; conflict and cooperation in the Korean Peninsula; economic interdependence and frictions; human rights and security relations; Asian regional disputes. Students may not receive credit for both IR/ASIA 063 and IR/ASIA 163.
Attribute/Distribution: SS

IR 066 (ASIA 066) Japan in a Changing World 4 Credits
This course explores Japanese foreign policy through its historical and international context; domestic determinants; foreign and security policymaking processes; policy toward major regional players; foreign economic policy; current grand strategic debates.
Attribute/Distribution: SS

IR 074 American Foreign Policy 4 Credits
Addresses major themes and trends in U.S. foreign policy, including its historical evolution. Assesses the interests and values that underlie the goals of policy and the beliefs that shape decisions on how to achieve those goals. Also examines issues such as the constitutional division of authority, bureaucratic politics and processes, civil-military relations, and public opinion.
Attribute/Distribution: SS

IR 082 (JST 082) Middle East in World Affairs Since 1945 4 Credits
Rise of Turkish, Iranian, and Arab nationalism; creation of Israel; decline of British and French power; growth of U.S. and Soviet influence; Middle East as the world's major oil producer.
Attribute/Distribution: SS

IR 086 (JST 086) The Israeli-Palestinian Conflict 4 Credits
Attribute/Distribution: SS

IR 100 Methods and Research Design 4 Credits
The course has two principal aims - to introduce students to the logic of social scientific research and to equip them with the basic tools of research design. To that end the course 1) examines controversies surrounding the scientific method; 2) analyzes the logics of experimental, statistical, and case-study methods; 3) explores the most common methodological errors in social scientific research; and 4) gives students a hands-on experience in designing a study.
Prerequisites: IR 010
Attribute/Distribution: SS

IR 105 Theories of International Relations 4 Credits
The role of theory in historical explanation, prediction, and policy. Issues of theory design and testing. Important theoretical approaches to international relations, including Realism; the Democratic Peace; the domestic politics of foreign policy; history and mythmaking; psychological explanations.
Prerequisites: IR 010
Attribute/Distribution: SS

IR 108 Game Theory and International Politics 4 Credits
The course is designed as a rigorous treatment of the concept of strategic interaction. The focus is on topics like collective action, bargaining under incomplete information, problems of moral hazard and adverse selection, and evolutionary models of interaction. The empirical examples will mostly be drawn from international politics, but anyone curious about the general claim that good outcomes do not necessarily follow from good intentions should find this course interesting.
Attribute/Distribution: MA, SS

IR 119 Issues in International Relations 1-4 Credits
Readings on selected themes in world politics, with theme to change each semester. Offered on an occasional basis only.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

IR 127 Research in International Relations 4 Credits
Research skills in international relations. The role of theory, models and evidence in the explanation of international phenomena. Literature review; problem formulation; theory construction; research design, methods and measures; collection, analysis and interpretation of data; principles of hypothesis testing. Professional writing, either through individual research projects under faculty supervision or an apprenticeship in ongoing faculty research projects. Consent of instructor required.
Prerequisites: IR 010
Attribute/Distribution: SS

IR 132 Nationalism and Ethnic Conflict 4 Credits
The ideal of nationalism exerts a powerful pull on almost all people everywhere. This course investigates the sources, spread, and possible future decline of nationalism and national identity, the manipulation of nationalist feelings for political purposes, and the sources of national and ethnic conflict. We will also consider proposals for managing ethnic conflicts and their records of success (or failure). We will study recent and current cases, such as the Israeli-Palestinian conflict, ethnic relations in Iraq and Afghanistan, the Balkans, or others as current events demand. Prospects for the futures of nationalism, ethnic conflict, and ethnic conflict management. Simulations of decision-making of groups involved in ethnic conflicts.
Attribute/Distribution: SS

IR 163 (ASIA 163) U.S.-China Relations 4 Credits
Introduction and analysis of the historical context and key aspects of contemporary US-China relations: Cold War US containment, rapprochement and diplomatic normalization; American arms sale and the Taiwan controversy; conflict and cooperation in the Korean Peninsula; economic interdependence and frictions; human rights and security relations; Asian regional disputes. This is an advanced course on US-China relations. Students may not receive credit for both IR/ASIA 063 and IR/ASIA 163.
Prerequisites: IR 010 or IR 061
Attribute/Distribution: SS
IR 164 (ASIA 164) Japan in a Changing World 4 Credits
This course explores Japanese foreign policy through its historical and international context; domestic determinants; foreign and security policymaking process; policy to major regional players; foreign economic policy; current grand strategic debates.
Prerequisites: IR 010 or IR 061
Attribute/Distribution: SS

IR 169 Russia and the West 4 Credits
The course is an exploration of the most important issues and debates about the politics of the post-Soviet space. They include the collapse of communism, the collapse of the USSR, the problems of economic and political transition, the conflicts of the post-Soviet space, the problem of selective integration of post-Communist states into the Western integration, and many others.
Attribute/Distribution: SS

IR 177 International Relations of Latin America 4 Credits
Survey of major international and domestic crises facing Central and South America. Examines factors affecting Latin American system of states such as international debt, involvement of foreign powers, and social and political instabilities.
Attribute/Distribution: SS

IR 210 Foreign Policy 4 Credits
This course explores the major international and domestic determinants of foreign policy, as well as contemporary problems associated with the conduct of foreign policy in the 21st century. Principal topics include the influence of the international system, geography, leadership, regime-type, transnationalism, and non-governmental organizations on foreign policy. The course draws upon the experiences of a variety of Western democratic states.
Prerequisites: IR 010
Attribute/Distribution: SS

IR 220 Globalization and World Politics 4 Credits
An exploration of the economic, political, cultural, and military manifestations of globalization and the effects on the internal order of states and the relations among them.
Prerequisites: IR 010 and ECO 001
Attribute/Distribution: SS

IR 222 Political Economy of North-South Relations 4 Credits
Political economy of relations between developed and less developed countries. Issues arising from trade, investment, and foreign aid. Consequences of North-South transactions. Controversies over system structure and reform proposals for international institutions (e.g. World Bank, IMF, WTO).
Prerequisites: IR 225 or POLS 225
Attribute/Distribution: SS

IR 225 (POLS 225) International Political Economy 4 Credits
Principles governing the interaction between the economic and political components of international phenomena. Political aspects of trade, investment, and global economic order. Political underpinnings of international economic relations. Domestic and international political consequences of economic policy and international economic relations.
Prerequisites: IR 010 and ECO 001
Attribute/Distribution: SS

IR 226 Political Economy of Corruption II 4 Credits
This course examines causes and consequences of various forms of corruption from the political-economic perspective; helps students better understand various sources, types, patterns, and consequences of corruption; considers corruption that exists in both the public and private sectors; evaluates how corruption affects economic growth and resource allocation; and assesses global and national strategies to reduce corruption. Students may not receive credit for both IR 026 and IR 226.
Prerequisites: ECO 001
Attribute/Distribution: SS

IR 229 Issues in International Political Economy 1-4 Credits
Selected issues in international political economy, with theme to change each semester. Offered on an occasional basis only.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

IR 234 Great Power Politics 4 Credits
Overview of the dynamics of strategic interaction between great powers, including the causes of conflict, origins of alliances, logic of coercion, sources of order, and definition of national interests. Focus on the interwar period (multi-polarity), the Cold War (bio-polarity), and the post-Cold War period (uni-polarity).
Prerequisites: IR 010
Attribute/Distribution: SS

IR 235 International Security 4 Credits
Prerequisites: IR 010
Attribute/Distribution: SS

IR 236 Causes of War 4 Credits
Systematic examination of major schools of thoughts on the origins and prevention of war, including system-level theories of war and peace, domestic and societal sources of conflict, military policy, and ideational and psychological causes of war. Application and testing of theories to classic cases of war and conflict in history and the contemporary world.
Prerequisites: IR 010
Attribute/Distribution: SS

IR 237 National Security: The Military Instrument of Foreign Policy 4 Credits
This course will begin by exploring the theory, logic and history of US strategy, the elements of ground forces, air power, naval power and nuclear power, and the economics of military strategy. The second half of the course will examine contemporary problems and debates over US security policy.
Prerequisites: IR 010

IR 242 International Law 4 Credits
This course deals with the nature and sources of international law and the major theoretical and historical developments that have created the legal system of states as it now stands. Topics include: armed conflict, international trade, human rights and international environmental law.
Prerequisites: IR 010
Attribute/Distribution: SS

IR 245 International Organization 4 Credits
Examines how cooperation is achieved and sustained in world politics. Under what circumstances does cooperation take place? What role do formal international organizations play? What is the relative importance of power, ideas, and economic interests? Pursues questions theoretically and in practical terms across topical issues (e.g., humanitarian intervention, environmental protection).
Prerequisites: IR 010
Attribute/Distribution: SS

IR 257 Political Economy of Post-Communist Transitions and European Integration 4 Credits
Central and Eastern Europe, which was once ruled by communist regimes supported by the Soviet Union, underwent radical political and economic transformations in the 1990s. For the first time after decades of communism, East European countries held competitive elections, introduced market principles in their economies, and joined European institutions. This course focuses on the analysis of post-communist economic transitions and the region’s economic integration with the European Union.
Prerequisites: ECO 001
Attribute/Distribution: SS

IR 321 Economic Relations of Advanced Industrial Societies 4 Credits
Foreign economic policies of advanced industrial nations. Bilateral and multilateral economic relations; international economic regimes and institutions; interdependence and Cooperation; managing conflict. Consent of department required.
Prerequisites: IR 225
Attribute/Distribution: SS
IR 322 Poverty and Development 4 Credits
Patterns and causes of poverty in poor countries. Diagnosis of development problems and evaluation of development planning. Explanations for choices of development policy, especially issues of trade, foreign aid, and foreign direct investment. Written and oral presentation of individual country research. Consent of department required.
Prerequisites: IR 010
Attribute/Distribution: SS

IR 323 Political Economy of Industrialization and Development 4 Credits
Political foundation and consequences of economic development and growth. Global inequality in the rates and levels of economic development. Analysis of the differences between the development strategies adopted in different parts of the world. Explanations for patterns of success and failure. Origins of underdevelopment; the politics of failed development strategies; the challenge of the increasingly competitive world economy and relations with the U.S. and other developed nations. Consent of department required.
Prerequisites: IR 125 and IR 010
Attribute/Distribution: SS

IR 330 Mass Murder 4 Credits
Is mass murder modern or ancient? Is such violence committed by states or societies? Why do some conflicts degenerate to mass murder and some do not? Are democracies immune to committing this kind of violence? These are just some of the questions that inform the critical examination of the literature on mass murder, which is the principal aim of this course. The prominent cases of mass murder in the 20th century form its main empirical content. Consent of department required.
Prerequisites: IR 010
Attribute/Distribution: SS

IR 332 Theories of Peace 4 Credits
The most important focus of the discipline of international relations has been to understand the causes of war and the paths to peace. This course will explore some of the leading contemporary theories of peace and cooperation. It will conclude with a discussion of the prospects for war and peace in the emerging international system.
Prerequisites: IR 010
Attribute/Distribution: SS

IR 333 Intervention 4 Credits
Strong states frequently intervene in the affairs of weaker societies. Since 1945, the most frequent intervener has been the United States. International norms cut both ways—sovereignty opposes intervention while an emerging “responsibility to protect” sometimes favors it. This course explores why and by what means states and international organizations intervene and what factors influence the success of interventions. We focus mainly on two types—counterinsurgency and humanitarian intervention—that have been and are likely to remain the most common. Consent of department required.
Prerequisites: IR 010
Attribute/Distribution: SS

IR 337 Conflict and Cooperation 4 Credits
The course is designed as an advanced undergraduate seminar to students, who are interested in getting deeper familiarity with the rational choice literature on conflict and cooperation. Its primary focus is on socially suboptimal outcomes in situations that can be modeled as a prisoners’ dilemma, collective action problems, bargaining failures due to incomplete information and commitment problems, etc. The applied material deals with issues like crisis bargaining, alliance politics, revolutions, interventions, trade, democratic transitions, etc. Consent of department required.
Prerequisites: IR 010
Attribute/Distribution: SS

IR 344 International Politics of Oil 4 Credits
Historical influence of oil in international politics and the role it plays today. Focus on differing views of producers, such as Middle Eastern and Latin American states, and consuming nations, largely the economically developed Western states. Consent of department required.
Prerequisites: IR 010 or ECO 001
Attribute/Distribution: SS

IR 347 Non-State Actors in a Globalized World 4 Credits
Interdisciplinary analysis of international and transnational influences on regime transitions. Addresses the role of war, trade, colonial legacies, waves of democratization, socializations, demonstration effects, and international law; the policies of the United States, EU, OAS, UN, World Bank, and NGOs; and the efficacy of different instruments of democracy promotion. Consent of department required.
Prerequisites: IR 010
Attribute/Distribution: SS

IR 364 (ASIA 364) Chinese Foreign Policy 4 Credits
Research-oriented seminar focusing on the sources of Chinese foreign policy preferences and goals, foreign policy decision-making processes; international implications of the rise of China, and the pressing regional and global issues that China is facing now and in the future. Consent of department required.
Prerequisites: IR 010
Attribute/Distribution: SS

IR 367 International Relations of Russia and other Post-Soviet States 4 Credits
Analysis of foreign relations of Russia and the other fourteen states that emerged after the collapse of the USSR. Consent of department required.
Prerequisites: (IR 010 or IR 169)
Attribute/Distribution: SS
**IR 388 Honors Thesis in International Relations 4 Credits**
International relations majors with senior standing may undertake an intensive, two-semester project under the direct guidance of a faculty member in the student’s special area of interest. Students who successfully complete the thesis and whose GPA in the major at the time of graduation is 3.5 or higher receive Departmental Honors. Department permission required. See IR Department website http://cas.lehigh.edu/ir for additional information.

**Repeat Status:** Course may be repeated.

**IR 389 (MLL 389) IR/MLL Capstone Project 4 Credits**
A research project on international politics that will include original research in at least one foreign language under the joint supervision of an adviser in IR and one in the relevant language in MLL. Consent of department required.

**Attribute/Distribution:** SS

**IR 390 Readings in International Relations 1-4 Credits**
Directed course of readings intended for students with special competence or interest in fields of international relations not fully covered by regular course offerings. Department permission required.

**Repeat Status:** Course may be repeated.

**Attribute/Distribution:** SS

**IR 391 Internship in International Relations 1-4 Credits**
Internship in public or private agency. Department permission required.

**Repeat Status:** Course may be repeated.

**Attribute/Distribution:** SS

**IR 392 Independent Study 1-4 Credits**
This course enables students to work with faculty on individual projects and material not covered by the current course offerings. Department permission required.

**Repeat Status:** Course may be repeated.

**Attribute/Distribution:** SS

**IR 393 Seminar in International Relations 3,4 Credits**
Advanced seminar, comparable to other 300-level seminars, that focuses on discussion and research on specialized subjects in international relations. Variable subject matter. Junior standing and department permission required.

**Repeat Status:** Course may be repeated.

**Attribute/Distribution:** SS

**IR 394 Special Topics in International Relations 1-4 Credits**
Intensive, research-oriented study for students with special competence or interest in fields of international relations not fully covered by regular course offerings. Department permission required.

**Repeat Status:** Course may be repeated.

**Attribute/Distribution:** SS

**IR 493 IR Graduate Seminar 3 Credits**
Graduate level research seminar.

**Repeat Status:** Course may be repeated.

**Jewish Studies**

**Program Director:** Hartley Lachter, Ph.D. ([http://religion.cas2.lehigh.edu/content/dr-hartley-lachter/New York University](https://religion.cas2.lehigh.edu/content/dr-hartley-lachter) ([https://religion.cas2.lehigh.edu/content/hartley-lachter](https://religion.cas2.lehigh.edu/content/hartley-lachter))

**Email:** lachter@lehigh.edu | **Phone:** 610-758-2130

**Website:** [http://cjls.cas2.lehigh.edu/](http://cjls.cas2.lehigh.edu/)

Supported by the Office of Interdisciplinary Programs, 610-758-3996; incasip@lehigh.edu

**Williams Hall, 31 Williams Drive**

The Jewish studies minor, coordinated by the Philip and Muriel Berman Center for Jewish Studies (http://catalog.lehigh.edu/graduatestudyandresearch/researchcentersandinstitutes/philipandmurielbermancenterforjewishstudies), provides students with the opportunity to explore the history, literature, religion, and social institutions of the Jewish people from its inception to the present. The diverse selection of courses highlights the interaction of Judaism with other cultures and societies in Europe, the Middle East, and the United States. Students will discover that courses in Jewish studies enhance their understanding of individual and group identity and the dynamics of religious-cultural pluralism. The program is designed to appeal to students with varied interests in any field of concentration. The flexible requirements of the minor in Jewish Studies make it an ideal complement to any major or minor in Arts and Sciences, Business, Engineering, or Education. Students should coordinate their minor program in Jewish studies with the director.

The Berman Center for Jewish Studies supplements formal course offerings through an extensive program of lectures, colloquia, films, field trips, and other cultural events. The Center also provides funding to students to help them pursue study abroad experiences or other enhancements to their academic work in the field of Jewish Studies.

**JEWISH STUDIES MINOR**

Students pursuing a minor in Jewish studies must fulfill 16 credit hours.

**Four (4) courses from the approved course list or in consultation with the program director.**

| Total Credits | 16 |

1 A maximum of eight credit hours of Hebrew may be counted

**COURSES**

<table>
<thead>
<tr>
<th>COURSES</th>
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<tr>
<td>HEBR 001</td>
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<tr>
<td><strong>Elementary Modern Hebrew</strong></td>
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<td>HEBR 002</td>
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<tr>
<td><strong>Elementary Modern Hebrew</strong></td>
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<td>HEBR 011</td>
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<tr>
<td><strong>Intermediate Modern Hebrew</strong></td>
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<td>HEBR 012</td>
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<tr>
<td>HEBR 151</td>
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<td><strong>Hebrew Special Topics</strong></td>
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<td>HEBR 152</td>
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<td><strong>Hebrew Special Topics</strong></td>
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<td>JST/REL 073</td>
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<td>JST/REL 081</td>
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<td><strong>Jewish Mysticism</strong></td>
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<td>JST/IR 082</td>
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<td><strong>Middle East in World Affairs Since 1945</strong></td>
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<tr>
<td>JST/IR 086</td>
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<tr>
<td><strong>The Israeli-Palestinian Conflict</strong></td>
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<tr>
<td>JST/REL/ENGL/AAS 102</td>
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<tr>
<td><strong>Promised Lands: Jewish and African American Children's Literature</strong></td>
<td>4</td>
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<tr>
<td>JST/REL 111</td>
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<tr>
<td><strong>Jewish Scriptures/Old Testament</strong></td>
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<tr>
<td>JST/REL 112</td>
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<tr>
<td><strong>The Beginnings of Judaism and Jewish Origins: Jewish Diversity in the Greco-Roman World</strong></td>
<td>4</td>
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<tr>
<td>JST/CLSS/REL 114</td>
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<tr>
<td><strong>Christian Origins: New Testament and the Beginnings of Christianity</strong></td>
<td>4</td>
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<tr>
<td>JST/SOC/GS 116</td>
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<tr>
<td><strong>Jewish Community and Identity</strong></td>
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<tr>
<td>JST/REL 121</td>
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<td><strong>Sources for the Life of Jesus: the Jewish and Christian Context</strong></td>
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<td>JST/REL 122</td>
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<td><strong>Archaeology and the Bible</strong></td>
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<tr>
<td>JST/REL 123</td>
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<tr>
<td><strong>Armaggedon: Endtime Thinking in Judaism and Christianity</strong></td>
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<td>JST/PHIL/REL 129</td>
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<td><strong>Jewish Philosophy</strong></td>
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<td>JST/REL/WGSS 138</td>
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<tr>
<td><strong>Sex, Gender, Jews</strong></td>
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<tr>
<td>JST/REL 152</td>
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<tr>
<td><strong>American Judaism</strong></td>
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<td>JST/REL/HIST 154</td>
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<td><strong>The Holocaust: History and Meaning</strong></td>
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<td>JST/REL 156</td>
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<tr>
<td><strong>Judaism and Comic Books</strong></td>
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<tr>
<td>JST/REL/WS 161</td>
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<td><strong>Globalization in the Ancient Mediterranean</strong></td>
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<tr>
<td>JST/REL 174</td>
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<tr>
<td><strong>Modern Theology</strong></td>
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<tr>
<td>JST/REL/THTR 177</td>
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<tr>
<td><strong>Jews and the Broadway Musical</strong></td>
<td>4</td>
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<tr>
<td>JST 180</td>
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<tr>
<td><strong>Independent Study in Jewish Studies</strong></td>
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<tr>
<td>JST 181</td>
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<tr>
<td><strong>Special Topics in Jewish Studies</strong></td>
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<tr>
<td>JST/REL 230</td>
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<tr>
<td><strong>Kabbalah: Jewish Mystical Tradition</strong></td>
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<tr>
<td>JST/REL 231</td>
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<tr>
<td><strong>Classic Jewish Texts</strong></td>
<td>4</td>
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<tr>
<td>PHIL 133</td>
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<tr>
<td><strong>Medieval Philosophy</strong></td>
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Courses

JST 073 (REL 073) The Jewish Tradition 4 Credits
Judaism is both a textual tradition and a lived religion. Students read basic Jewish texts—Bible, Talmud, Midrash—and study the ways Jews sanctify the life cycle through rites of passage, and the round of the year through the festival cycle.
Attribute/Distribution: HU

JST 081 (REL 081) Jewish Mysticism 4 Credits
This course will examine both the history and the central texts and ideas of the Jewish mystical tradition. We will read a broad range of texts, including the ancient Sefet Yetzirah or Book of Creation, the Zohar, the works of Isaac Luria and his disciples, and the writings of some of the 18th and 19th century Hasidic rabbis. We will also explore the contemporary emergence of Kabbalah and the activities of the Kabbalah Center in contemporary America.
Attribute/Distribution: HU

JST 082 (IR 082) Middle East in World Affairs Since 1945 4 Credits
Rise of Turkish, Iranian, and Arab nationalism; creation of Israel; decline of British and French power; growth of U.S. and Soviet influence; Middle East as the world's major oil producer.
Attribute/Distribution: SS

JST 086 (IR 086) The Israeli-Palestinian Conflict 4 Credits
Attribute/Distribution: SS

JST 102 (AAS 102, ENGL 102, REL 102) Promised Lands: Jewish and African American Children's Literature 4 Credits
In the Hebrew Bible, Psalm 137 asks, “How can we sing the Lord's song in a strange land?” For Jews, blacks, and black Jews, this was and is a poignant question. This course examines how these two rich, often overlapping and interacting groups tell their stories in literature for children and young adults, with a particular focus on the mediation of traumatic pasts. What does it mean to imagine promised lands beyond such pasts—and can they be reached?
Attribute/Distribution: HU

JST 111 (REL 111) Jewish Scriptures/Old Testament 4 Credits
The religious expression of the Hebrews, Israelites, and Jews as found in the Jewish Scriptures (TANAK/Christian Old Testament). Near Eastern context of Hebrew religion, the Patriarchs, the Exodus, the monarchy, prophecy, Exile and Return. Emphasis on historical, literary, critical problems, and newer socio-historical methods.
Attribute/Distribution: HU

JST 112 (REL 112) The Beginnings of Judaism and Jewish Origins: Jewish Diversity in the Greco-Roman World 4 Credits
The variety of approaches to Judaism in the period following the Babylonian exile through the second century C.E. The literature studied will include Apocrypha, Pseudepigrapha, and the Dead Sea Scrolls.
Attribute/Distribution: HU

Early Christianity from its beginnings until the end of the second century. Coverage includes the Jewish and Hellenistic matrices of Christianity, traditions about the life of Jesus and his significance, and the variety of belief and practice of early Christians. Emphasis on encountering primary texts.
Attribute/Distribution: HU

JST 116 (GS 116, SOC 116) Jewish Community and Identity 4 Credits
A century ago, large Jewish communities existed throughout the world, including North Africa, Europe, the Middle East, and South America. Today, over 80% of all Jews live in North America or Israel. This course focuses on these historical changes in Jewish communities and the transformation of Jewish identities and social life in recent years, particularly in the U.S. and in Israel.
Attribute/Distribution: SS

JST 121 (REL 121) Sources for the Life of Jesus: the Jewish and Christian Context 4 Credits
Ancient sources that claim to provide information about Jesus of Nazareth. Approaches taken to Jesus’ life and career; early Christian interpretations of the significance of Jesus; methodology in assessing evidence for the historical Jesus and his message.
Attribute/Distribution: HU

JST 122 (REL 122) Archaeology and the Bible 4 Credits
In this course we will examine the way that archaeological work can inform the study of the Bible. One important consideration is how archaeological data have been used either to confirm or falsify the biblical texts. We will look at how archaeologists work and how archaeological data and the Bible intersect. We will examine in detail several archaeological sites in order to understand better the difficulties in interpreting the material remains that archaeologists dig up.
Attribute/Distribution: HU

JST 123 (REL 123) Armageddon: Endtime Thinking in Judaism and Christianity 4 Credits
Thinking about how the world will end was an important feature of certain types of ancient Judaism. Early Christianity took over many of these ideas, and they became fundamental to later Christian theologies, including many that continue to be advocated today. This course will look at ancient Jewish and Christian texts that speak about the end of the world and will trace some of them through more contemporary developments in these two religious traditions.
Attribute/Distribution: HU

JST 129 (PHIL 129, REL 129) Jewish Philosophy 4 Credits
Consideration of how major Jewish thinkers from the first to 21st centuries confronted questions at the intersection of religion and philosophy: the existence and nature of God, free will, evil, divine providence, miracles, creation, revelation, and religious obligation.
Attribute/Distribution: HU

JST 138 (REL 138, WGSS 138) Sex, Gender, Jews 4 Credits
How do Jews of all genders tell their stories? What are the varied Jewish approaches to sexuality? How have feminist movements affected Jewish rituals? In this course, we will consider how religion, gender, sexuality, race, and class intersect in the lives of Jews, with a particular focus on North America. Topics will include: Jewish women’s memoirs; the voices of LGBTQ Jews; recent innovations in Jewish ritual and leadership; Jewish masculinities; and the gendering of Jewish children’s literature, among others.
Attribute/Distribution: HU

JST 152 (REL 152) American Judaism 4 Credits
Diverse cultural and social forms through which American Jews express their distinct identity. Is American Jewry an example of assimilation and decline or creative transformation? What, if anything, do American Jews share in common? Compatibility of Judaism with individualism, pluralism, and voluntarism. How have the Holocaust and the State of Israel shaped the self-understanding of American Jewry?
Attribute/Distribution: HU

JST 154 (HIST 154, REL 154) The Holocaust: History and Meaning 4 Credits
The Nazi Holocaust in its historical, political and religious setting. Emphasis upon the moral, cultural and theological issues raised by the Holocaust
Attribute/Distribution: HU

JST 156 (REL 156) Judaism and Comic Books 4 Credits
Is The Thing Jewish? What does Superman have to do with the bible? Do Orthodox Jewish girls fight trolls? In this course, we will closely examine comic books and graphic novels in order to expand our understanding of what Jewishness might mean. With a POW! and a BAM!, we will consider many topics “from Krakow to Krypton,” including American Jewish history, how representations of Jews are gendered, global Jewish traditions, monsters and mutations, biblical adaptations, and more!
Attribute/Distribution: HU
JST 161 (GS 161, REL 161) Globalization in the Ancient Mediterranean 4 Credits
We often think of globalization as a modern phenomenon. Yet as early as the twelfth century BCE, transportation, trade, political and religious networks tied the Mediterranean basin together. This course will examine in three periods—the Late Bronze Age, the Hellenistic period, and the Roman period—how these networks were organized and how they affected a range of Mediterranean and Near Eastern peoples. We will use some modern approaches to globalization as analytical tools for understanding the ancient world.
Attribute/Distribution: HU

JST 174 (REL 174) Modern Theology 4 Credits
Major 20th century movements within Christian and Jewish theology understood as responses to the problems of modern times. May be repeated for credit as the subject matter varies.
Repeat Status: Course may be repeated.

JST 177 (REL 177, THTR 177) Jews and the Broadway Musical 4 Credits
The history of American musical theater is deeply interwoven with the history of American Jews. This course examines how Jews have taken part in musical theater on multiple levels—as composers, lyricists, producers, and performers, among other roles. It also examines how Jews are depicted in Broadway musicals, with particular attention to gender and ethnicity.
Attribute/Distribution: HU

JST 180 Independent Study in Jewish Studies 1-4 Credits
Directed readings or research on a Jewish Studies related topic under the direction of a Jewish Studies faculty member. May be repeated for credit up to eight credits. Must have consent of the program director.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

JST 181 Special Topics in Jewish Studies 4 Credits
Study of a subject or issue in Jewish Studies not covered in other courses. May be repeated for credit as subtitle varies.
Repeat Status: Course may be repeated.

JST 230 (REL 230) Kabbalah: Jewish Mystical Tradition 4 Credits
Explores the history of the quest to know God, through mystical experience or theosophical speculation, as found in Jewish tradition. Examines such issues as the tensions between institutional religion and personal religious experience, between views of God as immanent in the world or transcending it, and between imagery for God and religious experience of God.
Attribute/Distribution: HU

JST 231 (REL 231) Classic Jewish Texts 4 Credits
Many people know that the Hebrew Bible (“Old Testament”) is a foundational scripture for Judaism. Fewer are familiar with the post-biblical Jewish classics. Yet these works shaped the understanding of God, the identity of the Jewish people, and the vision of history and of the ethical life that inform Judaism today. As students read the Talmud, Midrash, and traditional prayer-book, they will become familiar with the wisdom of the rabbinic sages, and the central concepts of Judaism.
Attribute/Distribution: HU

Joint International Relations and Economics Major
This major combines international economics, which is the study of markets and economic policy, with international political economy, which studies international institutions and the interactions of states with those institutions and each other motivated by trade-offs among economic goals and considerations of power, national security, and citizen welfare. Study of economic theory, as well as institutional arrangements, allows students to understand consequences for the world economy including political and distributional consequences.

Program Advisors:
Professor Dinissa Duvanova, International Relations Department, Professor Mary Anne Madeira, International Relations Department, Professor Frank R. Gunter, Economics Department

Professors. Henri J. Barkey, PHD (University of Pennsylvania); Shin-Yi Chou, PHD (Duke University); James A. Dearden, PHD (The Pennsylvania State University); Mary E. Deily, PHD (Harvard University); Frank R. Gunter, PHD (Johns Hopkins University); Judith A. McDonald, PHD (Princeton University); Chad Meyershofer, PHD (Cornell University); Vincent G. Munley, PHD (State University of New York at Binghamton); Norrin M. Ripsman, PHD (University of Pennsylvania); Larry W. Taylor, PHD (University of North Carolina, Chapel Hill); Todd A. Watkins, PHD (Harvard University)

Associate Professors. Dinissa Duvanova, PHD (Ohio University); Yinan He, PHD (Massachusetts Institute of Technology); Chaim D. Kaufmann, PHD (Columbia University); Ernest Kong-Wah Lai, PHD (University of Pittsburgh); Alberto Lamadriz, PHD (Cornell University); Kevin Narizny, PHD (Princeton University); Oleksandr Nikolsko Rzhevskyi, PHD (University of Houston University Park); Ahmed S. Rahman, PHD (University of California Davis); Seth Richards-Shubik, PHD (University of Pennsylvania); Muzhe Yang, PHD (University of California, Berkeley)

Assistant Professors. Arman Grigoryan, PHD (Columbia University); Mary Anne Madeira, PHD (University of Washington)

Professors Of Practice. Luis F. Brunstein, PHD (University of California, Riverside); Yuval Erez, PHD (Cornell University)

Emeriti. J. Richard Aronson, PHD (Clark University); Nicholas W. Balabkins, PHD (Rutgers University); Thomas J. Hyclak, PHD (University of Notre Dame); Jon T. Innes, PHD (University of Oregon); Arthur E. King, PHD (Ohio State University); John R. McNamara, PHD (Rensselaer Polytechnic Institute); Rajan M. Menon, PHD (University of Illinois at Urbana-Champaign); Bruce E. Moon, PHD (Ohio State University); Anthony Patrick O’Brien, PHD (University of California, Berkeley); Oles M. Smolansky, PHD (Columbia University); Robert J. Thornton, PHD (University of Illinois); Raymond F. Wylie, PHD (University of London)

Collaborative course in Mathematics:
Any one of the following courses:
MATH 021 Calculus I 4
MATH 031 Honors Calculus I 4
MATH 051 Survey of Calculus I 4
MATH 075 Calculus I, Part A 4
MATH 076 and Calculus I, Part B 4
MATH 081 Calculus with Business Applications 4

_required_courses 60-61 credits, as follows:

Introductory courses (2 courses/8 credits)
ECO 001 Principles of Economics 4
IR 010 Introduction to World Politics 4

IR Core Courses (4 courses/16 credits)
IR 100 Methods and Research Design 4
IR 225 International Political Economy 4
Any two of the following courses:
IR 105 Theories of International Relations 4
IR 210 Foreign Policy 4
IR 234 Great Power Politics 4
IR 235 International Security 4
IR 236 Causes of War 4
IR 237 National Security: The Military Instrument of Foreign Policy 4
IR 245 International Organization 4

Economics Core Courses (3 courses/12 credits)
ECO 045 Statistical Methods 3
ECO 146 Intermediate Microeconomic Analysis 3
ECO 119 Intermediate Macroeconomic Analysis 3

Advanced courses in IR (2 courses/8 credits)
Chosen from any IR courses 300-387 or 393

Advanced courses in Economics (2 courses/6 credits)
Chosen from ECO 303, ECO 338, ECO 339, ECO 340, ECO 342, ECO 345
Electives (3 courses/10-11 credits)
At least one course chosen from IR 200-387 or 393
At least one course chosen from ECO 200+ except ECO 201, 259, 273, 274, 301, 362, 371 and 389
The third may be from either of the two above categories.

Recommended Economics electives:
ECO 203 Microfinance: Financial Inclusion for the Poor
ECO 209 Comparative Economic Systems
ECO 303 Economic Development
ECO 339 International Trade
ECO 340 International Finance
ECO 342 Economic Development in China
ECO 345 Political-Economy of Iraq

Recommended IR electives:
IR 222 Political Economy of North-South Relations
IR 321 Economic Relations of Advanced Industrial Societies
IR 322 Poverty and Development
IR 323 Political Economy of Industrialization and Development
IR 344 International Politics of Oil

Majors in this program may NOT minor or major in either Economics or IR

Joint International Relations/Modern Languages and Literatures Major

Program directors: IR: Yinan He; MLL: M.H. Chabut

The multidisciplinary Joint IR/MLL Major is offered jointly by the Department of International Relations (IR) and the Department of Modern Languages and Literatures (MLL). The program, which offers a Bachelor of Arts, incorporates courses from both IR and MLL, as well as electives from a broad cross-section of other departments, for a challenging program that requires overseas study, language facility, and undergraduate research.

The Joint IR/MLL Major recognizes that Lehigh graduates must be adequately prepared to play an active role in the world of the 21st century. For that, they will need an acute understanding of essential issues of global politics, broad linguistic and cultural skills, significant overseas experience, and both intellectual and cultural sophistication. The Joint IR/MLL Major meets those requirements with courses in economics, international relations, language, and culture. Extended study abroad and undergraduate research in more than one language are also required. The program will help students develop a deeper and richer understanding of cultural, linguistic, and political diversity around the world.

The program requires a total of 16 courses for 60-64 credits. At least one semester of study abroad in an approved Lehigh program is required, as is undergraduate research that uses sources in at least one language other than English. Each student will have two major advisors, one each from IR and MLL.

Professors. Henri J. Barkey, PHD (University of Pennsylvania); Marie-Helene Chabut, PHD (University of California, San Diego); Constance A. Cook, PHD (University of California, Berkeley); Kiri Lee, PHD (Harvard University); Mary A. Nicholas, PHD (University of Pennsylvania); Norrin M. Ripsman, PHD (University of Pennsylvania)

Associate Professors. Marie-Sophie Armstrong, PHD (University of Oregon); Taieb Berrada, PHD (Northwestern University); Matthew R. Bush, PHD (University of Colorado Boulder); Dinissa Duvanova, PHD (Ohio University); Yinan He, PHD (Massachusetts Institute of Technology); Chaim D. Kaufmann, PHD (Columbia University); Kevin Narizny, PHD (Princeton University); Antonio Prieto, PHD (Princeton University); Vera S. Stegmann, PHD (Indiana University Northwest)

Assistant Professors. Thomas Chen, PHD (University of California Los Angeles); Arman Grigoryan, PHD (Columbia University); Olivia Landry, PHD (Indiana University Bloomington); Mary Anne Madeira, PHD (University of Washington); Lilia Adriana Perez Limon, PHD (University of Wisconsin-Madison); Sara Lindsey Reuben, MA (Columbia University); Nobuko Yamasaki, PHD (University of Washington)

Lecturer. Jessica Racines Brandt, MA (Lehigh University)

Professors Of Practice. Eunice Cortez, PHD (Temple University); Limei Shan, MS (East China Normal University); Kyoko Taniguchi, PHD (Emory University)

Emeriti. Linda S. Lefkowitz, PHD (Princeton University); Rajan M. Menon, PHD (University of Illinois at Urbana-Champaign); Bruce E. Moon, PHD (Ohio State University); David W. Pankenier, PHD (Stanford University); Oles M. Smolansky, PHD (Columbia University); Anje C. Van Der Naald, PHD (University of Illinois at Urbana-Champaign); Lenora D. Wolfgang, PHD (University of Pennsylvania); Raymond F. Wylie, PHD (University of London)

Joint IR/MLL Major

International Relations courses (6 courses/24 credits)

IR 010 Introduction to World Politics
Any three of the following courses:
IR 100 Methods and Research Design
IR 105 Theories of International Relations
IR 210 Foreign Policy
IR 220 Globalization and World Politics
IR 225 International Political Economy
IR 236 Causes of War
IR 237 National Security: The Military Instrument of Foreign Policy
IR 245 International Organization

Two IR advanced courses numbered 300-387 (except IR 307) or IR 393

Modern Languages and Literature courses (6 courses/22-24 credits)

16 credits in one language, either Arabic, Chinese, Hebrew, Japanese, Russian, French (above the level of French 2), German (above the level of German 2), and Spanish (above the level of Spanish 2)

Two culture courses from an approved list or in consultation with the MLL advisor

Capstone project: IR 389/MLL 389
A research project on international politics that will include original research in at least one foreign language under the joint supervision of an advisor in IR and one in the relevant language in MLL.

Study Abroad
1 semester or more in an approved Lehigh program

Electives (3 courses/10-12 credits)
Any IR courses except IR 002, 019, 090, 307, 388, 389, 391, or courses from an approved list.

Total Credits
60-64

Journalism and Communication

The Department of Journalism and Communication offers two majors: one in Journalism and another in Journalism and Science and Environmental Writing. It also offers a minor in Mass Communication.

Journalism is crucial to the public life of a democracy. At its best, journalism serves as a watchdog to government, offers a voice for the powerless at home and abroad, entertains and instructs the public, represents the views of varied constituencies, monitors and protects the environment and public resources, and provides a common memory for a people.

The purpose of the journalism program is to provide students with the knowledge and skills to fulfill such roles. The program emphasizes research, writing, editing, and critical thinking and analysis. Students
integrate online technology with legal and ethical thinking and a global perspective that will prepare them for numerous opportunities in and out of journalism.

In the journalism major, students take courses in writing, editing, visual communication, law and ethics, a professional internship and varied courses in the relationship of the media with society.

A second major available to students is the science and environmental writing program. Students learn to write about pure and applied scientific research, technology, engineering, the environment and medicine and health for a variety of audiences ranging from the general public to scientists and engineers in industry and government. Students can also gain experience in the science and environmental writing field research program. A minor in science and environmental writing is available that may be valuable for students with majors in science or engineering.

An interdisciplinary minor in mass communication is also offered for students to complement their liberal arts education. The minor consists of 15-16 credits of Journalism or Communication classes; the credits can include up to four credits of classes for The Brown and White.

Career opportunities are numerous for graduates of the department. Students find work in traditional journalism organizations, such as newspapers, wire services, magazines, cable, television and radio stations, and other media outlets. Students find work too in new media, such as web sites and other digital production activities.

Students also find work in public relations positions, with responsibilities in government, corporations, hospitals, health care organizations, universities, sports information, nonprofit agencies and other groups.

A background in journalism, with its emphasis on research and writing, also proves to be excellent preparation for many other fields and provides a fine basis for the study and practice of law, graduate study in a variety of disciplines, government service, teaching and business management.

Students in science and environmental writing can expect to pursue careers in science, health and environmental journalism in both the traditional and online media; public relations for scientific societies, environmental organizations, government agencies, universities or hospitals; technical writing for industry and government agencies, and other areas, such as management, administration and teaching. The program also prepares students for graduate study in science or environmental writing, journalism and other disciplines.

The interdisciplinary minor in mass communication will be useful to students interested in organizational and written communication, law, business, philosophy, government, teaching, telecommunication or other careers where understanding of communication is important.

Students are also eligible for scholarships and awards. Incoming high school seniors can apply for the Rodale Scholar award, which provides a scholarship along with opportunities in magazines, books and multimedia. Lehigh Journalism students compete for an array of prestigious writing prizes that include the William Prizes in Journalism, the Kachel Awards in Writing, the Cagan Award for reporting, the Strassberg Award for research, and the Jesse Siegel Writing Award. Recent donations allow students to travel to professional workshops and conferences.

Professors. Sharon M. Friedman, MA (The Pennsylvania State University); John F. Lule, PhD (University of Georgia); Kathleen K. Olson, PhD (University of North Carolina at Chapel Hill)

Associate Professor. Jeremy J. Littau, PhD (University of Missouri Columbia)

Assistant Professors. Mariana De Maio, PhD (University of Florida); Haiyan Jia, PhD (The Pennsylvania State University)

Professors Of Practice. Matthew Veto, MA (University of Missouri Columbia); John J Vlianov, MA (University of Pennsylvania)

Emeriti. Carole M. Gorney, MS (Northwestern University); Walter W. Trimble, MA (Ohio State University)

REQUIRED MATH COURSE
Understanding statistical information has become extremely important in modern society. MATH 012, Basic Statistics, is required for students taking a journalism or science and environmental writing major. Students should take MATH 012 to fulfill the college’s distribution requirement. ECO 045, Statistical Methods, is an acceptable alternative. For science/science writing double majors, calculus will be considered as a substitute for statistics.

JOURNALISM MAJOR
Program Description is in Program Requirements Above. Unable to add new classes to the Program Description below because the new classes have not been created yet.

Core Courses
JOUR 001 Brown and White 1
JOUR 002 Brown and White 1
JOUR 003 Brown and White 1
JOUR 004 Brown and White 1
COMM 001 Media and Society 4
JOUR 021 Writing for the Media 4
JOUR 023 Editing 4
JOUR 024 Visual Communication 4
JOUR 122 Media Ethics and Law 4
JOUR 275 Writing for Media II (Course fulfills university junior writing intensive requirement) 4
Senior Seminar: Journalism or Communication course at 300 level 4
Capstone (Choose one among three in consultation with adviser)
JOUR 361 Internship 4
JOUR 375 Writing for Media III 4
JOUR 390 Honors Thesis 1-4

Required Elective
Select one additional Journalism or Communication course.

Collateral Requirements
Students must also complete a second major, OR a minor outside of the Department of Journalism and Communication.

1 NOTE: Students must consult an adviser in choosing the elective course as not all courses with JOUR or COMM designations can be used.

JOURNALISM/SCIENCE AND ENVIRONMENTAL WRITING MAJOR

Core Courses
JOUR 001 Brown and White 1
JOUR 002 Brown and White 1
or JOUR 231 Science Writing Practicum 1
Select one of the following:
JOUR 123 Basic Science and Technical Writing 4
JOUR 311 Science and Technical Writing 4
JOUR 021 Writing for the Media 4
JOUR 023 Editing 4
JOUR 024 Visual Communication 4
JOUR 230 Multimedia Storytelling 4
JOUR 275 Writing for Media II (Choose between JOUR 230 or JOUR 275) 4

Advanced Courses
JOUR/STS 124 Politics of Science 4
JOUR 125 Environment, the Public and the Mass Media 4
JOUR/STS/HMS 323 Health and Environmental Controversies 4
JOUR 361 Internship 4

Required Electives
Select one additional 4-credit Journalism or Communication course. 1
Total Credits 42

1 NOTE: Students must consult an adviser in choosing the elective course as not all courses with JOUR or COMM designations can be used.
Collateral Requirements
Students must also complete 15-16 credits in science for the journalism/science and environmental writing major.

Required courses
A minimum of 15-16 credits in the physical, biological, environmental or social sciences or engineering is required. These hours can be concentrated in any one area or distributed among all five areas, although an area concentration is recommended. Dual majors in journalism/science and environmental writing and a science are encouraged. Science courses should be chosen in consultation with the major adviser.

Science and environmental writing field research program
Available to science, environmental and technical writing students at the junior or senior level, this program provides practical experience in scientific research and science writing for students who work on and write about research projects directed by university scientists and engineers. Another segment of the program allows students to attend major scientific meetings as fully accredited science reporters. Students observe professional science writers in action and write their own stories about the scientific sessions and press conferences held at the meetings.

SCIENCE AND ENVIRONMENTAL WRITING MINOR
JOUR 001 or JOUR 231 Brown and White Science Writing Practicum
JOUR 021 or JOUR 123 Writing for the Media Basic Science and Technical Writing
JOUR 124 Politics of Science
JOUR 125 Environment, the Public and the Mass Media
JOUR 323 Health and Environmental Controversies

Total Credits 17

MASS COMMUNICATION MINOR
Purpose
The Mass Communication Minor focuses on how information is disseminated and the effect on the shaping of societies. As traditional forms of mass communication change and new forms arise, it is more important than ever to understand the interplay of the media and society. In this minor, students will learn to evaluate and interpret media messages so that they can understand and participate in this increasingly complicated world. They can also choose to combine theory with practice in research, interviewing, writing, visual communication and editing to enhance their skills in those areas. Because the minor draws on the same courses, it is not open to majors in Journalism or Journalism/Science and Environmental Writing.

Requirements
Four 3- or 4-credit COMM or JOUR classes, with one at or above the 200 level. NOTE: Students must consult an adviser in choosing the elective courses as not all courses with COMM or JOUR designations can be used.

Total 15-16 credits

Communication Courses
COMM 001 Media and Society 4 Credits
This introduction to the roles of mass media in U.S. and global society explores a media-saturated society. Students learn how mass media operate in relationship to society, controversies surrounding their activities, social consequences of media behavior, and theories for examining mass media. Restricted to CAS students but other colleges and upperclassmen allowed by instructor’s permission.

COMM 040 (ENTP 040) Entrepreneurial Communication for Creative Industries 3 Credits
Explores the evolving culture of social media and related communication strategies and analysis. In depth discussion of tools, technique and tone; digital identity, content, voice and audience; and of managing social media blended with traditional platforms. Practical applications and best practices for multiple methods. Covers all the leading social media platforms, crowdsourcing, crowdfunding, guerilla marketing, as well as exploring new emerging platforms. Case discussions with external profit, nonprofit and government practitioners. Students design, execute and evaluate a communication campaign strategy.

COMM 050 Intro to Political Communication 4 Credits
Whether we realize it or not, political communication is a big part of our daily lives. This course aims to introduce students to this interdisciplinary field that bridges communication and political science. It will provide an overview of how news and political messages are created and disseminated through mass and interpersonal communication, and how those influence our political perceptions, attitude, and behaviors. The implications of the changing media landscape for society and relevant theories will be also discussed. (SS).

COMM 102 (DOC 102, FILM 102) The Sports Documentary 4 Credits
The sports documentary has become an increasingly important form of media. Through the sports documentary, some of society’s most significant concerns are portrayed and discussed, including issues of race, gender, terrorism, inequality and more. Too, the sports documentary has adapted to various media, from film to television to online, from the multi-volume work of Ken Burns to ESPN’s “30 for 30.” This course examines and critiques the social, cultural, political and economic implications of the sports documentary in contemporary culture.

COMM 135 (JOUR 135, SOC 135) Human Communication 4 Credits
Processes and functions of human communication in relationships and groups.

COMM 143 Persuasion and Influence 4 Credits
The social, symbolic, and rhetorical means of persuasion and how this persuasive influence is expressed in politics, advertising, and the mass media. Students will gain experience in evaluating and creating persuasive communication messages and campaigns.

COMM 150 (HMS 150) Health Communication 4 Credits
Knowledge of health communication is an essential foundation for anyone working in the field. Yet communicating about health is often complex and multi-faceted. To better understand health communication, we will explore the role of media and persuasion. We’ll examine media coverage of health information; communications on risks and epidemics; theories and research of health behavior; effects of communication technologies on health communication; communicating about health data and information; health campaigns; engaging with individuals and communities with health messages and more.
COMM 160 Public Speaking (for IBE Students) 4 Credits
Applying the principles of public speaking to making informative and persuasive presentations effectively. Emphasis on speech composition and effective oral communication skills. This class is limited to students in the Integrated Business and Engineering Honors Program.
Attribute/Distribution: HU

COMM 165 Data Storytelling 4 Credits
The availability of large amounts of data offers new insights for many fields, such as computer science, marketing, health and journalism. Data storytelling -- the ability to gather, analyze, visualize and tell stories with data -- has become a sought-after skill. This course, designed for students with skills or prior experience in data analytics, statistics, math or programming, demonstrates the value of data storytelling for all fields and provides students with advanced tools to create meaningful, compelling data stories.
Attribute/Distribution: SS

COMM 220 Public Relations 4 Credits
Study of public relations principles and writing. Ethical, legal and public opinion environments for public relations; development of communication strategies for various audiences, including the mass media. Preparing publicity; planning and conducting news conferences; writing speeches, brochures, newsletters and reports.
Prerequisites: (JOUR 013 or JOUR 023) and (JOUR 014 or JOUR 024)
Attribute/Distribution: ND

COMM 248 (GS 248) Global Communication 4 Credits
This class uses historical and cultural perspectives to study how globalization shapes and is shaped by communication and media structures and processes, with emphasis on journalism, the media industries and popular culture. Topics include: global media industries and media flow, entertainment, media hybridity, development communication and alternative media.
Attribute/Distribution: SS

COMM 276 (AAS 276) Media and Race 4 Credits
Considers the role of print, broadcast and new media representations upon social reality. Focuses upon making the connections between information and entertainment media that perpetuate stereotypes and how such stereotypes create dominant, contemporary understandings of various groups. This course is writing intensive.
Attribute/Distribution: SS

COMM 277 (AAS 277) Race Representations & News Media 4 Credits
This course examines the representation of racial and ethnic minorities in American media and media outlets globally. It begins with a comparative analysis of majority/minority representations. It further analyzes the impact of such portrayals upon public opinion, public policy, and interpersonal life within the U.S. and abroad. Class discussions and assignments will address the role of print, broadcast and online media in shaping the contemporary dominant understandings of various racial groups in a globalized world and social constructions of reality.
Attribute/Distribution: SS

COMM 278 (AAS 278) Race, Sports, Media and Social Activism 4 Credits
This course investigates the role and use of media in key efforts of social resistance among American athletes of color. Our analysis will include a look at the lives of athletes who engage in these actions; key acts of resistance; media coverage; and the public response both for and against the protests. Students will learn about media literacy, the power of representation, public sphere protest among celebrities and the role of news media in protest.
Attribute/Distribution: SS

COMM 300 Apprenticeship Teaching 1-4 Credits

COMM 325 Special Topics In Communication 1-4 Credits
Attribute/Distribution: SS

COMM 327 Mass Communication and Society 4 Credits
A review of theories and research on the relationship of mass communication to social processes. Intensive analysis of selected media products (e.g., TV news, dramas, and sitcoms; films; print; music videos, etc.).
Prerequisites: SOC 001 or ANTH 001
Attribute/Distribution: SS

COMM 331 Business and Professional Speaking 4 Credits
The principals of oral communication as applied to business and professional situations. Professional presentations, small group interaction and interpersonal communication in the business setting.
Attribute/Distribution: ND

COMM 375 (AAS 375) Global Media and Culture 4 Credits
Cultural Studies investigates dominant understandings; issues of identity and experience; and society. A Cultural Studies approach to understanding representations of difference in global media. Focus will center upon the role of media in shaping the contemporary dominant understandings of various groups in a globalized world; introductions to philosophies and theories that function as fundamental texts on the relationship between media, social life and human behavior; and the ways in which media socially construct a new, globalized reality.
Attribute/Distribution: SS

COMM 376 (AAS 376, WGSS 376) New Media, Race and Gender 4 Credits
This class explores the relationship among race, gender and new media. It examines depictions of racial minorities and women online; how users access and use new media across race and gender (including a look at the digital divide); and differences in use of social media websites across race and gender. The goal is for students to understand how existing racial and gender categorizations are not transmitted to the online community and do not become extensions of present social hierarchy.
Attribute/Distribution: SS

COMM 385 Seminar in Communication Issues 3-4 Credits
A seminar focusing on contemporary issues and problems facing the mass media and communication. Topics vary. Taken by seniors for 4 credits and graduate students for 3 credits. Open to senior journalism or senior journalism/science writing majors or have consent of the instructor.
Attribute/Distribution: SS

Journalism Courses

JOUR 001 Brown and White 1 Credit
This course is a student's first semester on the staff of the semiweekly undergraduate newspaper. Students register for this course, attend a meeting on the first Wednesday of the semester, and are placed on the staff. Because this is an introductory training class, JOUR 001 is for students with freshman or sophomore standing; juniors only with consent of department chair.
Attribute/Distribution: ND

JOUR 002 Brown and White 1 Credit
Enrollment constitutes continued membership on the staff of the semiweekly undergraduate newspaper. These courses are taken consecutively after a student has completed JOUR 001. For a second semester on the newspaper, a student registers for JOUR 002. For a third semester, JOUR 003. For a fourth semester, JOUR 004. And so on.
Prerequisites: JOUR 001
Attribute/Distribution: ND

JOUR 003 Brown and White 1 Credit
Enrollment constitutes continued membership on the staff of the semiweekly undergraduate newspaper. These courses are taken consecutively after a student has completed JOUR 001. For a second semester on the newspaper, a student registers for JOUR 002. For a third semester, JOUR 003. For a fourth semester, JOUR 004. And so on.
Prerequisites: JOUR 002
Attribute/Distribution: ND

Brown and White
JOUR 004 Brown and White 1 Credit
Enrollment constitutes membership on the staff of the semiweekly undergraduate newspaper. These courses are taken consecutively after a student has completed JOUR 001. For a second semester on the newspaper, a student registers for JOUR 002. For a third semester, JOUR 003. For a fourth semester, JOUR 004. And so on.
Prerequisites: JOUR 003
Attribute/Distribution: ND

JOUR 005 Brown and White 1 Credit
Enrollment constitutes membership on the staff of the semiweekly undergraduate newspaper. These courses are taken consecutively after a student has completed JOUR 001. For a second semester on the newspaper, a student registers for JOUR 002. For a third semester, JOUR 003. For a fourth semester, JOUR 004. And so on.
Prerequisites: JOUR 004
Attribute/Distribution: ND

JOUR 006 Brown and White 1 Credit
Enrollment constitutes membership on the staff of the semiweekly undergraduate newspaper. These courses are taken consecutively after a student has completed JOUR 001. For a second semester on the newspaper, a student registers for JOUR 002. For a third semester, JOUR 003. For a fourth semester, JOUR 004. And so on.
Prerequisites: JOUR 005
Attribute/Distribution: ND

JOUR 007 Brown and White 1 Credit
Enrollment constitutes membership on the staff of the semiweekly undergraduate newspaper. These courses are taken consecutively after a student has completed JOUR 001. For a second semester on the newspaper, a student registers for JOUR 002. For a third semester, JOUR 003. For a fourth semester, JOUR 004. And so on.
Prerequisites: JOUR 006
Attribute/Distribution: ND

JOUR 008 Brown and White 1 Credit
Enrollment constitutes membership on the staff of the semiweekly undergraduate newspaper. These courses are taken consecutively after a student has completed JOUR 001. For a second semester on the newspaper, a student registers for JOUR 002. For a third semester, JOUR 003. For a fourth semester, JOUR 004. And so on.
Prerequisites: JOUR 007
Attribute/Distribution: ND

JOUR 009 Brown and White Photography 1 Credit
Enrollment constitutes membership on the photography staff of the semiweekly undergraduate newspaper. Students should have basic camera skills and knowledge of digital photography. Classes will include review of these subjects and more advanced techniques in digital darkroom techniques. Members of the class work on a series of assignments for the newspaper. Students should have their own digital SLR camera equipment and will be expected to provide examples of their work for admission to the class.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

JOUR 010 Brown and White 1-2 Credits
Enrollment constitutes an editorial position on the staff of the semiweekly undergraduate newspaper. Editors are chosen by the instructors and the newspaper's editorial board. Consent of department required.
Repeat Status: Course may be repeated.
Prerequisites: JOUR 001
Attribute/Distribution: ND

JOUR 011 Brown and White Projects 1-4 Credits
This section of The Brown and White is devoted to special projects that fall outside or complement traditional sections and can include investigative reporting, podcasts, partnerships with other media organizations, such as WLVR and PBS, data stories, experiments in new forms of storytelling and other efforts. Instructor Permission.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

JOUR 012 Brown and White Videography 1 Credit
Enrollment constitutes membership on the videography staff of the student newspaper. Students should have basic camcorder skills and knowledge of editing video. Members of the class use the newspaper's video equipment and work on assignments for the newspaper's Web site. First-time students should provide examples of their work for admission to the class. Does not count in department's majors or minors.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

JOUR 021 Writing for the Media 4 Credits
Practice gathering, writing and editing news; definition and components of news; structure and style; interviewing. Study and practice in use of social media and blogs by journalists as a way to gather and publish information. Requires freshman or sophomore standing.
Attribute/Distribution: SS

JOUR 023 Editing 4 Credits
Students will strengthen news judgment, critical thinking and writing through careful editing of articles for accuracy, fairness and clarity, including use of proper spelling, grammar, usage and style. Practice in writing headlines for print and the Web, including search engine optimization and multimedia presentation of content.
Prerequisites: JOUR 021 or JOUR 123
Attribute/Distribution: SS

JOUR 024 Visual Communication 4 Credits
Study of and practice in techniques of multimedia storytelling including digital photography, data visualization, print layout, and video-shooting and editing skills. This course combines principles of visual communication with hands-on work to help improve your visual literacy and multimedia skills and develop a professional digital portfolio. Prerequisite: Jour 21 or Jour 123.
Prerequisites: JOUR 021 or JOUR 123
Attribute/Distribution: SS

JOUR 025 Data Journalism 4 Credits
Journalists, now more than ever, need to be able to use data as any other type of information for news reporting and storytelling. This introductory course, designed for journalism majors, encourages students to understand data as a natural source of journalism, understand the core concepts of data journalism, gain capacity and literacy to assess data for news reporting, and learn skills and tools for searching and using datasets as a part of journalistic practices.
Prerequisites: JOUR 021
Attribute/Distribution: SS

JOUR 101 Media, Sports and Society 4 Credits
Analysis of social, political and economic implications of media sports coverage; emphasis placed on media coverage of events of international scope, such as the World Cup, World Series and the Olympics; special attention paid to the role of the sports press in coverage of issues such as AIDS, racism, sexism, drug use and terrorism.
Attribute/Distribution: SS

JOUR 111 Sportswriting 3 Credits
Principles and practice of writing about sports for general print and specialized publications; emphasis placed on instruction in reporting, writing and editing; topics covered include the history of sports journalism; recent trends in the field; ethical considerations, and the exploration of social and political issues through sportswriting.
Attribute/Distribution: ND
JOUR 242 Web Writing & Design 4 Credits
This course examines the ways in which writing and design are influenced by online technology. Students will learn principles and practice of hypertext, Web writing and Web design and will plan and create Web sites that tell stories using the unique features of online technology.
Prerequisites: JOUR 021 or JOUR 123
Attribute/Distribution: ND

JOUR 246 (GS 246) International Communication 4 Credits
The subject matter is crucial to understanding modern life: the role of international news media in world affairs. The class studies the social, political and economic contexts that frame the reporting of international events by U.S. news media, such as politics, war, disasters, and other crises, as well as U.S. reporting on international issues, such as poverty, disease, and environmental change. The course also surveys reporting practices in nations around the world, including the varying systems of journalism and mass media and the brutal censorship and repression facing many foreign journalists.
Attribute/Distribution: SS

JOUR 275 Writing for Media II 4 Credits
This course fulfills the college junior-level writing intensive requirement and is required by the majors of Journalism and Journalism/Science Writing. Building on Writing for the Media I, the class combines essential aspects of Jour 211 Reporting, Jour 212 Feature Writing and Jour 218 Freelance Writing. Students will report and produce in-depth stories, to be published in The Brown and White, in paper and online, which will add substantially to their portfolios.
Prerequisites: JOUR 021 and JOUR 023 and JOUR 024
Attribute/Distribution: SS

JOUR 300 Apprenticeship Teaching 1-4 Credits
Repeat Status: Course may be repeated.

JOUR 311 Science and Technical Writing 3-4 Credits
Study of and practice in writing about scientific and technical issues for multiple audiences. Emphasis on developing effective writing and organizational skills and translating scientific information for a wide range of audiences. Similar in content to JOUR 123, but should be taken instead by upperclassmen (34 credits) and graduate students (34 credits). 4 credits for upperclassmen and 3 for graduate students.
Attribute/Distribution: SS

JOUR 312 Advanced Science Writing 3 Credits
Further practice, on individual basis, in science writing techniques.
Prerequisites: JOUR 123 or JOUR 311
Attribute/Distribution: SS

JOUR 313 Special Topics in Science Communication 1-4 Credits
Research or writing involving a topic, medium or issue in science, environmental or technical communication not covered in other courses. Must have completed eight hours in science or environmental writing or have consent of the instructor.
Attribute/Distribution: SS

JOUR 314 Technical Communication 3-4 Credits
This online course covers basic tools needed to write about all kinds of science and technical information for academic papers, term papers, proposals, reports, theses and dissertations. Involves practice with feedback on definitions, descriptions, cause and effect relationships, process writing, concept maps, graphics, classification, comparison and more. Taken by seniors for 4 credits and graduate students for 3 credits.
Attribute/Distribution: ND

JOUR 323 (ES 323, HMS 323, STS 323) Health and Environmental Controversies 4 Credits
Exploration of health and environmental controversies from the perspectives of scientific uncertainty and mass media coverage. Examines genetic engineering, biotechnology, environmental health risks and nanotechnology. Includes discussion of ethical and social responsibilities and interactions with the public.
Attribute/Distribution: SS

JOUR 327 (SOC 327) Mass Communication and Society 4 Credits
A review of theories and research on the relationship of mass communication to social processes. Intensive analysis of selected media products.
Prerequisites: ANTH 001 or ANTH 011 or ANTH 012 or SOC 005 or SOC 021 or PSYC 021 or SOC 001
Attribute/Distribution: SS

JOUR 330 Critical Studies in Journalism 4 Credits
This course prepares students to be critical news consumers by giving them tools to understand how journalism works. Theoretical perspectives by and about journalists help students analyze news in historical, global, political, economic and social contexts.
Attribute/Distribution: SS

JOUR 334 Technical Writing for Engineers 3.4 Credits
This online course is for upper-class and graduate students who plan to work in engineering and environmental services. The course covers basic grammar, punctuation, style rules, organization and clarity issues that engineers face when writing reports and proposals, including executive summaries, introductions, site descriptions, project backgrounds and research findings. Must have junior status or have consent of the instructor.

JOUR 361 Internship 4 Credits
Professionally supervised work on newspapers, magazines, Web sites radio and television stations, or with public relations organizations. Some internships involve science writing. Must have senior standing and declared major in journalism or science writing.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

JOUR 366 Online Journalism 3-4 Credits
The course examines the social, cultural, political, legal and economic influence of online technology on journalism and the role of journalism in society. Emphasizing critical thinking and analysis, the course studies the ways in which digital technology has changed the way journalists research, write, edit and design. Taken by seniors for 4 credits and graduate students for 3 credits. Consent of department chair.
Prerequisites: (JOUR 021 or JOUR 123) and JOUR 122
Attribute/Distribution: ND

JOUR 375 Writing for Media III 4 Credits
Building on Writing for the Media I and II, the class will offer different approaches and different platforms to advanced writing for media, from long-form journalism to multimedia storytelling to telling stories with data and visuals to experiments with new forms of storytelling. Prerequisite: JOUR 275 (SS).
Attribute/Distribution: SS

JOUR 385 Seminar in Journalism Issues 3-4 Credits
A seminar focusing on contemporary issues and problems facing the mass media and journalism. Topics vary. Taken by seniors for 4 credits and graduate students for 3 credits. Open to senior journalism or senior journalism/science writing majors or have consent of the instructor.
Attribute/Distribution: SS

JOUR 388 College Scholar Project 1-8 Credits
Opportunity for college scholars to pursue an extended project. College wide course designation. Transcript will identify department in which project was completed. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

JOUR 390 Honors Thesis 1-4 Credits
Directed undergraduate research thesis required of students who apply for and qualify for graduation with departmental honors. Qualifications are 3.75 GPA in the major and 3.5 overall GPA.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND
JOUR 391 Special Topics in Journalism and Communication 1-4 Credits
Directed research or writing involving a subject or issue in journalism not covered in other courses. Must have completed twelve hours in journalism or have consent of the instructor.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

Latin American and Latino Studies

Program Director: Hugo Ceron Anaya, PhD (University of Essex)
Email: hrc209@lehigh.edu (hrc209@lehigh.edu) | Phone: 610-758-3627
Website: http://las.cas2.lehigh.edu/
Supported by the Office of Interdisciplinary Programs 610-758-3996; incasip@lehigh.edu
Williams Hall, 31 Williams Drive

The Latin American and Latino Studies program is designed for students who wish to develop an understanding of a neighboring region that is of vital importance to the United States, and also of those Latino communities within the United States itself. Courses in anthropology; archeology; foreign policy; history; language and literature; politics; sociology; and art, architecture and design allow students to explore various aspects of Latin American and Latino cultures and societies from an interdisciplinary perspective. The program contributes to a liberal arts education by offering students an international vantage point from which they can examine the cultural complexity of their own society, preparing them to meet the challenges of an increasingly interdependent world. Additionally, the unprecedented movement of peoples and ideas between the American continents in recent decades makes the study of Latin America and its connections to the U.S. Latino population an essential component for understanding the history and culture of globalization in the Americas. The major and minor in Latin American and Latino Studies thus complement the study of other disciplines with either an international or a domestic focus, and enhance the relevance of a Lehigh education by preparing students to be citizens of a culturally diverse society and, more generally, of the Americas.

Associate Professors. Matthew R. Bush, PHD (University of Colorado Boulder); Antonio Prieto, PHD (Princeton University)
Assistant Professors. Marilia De Maio, PHD (University of Florida); Marilia Jimenez, PHD (University of Florida)

THE MAJOR

The major in Latin American and Latino Studies requires a minimum of 10 courses with four courses at the 200/300 level. Students are required to possess intermediate language proficiency in Spanish. Courses taken as study abroad may fulfill program requirements with approval of the program director.

Required Core Course

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAS/GS/HIST 049 The True Road to El Dorado: Colonial Latin America</td>
<td>4</td>
</tr>
<tr>
<td>LAS/GS/HIST 050 Heroes, Dictators, and Revolutionaries: Latin America since Independence</td>
<td>4</td>
</tr>
<tr>
<td>LAS/ENGL 105 Intro to Latino/a Literature and Culture</td>
<td>4</td>
</tr>
<tr>
<td>LAS/SPAN 152 The Cultural Evolution of Latin America</td>
<td>4</td>
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</tbody>
</table>

Language Requirement

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>SPAN 012 Intermediate Spanish II</td>
<td>4</td>
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</table>

Humanities Requirement

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Two classes from the list of electives that carry a HU distribution.</td>
<td>7-8</td>
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</tbody>
</table>

Social Sciences Requirement

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two classes from the list of electives that carry a SS distribution.</td>
<td>7-8</td>
</tr>
</tbody>
</table>

Additional Electives

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Four courses chosen from the list of approved electives. Additional electives may be chosen in consultation with the Program Director.</td>
<td>14-16</td>
</tr>
</tbody>
</table>

Total Credits 36-40

1 Courses taken and not used to fulfill core requirement may fulfill elective requirement.
2 No less than three courses in Latino Studies.
3 No more than two courses in Spanish at the 200/300 level may count toward the major.

LATIN AMERICAN STUDIES ELECTIVES

Each semester, a complete list of Latin American Studies course offerings can be found on the web site or in the Office of Interdisciplinary Programs, Williams Hall, Suite 101. Other courses approved by the program director.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTH 178 Mesoamerican Archaeology</td>
<td>4</td>
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<tr>
<td>HIST 368 Seminar in Latin American History</td>
<td>4</td>
</tr>
<tr>
<td>IR 177 International Relations of Latin America</td>
<td>4</td>
</tr>
<tr>
<td>IR 222 Political Economy of North-South Relations</td>
<td>4</td>
</tr>
<tr>
<td>IR 323 Political Economy of Industrialization and Development</td>
<td>4</td>
</tr>
<tr>
<td>LAS/AAS/SOC 106 Race and Ethnicity in the Americas</td>
<td>4</td>
</tr>
<tr>
<td>LAS/GS/HIST 049 The True Road to El Dorado: Colonial Latin America</td>
<td>4</td>
</tr>
<tr>
<td>LAS/GS/HIST 050 Heroes, Dictators, and Revolutionaries: Latin America since Independence</td>
<td>4</td>
</tr>
<tr>
<td>LAS/AAS/POLS/MLL/FREN 133 Lehigh in Martinique: Globalization and Local Identity</td>
<td>3-4</td>
</tr>
<tr>
<td>LAS/HIST 149 Narcos: The Global Drug Wars</td>
<td>4</td>
</tr>
<tr>
<td>LAS/SPAN 152 The Cultural Evolution of Latin America</td>
<td>4</td>
</tr>
<tr>
<td>LAS/AAS/SOC 155 Afro-Latino Social Movements in Latin America</td>
<td>4</td>
</tr>
<tr>
<td>LAS/AAS/SOC 177 Cuba: Race, Revolution and Culture</td>
<td>4</td>
</tr>
<tr>
<td>LAS/ANTH 184 Indigenous Cultures of Latin America</td>
<td>4</td>
</tr>
<tr>
<td>LAS/GS/MLL/ENGL 202 Latin America In Fact, In Fiction</td>
<td>4</td>
</tr>
<tr>
<td>LAS/SPAN 211 Business Spanish</td>
<td>4</td>
</tr>
<tr>
<td>LAS/SPAN/FILM 213 Introduction to Hispanic Literature and Film</td>
<td>4</td>
</tr>
<tr>
<td>LAS/SPAN 243 Indigenous Cultures in Spanish American Narrative</td>
<td>4</td>
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<tr>
<td>LAS/SPAN 263 The Spanish American Short Story</td>
<td>4</td>
</tr>
<tr>
<td>LAS/SPAN/FILM 265 Spanish and Latin American Cinema</td>
<td>4</td>
</tr>
<tr>
<td>LAS/SPAN 276 Contemporary Literature of the Southern Cone</td>
<td>4</td>
</tr>
<tr>
<td>LAS/GS/ENGL/MLL 302 Travel and Adventure in Latin American Fiction</td>
<td>4</td>
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<tr>
<td>LAS/SPAN 307 Border-Crossers: The Migrant Experience in Contemporary Mexican and Central American Literature</td>
<td>4</td>
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<tr>
<td>LAS/SPAN 320 Literature of the Spanish Caribbean</td>
<td>4</td>
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<tr>
<td>LAS/SPAN 322 The Short Novel in Contemporary Spanish American Literature</td>
<td>4</td>
</tr>
<tr>
<td>LAS/SPAN 323 Literature and Revolution in Contemporary Cuba</td>
<td>4</td>
</tr>
<tr>
<td>LAS/SOC 330 Society, Democracy and Revolution in Latin America</td>
<td>4</td>
</tr>
<tr>
<td>LAS/SPAN/WGSS 346 Contemporary Hispanic Women Writers: The Novelists</td>
<td>4</td>
</tr>
<tr>
<td>LAS/ANTH 378 Blood, Pyramids, and the Tree of Life</td>
<td>4</td>
</tr>
<tr>
<td>LAS/SPAN 391 Melodrama in Contemporary Spanish American Narrative</td>
<td>4</td>
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<tr>
<td>LAS/SPAN 392 The City and the Country in Spanish American Narrative</td>
<td>4</td>
</tr>
<tr>
<td>LAS/SPAN 393 The Boom and Beyond</td>
<td>4</td>
</tr>
</tbody>
</table>
LATINO STUDIES ELECTIVES
Each semester, a complete list of Latino Studies course offerings can be found on the web site or in the Office of Interdisciplinary Programs, Williams Hall, Suite 101. Other courses approved by the program director.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Attribute/Distribution</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAS/ENGL 105</td>
<td>Intro to Latino/a Literature and Culture</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>LAS/AAS/SOC 106</td>
<td>Race and Ethnicity in the Americas</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>LAS/ART 227</td>
<td>Latino Visual Arts and Culture in the USA</td>
<td>4</td>
<td></td>
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<tr>
<td>LAS/ART 228</td>
<td>Photo as Contemporary Art</td>
<td>4</td>
<td></td>
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<tr>
<td>LAS/SPAN 325</td>
<td>Hispanic Literature of the United States</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>POLS 336</td>
<td>U.S. Foreign Policy and Latin America</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>SOC 115</td>
<td>A Nation of Immigrants: The American Experience</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

THE MINOR
The Latin American and Latino Studies minor program requires 15 to 16 credit hours of coursework. In addition to regular Lehigh offerings, students may receive minor credit for appropriate courses at other LVAIC institutions, study abroad programs in Latin America, and various Lehigh faculty-led programs, such as “Lehigh in Martínez” and “Lehigh in Costa Rica” (both offered during the winter term). Students are encouraged to take advantage of extracurricular activities sponsored by the Latin American and Latino Studies Program, which include guest speakers, exhibits, films, etc.

Required core course (choose one)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Attribute/Distribution</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAS/GS/HIST 049</td>
<td>The True Road to El Dorado: Colonial Latin America</td>
<td>4</td>
<td></td>
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<tr>
<td>LAS/GS/HIST 050</td>
<td>Heroes, Dictators, and Revolutionaries: Latin America since Independence</td>
<td>4</td>
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<tr>
<td>LAS/ENGL 105</td>
<td>Intro to Latino/a Literature and Culture</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>LAS/SPAN 152</td>
<td>The Cultural Evolution of Latin America</td>
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Language Requirement

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>SPAN 012</td>
<td>Intermediate Spanish II</td>
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Electives

<table>
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<th>Course Title</th>
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<tbody>
<tr>
<td>LAS/GS/HIST 100</td>
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<td>4</td>
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<tr>
<td>SPAN 290</td>
<td>Spanish Special Topics</td>
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Total Credits: 15-16

Courses

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<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>LAS 049 (GS 049, HIST 049)</td>
<td>The True Road to El Dorado: Colonial Latin America</td>
<td>SS</td>
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</tbody>
</table>

LATINO STUDIES ELECTIVES
Each semester, a complete list of Latino Studies course offerings can be found on the web site or in the Office of Interdisciplinary Programs, Williams Hall, Suite 101. Other courses approved by the program director.

<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Attribute/Distribution</th>
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<tbody>
<tr>
<td>LAS/ENGL 105</td>
<td>Intro to Latino/a Literature and Culture</td>
<td>4</td>
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<tr>
<td>LAS/AAS/SOC 106</td>
<td>Race and Ethnicity in the Americas</td>
<td>4</td>
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<tr>
<td>LAS/ART 227</td>
<td>Latino Visual Arts and Culture in the USA</td>
<td>4</td>
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<tr>
<td>LAS/ART 228</td>
<td>Photo as Contemporary Art</td>
<td>4</td>
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<tr>
<td>LAS/SPAN 325</td>
<td>Hispanic Literature of the United States</td>
<td>4</td>
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<tr>
<td>POLS 336</td>
<td>U.S. Foreign Policy and Latin America</td>
<td>4</td>
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<tr>
<td>SOC 115</td>
<td>A Nation of Immigrants: The American Experience</td>
<td>4</td>
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</table>

THE MINOR
The Latin American and Latino Studies minor program requires 15 to 16 credit hours of coursework. In addition to regular Lehigh offerings, students may receive minor credit for appropriate courses at other LVAIC institutions, study abroad programs in Latin America, and various Lehigh faculty-led programs, such as “Lehigh in Martinique” and “Lehigh in Costa Rica” (both offered during the winter term). Students are encouraged to take advantage of extracurricular activities sponsored by the Latin American and Latino Studies Program, which include guest speakers, exhibits, films, etc.

Required core course (choose one)

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Language Requirement

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<tbody>
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<td>Intermediate Spanish II</td>
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Total Credits: 15-16

Courses

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<tbody>
<tr>
<td>LAS 049 (GS 049, HIST 049)</td>
<td>The True Road to El Dorado: Colonial Latin America</td>
<td>SS</td>
</tr>
</tbody>
</table>
LAS 177 (AAS 177, SOC 177) Cuba: Race, Revolution and Culture 4 Credits
This course analyzes the role of race & "culture" in the Afro Cuban struggle for equality. By focusing on the arts: particularly music, film & literature, this course will analyze the development of race during Cuba’s colonial period; the Afro Cuban challenge to the “race blind” political and cultural movements of the Cuban Republic. We will then wrap up the semester by addressing the significance of contemporary cultural movements that challenge the social issues currently facing Afro Cubans.
Attribute/Distribution: SS

LAS 184 (ANTH 184) Indigenous Cultures of Latin America 4 Credits
This examines social change in Latin America from the perspective of indigenous peoples. Main goals are to develop an appreciation for the diversity of cultures found in Latin America, explore anthropological concepts like cultural ecology, ethnicity, acculturation, and religious syncretism, and to apply these concepts to contemporary issues, including cultural survival, human rights, and environmental sustainability.
Attribute/Distribution: SS

LAS 202 (ENGL 202, GS 202, MLL 202) Latin America In Fact, In Fiction 4 Credits
This class couples a survey of Latin American literature in translation with an interdisciplinary approach to the study of Latin America. Departing initially from readings of literary and cinematographic works, our analyses will engage methodologies from multiple disciplines including history, sociology, and cultural studies. Accordingly, this course will examine critical developments in Latin American aesthetics along with the cultural climates in which they matured. This course assumes no prior study of Spanish, Portuguese, or Latin American culture.
Attribute/Distribution: HU

LAS 211 (SPAN 211) Business Spanish 4 Credits
An introduction to business concepts and vocabulary in Spanish. Specialized professional vocabulary and business culture in Spanish-speaking countries.
Prerequisites: SPAN 141
Attribute/Distribution: HU

LAS 213 (FILM 213, SPAN 213) Introduction to Hispanic Literature and Film 4 Credits
An introduction to the analysis of Latin American and Spanish cultural productions.
Prerequisites: SPAN 141
Attribute/Distribution: HU

LAS 227 (ART 227) Latino Visual Arts and Culture in American Art 4 Credits
Because art has no country, but the artist does, is contemporary art a product of globalization? Is Latino and Latin American art, culture and art criticism a nationalistic platform of cultures. Who’s who in the current Latino and Latin American art world? Students will utilize works from the university (LUAG) collection and/or research and interview a contemporary artist at his or her studio (if possible) for essays or media projects.
Attribute/Distribution: HU

LAS 228 (ART 228) 4 Credits
A history of photography in an in-situ class, at the LUAG Teaching Collection Visual Laboratories and Integrated Open Storage classroom. The course will explore the power of photographs as a dominant 21st Century universal visual art form, emphasizing Latino and Latin American photography. The students will progressively work their way through today’s explosive array of digital, one channel video, photobase and conceptual discourses of our remix culture through evolutionary image-making of the 20th and 19th Century, and the uses of photographic processes that have enriched our perceptions and our world. Readings, group discussions and individual research. The course will conclude with a final project/paper: a one figure or theme paper and a small group/team project (to be determined later). This will constitute the transformative approach to study the state of photography today.
Attribute/Distribution: HU

LAS 243 (SPAN 243) Indigenous Cultures in Spanish America 4 Credits
A survey of Spanish American narratives that deal with the relationship between indigenous and occidental cultures. While examining works created from the late 19th century up until present day, we analyze the construction of cultural identity in several countries including Bolivia, Ecuador, and Mexico. Analysis will include works of poetry, short story, novel, essay, and film by several influential artists: Clorinda Matto de Turner, Jorge Icaza and José María Argüelles, to name just a few.
Prerequisites: SPAN 141
Attribute/Distribution: HU

LAS 263 (SPAN 263) The Spanish American Short Story 4 Credits
Comparative study of representative works by major writers such as Quiroga, Borges, and Cortazar, among others.

LAS 265 (FILM 265, SPAN 265) Spanish and Latin American Cinema 4 Credits
Prerequisites: SPAN 141
Attribute/Distribution: HU

LAS 275 (SPAN 275, WSSS 275) Introduction to Hispanic Women Writers 4 Credits
The objective of this class is to introduce students to Hispanic contemporary female authors from Latin America, Spain, and the United States through the analysis of all literary genres (novel, short story, poetry, essay, and drama). This class provides students with a solid introduction to Hispanic women’s writing from the last years of the Nineteenth Century to the present, as well as to feminist literary theory.
Attribute/Distribution: HU

LAS 276 (SPAN 276) Contemporary Literature of the Southern Cone 4 Credits
This course focuses on the literature of Argentina, Chile, and Uruguay from the beginning of the 20th Century to the present. It analyzes the works of major authors through different genres studying how they represent history and culture, particularly during periods of political instability and state violence. Texts by Jorge Luis Borges, Pablo Neruda, Manuel Puig, Griselda Gambaro, Cristina Peri Rossi, and Antonio Skarmeta, among others, are studied.
Attribute/Distribution: HU

LAS 302 (ENGL 302, GS 302, MLL 302) Travel and Adventure in Latin American Fiction 4 Credits
Centering on a corpus of works presenting tales of travel and adventure, this class offers an overview of Latin American narrative genres (including “fantastic” narrative, magical realism, and postmodern fiction) from the mid 20th century to present day. Through close readings of works by Adolfo Bioy Casares and Roberto Bolaño, among others, and the analysis of filmic representations of travel in Latin America, we will examine differing modes of perceiving the region defined as Latin America.
Attribute/Distribution: HU

LAS 307 (SPAN 307) Border-Crossers: The Migrant Experience in Contemporary Mexican and Central American Literature 4 Credits
In recent times, we find ourselves bombarded with highly emotional political opinions about the fate of undocumented immigrants in the United States, many of whom have arrived from Mexico and Central America. In this course we analyze a select list of literary texts and films by Mexican and Central American artists that aim at documenting the factors that cause the exodus of people from these regions of the world and their border-crossing experiences.
Attribute/Distribution: HU

LAS 320 (SPAN 320) Literature of the Spanish Caribbean 4 Credits
Study of representative works with emphasis on Cuba and Puerto Rico. Writers include Barret, Carpentier, and Rodríguez Juliá.
Attribute/Distribution: HU
**LAS 321 (SPAN 321) Children and Adolescents in Contemporary Spanish American Literature 4 Credits**
Discussion of narrative techniques and the category of the self as they relate to the images of adolescence and childhood in works by such authors as Vargas Llosa, Reinaldo Arenas, José Blanco, Silvina Ocampo.
Prerequisites: LAS 152 or SPAN 152
Attribute/Distribution: HU

**LAS 322 (SPAN 322) The Short Novel in Contemporary Spanish American Literature 4 Credits**
Reading and discussion of representative works by García Márquez, Onetti, Rulfo, and Biy Casares, among others.
Attribute/Distribution: HU

**LAS 323 (SPAN 323) Literature and Revolution in Contemporary Cuba 4 Credits**
Study of works written after 1959 by dissident, nondissident, and exiled authors (Desnoes, Norberto Fuentes, Benítez Rojo, and Pedro Juan Gutiérrez, among others).
Attribute/Distribution: HU

**LAS 325 (SPAN 325) Hispanic Literature of The United States 4 Credits**
Discussion of fiction, poetry, drama, and film from the main groups in the U.S. Hispanic population. Discussion of Hispanic ethnic identity, bilingualism, and minority issues.
Attribute/Distribution: HU

**LAS 326 (SPAN 326, WGSS 326) Tradition and Resistance: Women Writers of Latin America 4 Credits**
Study of poetry and narrative works by Latin American women writers. Authors include Rosario Ferré, Rosario Castellanos, Elena Poniatowska, Cristina Peri Rossi, among others.
Prerequisites: SPAN 152
Attribute/Distribution: HU

**LAS 330 (SOC 330) Society, Democracy and Revolution in Latin America 4 Credits**
Latin America is a region filled with protest and armed guerrilla movements. Since the fall of the Soviet Union in 1989, at least 5 nations in the region elected openly socialist or communist candidates, many of whom are still in power today. What is happening in Latin America? This course will focus on Latin American perspectives on democracy and social revolution. For many Latin American countries, the move to the ‘left,’ and the rejection of American capitalism is not that Latin American people embrace socialism, but rather it is a reflection of larger social dynamics at play... or is it?
Attribute/Distribution: SS

**LAS 342 (SPAN 342) The New Narrative Spanish American Literature 4 Credits**
Critical evaluation of distinguished works of Spanish American prose fiction of the 1960’s and 70’s. Readings by Donoso, Fuentes, García Márquez, and Vargas Llosa, among others.
Prerequisites: LAS 152 or SPAN 152
Attribute/Distribution: HU

**LAS 345 (SPAN 345) Testimonial Writing in the Hispanic World 4 Credits**
This course explores the genre testimonio, which confronts the official history of the Latin American and Spanish dictatorships and portrays the experiences and struggles of those who suffered political repression. The course focuses on the analysis of both literary and visual testimonios from the Hispanic world, as well as on theoretical issues concerning discourses of truth.
Attribute/Distribution: HU

**LAS 346 (SPAN 346, WGSS 346) Contemporary Hispanic Women Writers: The Novelists 4 Credits**
This course explores the works of Hispanic women writers who have been oppositional to hegemonic cultural politics during the Twentieth Century in Latin America and Spain. Within their particular contexts, we examine issues these writers define as important in their work, their literary and political impact, use of literature to empower minority positions, and their narratives’ effects on the changing literary canon. Selected topics include: historical interpretations, exile, forms of violence and repression, expressions of desire, and sexuality.
Attribute/Distribution: HU

**LAS 350 (ENGL 350) Special Topics in Latino Studies 3-4 Credits**
Selected works by Latinx Diaspora writers, poets, and artists. Course engages with an ethnic studies framework and approach to texts in terms of U.S. canon formation with attention to race, class, gender, language, and nationality. No prerequisite.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

**LAS 378 (ANTH 378) Blood, Pyramids, and the Tree of Life 4 Credits**
This course explores the ways of life of the Maya people. We will take a close look at their religion, their foods, their family life, music, medicine, festivals, etc. An important part of this class explores the long tradition of the Maya, making connections between the modern Maya and the Maya of their past.
Attribute/Distribution: SS

**LAS 391 (SPAN 391) Melodrama in Contemporary Spanish American Narrative 4 Credits**
From the earliest works of Latin American narrative onward, melodrama has served as a fundamental tool for the structuring of dramatic conflict. Ranging from the programmatic social novel to the most parodic contemporary works, we will carefully examine the aims of melodramatic narration in works by Roberto Arlt and Mario Vargas Llosa, among others, as well as in various films and telenovelas.
Attribute/Distribution: HU

**LAS 392 (SPAN 392) The City and the Country in Spanish American Narrative 4 Credits**
Across the history of the region defined as Latin America, urbanization, on the one hand, and the isolation of national interiors, on the other, have contributed to a problematic relationship between the city and the country. In examining works by the likes of Roberto Arlt, José Donoso, and Mario Bellatin, among others, this course examines the dialogue between the ostensibly separate environs of city and country, and questions they ways in which they influence one another.
Attribute/Distribution: HU

**LAS 393 (SPAN 393) The Boom and Beyond 4 Credits**
This class will examine works from the so-called Boom of Spanish American literature in the 1960s alongside texts produced following this crucial moment of artistic and social change throughout Latin America. Moving from the Boom toward the postmodern, we will consider works by Gabriel García Márquez, Manuel Puig, and Mario Levrero, among others.
Attribute/Distribution: HU

**Mathematics**

Mathematics is a subject of great intrinsic power and beauty. It is the universal language of science, and is essential for a clear and complete understanding of virtually all phenomena. Mathematical training prepares a student to express and analyze problems and relationships in a logical manner in a wide variety of disciplines including the physical, engineering, social, biological, and medical sciences, business, and pure mathematics itself. This is a principal reason behind the perpetual need and demand for mathematicians in education, research centers, government, and industry.

The department offers three major programs leading to the degrees of bachelor of arts with major in mathematics, bachelor of science in mathematics, and bachelor of science in statistics. It also offers several minor programs for undergraduates. Students can earn their bachelor and master of education (M.Ed.) degree in elementary education or secondary education plus Pennsylvania teacher certification in 5 years.
At the graduate level, the department offers programs leading to the degrees of master of science in mathematics, master of science in applied mathematics, master of science in statistics, doctor of philosophy in mathematics, and doctor of philosophy in applied mathematics. The department is a part of the interdisciplinary program in analytical finance.

CALCULUS SEQUENCES

Many degree programs throughout the university include a mathematics requirement consisting of a sequence in calculus. The Department of Mathematics offers four calculus sequences:

- **MATH 021 & MATH 022 & MATH 023**
- **MATH 031 & MATH 032 & MATH 033**
- **MATH 051 & MATH 052**
- **MATH 081 & MATH 082**

The MATH 021, MATH 022, MATH 023 sequence is a systematic development of calculus. Most students of mathematics, science, and engineering, will take some or all of this sequence.

As an honors sequence, the MATH 031, MATH 032, MATH 033 sequence covers essentially the same material but in greater depth and with more attention to rigor and proof. This sequence should be considered by students who have demonstrated exceptional ability in mathematics.

The MATH 051, MATH 052 sequence is a survey of calculus. This sequence is not sufficient preparation for most subsequent mathematics courses. Students contemplating further study in mathematics should consider MATH 021, MATH 022 instead.

MATH 081, MATH 082 sequence is a survey with business applications. This sequence is not sufficient preparation for most subsequent mathematics courses. Students contemplating further study in mathematics should consider MATH 021, MATH 022 instead.

MATH 075, MATH 076 is a two-semester sequence that substitutes for MATH 021, covering the same material but at a slower pace.

The MATH 031, MATH 032, MATH 033 sequence will be accepted in place of MATH 021, MATH 022, MATH 023. MATH 021, MATH 022 will be accepted in place of MATH 051, MATH 052. MATH 021 will be accepted in place of MATH 081. Credit will be awarded for only one course in each of the following groups:

**Group 1**

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<thead>
<tr>
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<th>Title</th>
<th>Units</th>
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<td>MATH 021</td>
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<tr>
<td>&amp; MATH 022</td>
<td>and Calculus II</td>
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<tr>
<td>&amp; MATH 023</td>
<td>and Calculus III</td>
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**Group 2**

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<th>Title</th>
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<tr>
<td>MATH 022</td>
<td>Calculus II</td>
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<tr>
<td>MATH 032</td>
<td>Honors Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 052</td>
<td>Survey of Calculus II</td>
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<tr>
<td>MATH 082</td>
<td>Mathematics for Analytical Finance</td>
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**Group 3**

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<tr>
<td>MATH 023</td>
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<tr>
<td>MATH 033</td>
<td>Honors Calculus III</td>
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</table>

**Professors.** Huai-Dong Cao, PhD (Princeton University); Donald M Davis, PhD (Stanford University); Bennett Eisenberg, PhD (Massachusetts Institute of Technology); Wei-Min Huang, PhD (University of Rochester); Garth Isaak, PhD (Rutgers University); David L. Johnson, PhD (Massachusetts Institute of Technology); Terrence J. Napier, PhD (University of Chicago); Mark Skandera, PhD (Massachusetts Institute of Technology); Steven H. Weintraub, PhD (Princeton University)

**Associate Professors.** Daniel Conus, PhD (Swiss Federal Institute of Technology); Bruce A. Dods, PhD (State University of NY at Stony Brook); Robert W. Neel, PhD (Harvard University); Xiaofeng Sun, PhD (Stanford University); Susan Szczepanski, PhD (Rutgers University New Brunswick); Ping-Shi Wu, PhD (University of California Davis); Yue Yu, DA (Brown University); Linghai Zhang, PhD (University of Minnesota Minneapolis)

**Assistant Professors.** Xiaoxing Gao, PhD (Hong Kong University of Science and Technology); Andrew Harder, PhD (University of Alberta); Angela Hicks, PhD (University of California, San Diego); Si Tang, PhD (University of Chicago); Lei Wu, PhD (Brown University)

**Lecturer.** Berend Johannes Coster, PhD (University of Connecticut)

**Professors Of Practice.** Vincent E Coll, PhD (University of Pennsylvania); Megan Ann Cream, PhD (Emory University); Miranda Ijang Teboh Ewungkem, PhD (Lehigh University)

**Emeriti.** Jerry P. King, PhD (University of Kentucky Fort Knox); Clifford S. Queen, PhD (Ohio State University); Eric P. Salathe, PhD (Brown University); Andrew K Snyder, PhD (Lehigh University); Lee J. Stanley, PhD (University of California, Berkeley); Ramamirtham Venkataraman, PhD (Brown University)

**UNDERGRADUATE DEGREE PROGRAMS**

The Department of Mathematics offers degree programs in Mathematics and Statistics. These programs have the flexibility and versatility needed to prepare students for a wide variety of careers in government, industry, research and education.

Students in the degree programs in mathematics must satisfy three types of requirements: Core Mathematics Requirements, Advanced Mathematics Electives and General Electives. The Core Mathematics Requirement ensures a common core of knowledge appropriate for students in each program. The Advanced Mathematics Electives consist of courses with specific mathematical or statistical content chosen by the student in consultation with the major advisor to complement the student's interest and career aspirations. With these further breadth and greater depth of knowledge are achieved. The General Electives consist of additional courses chosen from among those offered by the university faculty. Students can use these electives to pursue interests beyond the major, or may use these to expand upon the basic requirements of the degree program. Students are strongly encouraged to use some of these electives to earn a minor in another discipline.

Students in the degree program in statistics must satisfy four types of requirements beyond those required by the college: Required Major Courses, Major Electives, Professional Electives and General Electives. Each student is provided a faculty advisor to guide an individual program and supervise the selection of electives.

**B.A. WITH A MAJOR IN MATHEMATICS**

The B.A. program in mathematics emphasizes fundamental principles as well as the mastery of techniques required for the effective use of mathematics. The program provides a solid foundation for those who want to pursue a mathematically oriented career or advanced study in any mathematically oriented field.

**Requirements**

**Calculus requirement:**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>MATH 021</td>
<td>Calculus I</td>
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<td>&amp; MATH 022</td>
<td>and Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>&amp; MATH 023</td>
<td>and Calculus III</td>
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**Core Requirements**

<table>
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<th>Title</th>
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<tr>
<td>MATH 163</td>
<td>Introduction to Mathematical Reasoning</td>
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<tr>
<td>MATH 242</td>
<td>Linear Algebra</td>
<td>3</td>
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MATH 243 Algebra 3-4
MATH 301 Principles of Analysis I 3-4

Advanced Mathematics Electives 15-20
At least five courses (minimum of 15 credits) from the approved list; at least one of these must be at the 300 level; at most one course may be taken outside the department; chosen in consultation with major advisor.

Total Credits 42-47
The Writing Intensive requirement is achieved by MATH 243 and MATH 301.

A student must achieve an average of 2.0 or higher in major courses.

B.S. IN MATHEMATICS
The BS in Mathematics program provides a more extensive and intensive study of mathematics and its applications. This program is especially recommended for students intending to pursue advanced study in mathematics, applied mathematics, or closely related fields.

Requirements

Calculus Requirement 12
MATH 201 Calculus I
& MATH 202 and Calculus II
& MATH 203 and Calculus III

Core Requirements 15
MATH 163 Introduction to Mathematical Reasoning 3
MATH 242 Linear Algebra 3-4
MATH 243 Algebra 3-4
MATH 301 Principles of Analysis I 3-4

Advanced Mathematics Electives 24-32
At least eight courses (minimum of 24 credits) from the approved list; at least four of these must be at the 300 level; at most two courses may be taken outside the department; chosen in consultation with major advisor.

Two approved(*) CSE courses. (CSE 1 and CSE 2 are NOT sufficient to satisfy this requirement.)
(*)Computer sciences courses must include a programming component.

Total Credits 56-65
The Writing Intensive requirement is achieved by MATH 243 and MATH 301.

A student must achieve an average of 2.0 or higher in major courses.

List of approved Advanced Mathematics electives:
The list of Advanced Mathematics electives (ADV List) consists of the following courses:

• MATH 208, MATH 229, MATH 230, MATH 234, MATH 252, MATH 263, MATH 264;
• All 300 level courses offered by the Mathematics Department except MATH 301 (required core course), MATH 371 (see below) and MATH 391 (see below);
• Notes:
  • Together, Math 202 and Math 203 (as a three credit combination), is accepted as one Advanced Mathematics elective;
  • With prior approval, one Advanced Mathematics elective (3 credits) may be replaced with three credits of (a combination of) Math 271(Readings), Math 371(Readings), Math 291(Undergraduate Research) or Math 391(Senior Thesis) completed over one or two semesters;
  • All 400 level courses are accepted as Advanced Mathematics electives. (Note. To enroll in a 400 level course, an undergraduate must successfully petition the appropriate university committee.)

Suggested Concentrations:

Applied Mathematical Modeling Concentration: This concentration should be considered by students interested in graduate study in applied mathematics or computational mathematics. The eight Advanced Mathematics electives are selected in consultation with a major advisor and must include the following:

• MATH 230
• MATH 319
• At least two courses selected from: MATH 320, MATH 322, MATH 323, MATH 341
• At least two additional courses selected from:
  • MATH 305, MATH 306, MATH 307, MATH 310, MATH 311, MATH 312, MATH 320, MATH 322, MATH 323, MATH 334, MATH 338, MATH 340, MATH 341, MATH 343
• At least two additional courses selected from the list of approved Advanced Mathematics Electives (see ADV List below)
• At least four of these courses must be at the 300 level.

Probability and Statistics Concentration: This concentration should be considered by students interested in actuarial science. The eight Advanced Mathematics electives are selected in consultation with a major advisor and must include the following:

• MATH 263
• MATH 264
• At least two courses selected from: MATH 310, MATH 312, MATH 334, MATH 338
• At least two additional courses selected from:
  • MATH 202/203, MATH 208, MATH 263, MATH 264, MATH 252
  • MATH 305, MATH 306, MATH 307, MATH 310, MATH 311, MATH 312, MATH 320, MATH 322, MATH 323, MATH 334, MATH 338, MATH 340, MATH 341, MATH 343
• At least two additional courses selected from the list of approved Advanced Mathematics Electives (see ADV List below)
• At least four of these courses must be at the 300 level.

Theoretical Mathematics Concentration: This concentration should be considered by students interested in graduate study in mathematics or applied mathematics. The eight Advanced Mathematics electives are selected in consultation with a major advisor and must include the following:

• MATH 327
• MATH 302 or MATH 316
• At least two additional courses selected from: MATH 302, MATH 305, MATH 307, MATH 310, MATH 316, MATH 319, MATH 331, MATH 342
• At least four additional courses selected, in consultation with the major advisor, from the list of approved Advanced Mathematics Electives (see ADV List below)
• At least four of these courses will be at the 300 level.

Other concentration: Students, in consultation with the major advisor, may design their own concentration by selecting a coherent list of eight Advanced Mathematics electives from the list of approved courses (see ADV List above). For instance, this option should be considered by students with an interest in data science, computer science, or mathematical economics.

B.S. IN STATISTICS
Statistics provides a body of principles for designing the process of data collection, for summarizing and interpreting data, and for drawing valid conclusions from data. It thus forms a fundamental tool in the natural and social sciences as well as business, medicine, and other areas of research. Mathematical principles, especially probability theory, underlie statistics.

Applied Statistics Elective: This concentration should be considered by students interested in applied statistics. The eight Advanced Mathematics electives are selected in consultation with a major advisor and must include the following:

• MATH 012 Basic Statistics
• MATH 231 Probability and Statistics

Select one of the following: 3-4
### MINOR PROGRAMS

The department offers minor programs in different branches of the mathematical sciences. The requirement consists of a Calculus course (MATH 023 or MATH 033 or MATH 052 or MATH 082 depending on the minor) and four additional courses shown below for each of the programs. At most one of the five courses in the minor program may also be required in the major program or another minor. For substitutions, the student should consult the chairperson.

#### Minor in Pure Mathematics

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>MATH 023</td>
<td>Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>MATH 242</td>
<td>Linear Algebra</td>
<td>3-4</td>
</tr>
<tr>
<td>MATH 243</td>
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<td>3-4</td>
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<tr>
<td>MATH 301</td>
<td>Principles of Analysis I</td>
<td>3-4</td>
</tr>
<tr>
<td>MATH 302</td>
<td>Principles of Analysis II</td>
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#### Minor in Applied Mathematics

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<tbody>
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<td>MATH 023</td>
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<td>3-4</td>
</tr>
<tr>
<td>MATH 052</td>
<td>Survey of Calculus II</td>
<td>3-4</td>
</tr>
<tr>
<td>MATH 082</td>
<td>Mathematics for Analytical Finance</td>
<td>3-4</td>
</tr>
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#### Minor in Probability and Statistics

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</tr>
</thead>
<tbody>
<tr>
<td>MATH 023</td>
<td>Introduction to the Theory of Probability</td>
<td>3-4</td>
</tr>
</tbody>
</table>

#### Minor in Actuarial Science

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<td>Mathematics for Analytical Finance</td>
<td>3-4</td>
</tr>
</tbody>
</table>

### DEPARTMENTAL HONORS

Students majoring in mathematics must fulfill the Writing Intensive Requirement by completing MATH 374. The Writing Intensive requirement is achieved by MATH 374.

The requirement consists of a Calculus course (MATH 023 or MATH 033 or MATH 052 or MATH 082 depending on the minor) and four additional courses shown below for each of the programs. At most one of the five courses in the minor program may also be required in the major program or another minor. For substitutions, the student should consult the chairperson.

#### Minor in Pure Mathematics

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for information on examinations of actuarial societies, students may consult their minor advisor.

**Graduate Programs in Mathematics**
The department offers graduate programs leading to the degrees of master of science in mathematics, applied mathematics, or statistics, and the doctor of philosophy in mathematics or applied mathematics.

The Department does not offer a doctorate in statistics. However, students may choose statistics or mathematical statistics as a concentration in the doctor of philosophy programs in mathematics and applied mathematics. The Department is a part of the interdisciplinary program in analytical finance. For details on the master of science in analytical finance see the interdisciplinary graduate study and research, analytical finance section.

To begin graduate work in mathematics a student must present evidence of adequate undergraduate preparation. The undergraduate program should have included a year of advanced calculus, a semester of linear algebra, and a semester of abstract algebra.

**M.S. in Mathematics or Applied Mathematics**
The master’s program requires 30 credit hours of graduate courses with at least 18 credit hours at the 400 level. With the permission of the chairperson, up to six credit hours of these courses can be replaced by a thesis. All students in the master’s program must also pass a comprehensive examination. The M.S. degree can serve both as a final degree in mathematics or as an appropriate background for the Ph.D. degree.

**M.S. in Statistics**
This program requires 30 credit hours of graduate courses with at least 18 hours of 400-level STAT or MATH courses. The choice of courses must be approved by the graduate advisor, and up to six hours of coursework may be replaced with a thesis. All students in the program must also pass a comprehensive examination.

The M.S. program in statistics has two tracks:

### Statistics Track
The statistics track has recommended courses:

- **MATH 309** Probability with Applications and Simulations 3
- **MATH 312** Statistical Computing and Applications 3
- **STAT 410** Random Processes and Applications 3
- **STAT 434** Mathematical Statistics 3
- **STAT 438** Linear Models In Statistics with Applications 3
- **STAT 471** Topics in Statistical Learning and Computing 3

**Electives**

- **STAT 408** Seminar in Statistics and Probability
- **STAT 409** Seminar in Statistics and Probability
- **STAT 471** Topics in Statistical Learning and Computing
- **MATH 402** Real Analysis II
- **MATH 430** Numerical Analysis
- **MATH 467** Stochastic Calculus
- **MATH 468** Financial Stochastic Analysis
- **ECO 463** Topics in Game Theory
- **CSE 411** Advanced Programming Techniques
- **ISE 332** Product Quality
- **ISE 409** Time Series Analysis
- **ISE 410** Design of Experiments
- **ECO 460** Time Series Analysis
- **CSE 326** Topics in Game Theory
- **CSE 347** Data Mining
- **CSE 365** Applied Data Mining

Select three other possible electives:

- **STAT 408** Seminar in Statistics and Probability
- **STAT 409** Seminar in Statistics and Probability
- **STAT 471** Topics in Statistical Learning and Computing
- **MATH 402** Real Analysis II
- **MATH 430** Numerical Analysis
- **MATH 467** Stochastic Calculus
- **MATH 468** Financial Stochastic Analysis
- **ECO 463** Topics in Game Theory
- **CSE 411** Advanced Programming Techniques
- **ISE 332** Product Quality
- **ISE 409** Time Series Analysis
- **ISE 410** Design of Experiments
- **ECO 460** Time Series Analysis
- **CSE 326** Topics in Game Theory
- **CSE 347** Data Mining
- **CSE 365** Applied Data Mining

**Stochastic Modeling Track**
The stochastic modeling track has recommended courses:

- **MATH 309** Probability with Applications and Simulations 3
- **MATH 401** Real Analysis I 3
- **STAT 410** Random Processes and Applications 3
- **STAT 463** Advanced Probability 3

**Electives**

- **MATH 341** Mathematical Models and Their Formulation 3
- **STAT 434** Mathematical Statistics 3
- **STAT 438** Linear Models In Statistics with Applications 3
- **STAT 464** Advanced Stochastic Processes 3

Select two other possible electives:

- **STAT 408** Seminar in Statistics and Probability
- **STAT 409** Seminar in Statistics and Probability
- **STAT 471** Topics in Statistical Learning and Computing
- **MATH 402** Real Analysis II
- **MATH 430** Numerical Analysis
- **MATH 467** Stochastic Calculus
- **MATH 468** Financial Stochastic Analysis
- **ECO 463** Topics in Game Theory
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**Ph.D. in Mathematics**
The plan of work toward the doctor of philosophy degree will include a comprehensive examination, a qualifying examination, and an advanced topic examination. A language exam may be required at the discretion of the doctoral committee. The qualifying examination tests the student’s command of algebra and real analysis. The content of the advanced topic examination is determined by a department committee. A general examination, the doctoral dissertation, and its defense complete the work for the Ph.D. degree.

Each candidate's plan of work must be approved by a special committee of the department. A Ph.D. student is required to have 18 credits of approved graduate level coursework beyond the master's level. Successful completion of MATH 316 and MATH 307 is required of all students. After completion of 18 credits a student is required to take at least one course per academic year other than MATH 409, MATH 410, and MATH 499.

**Ph.D. in Applied Mathematics**
The plan of work toward the doctor of philosophy degree will include a comprehensive examination, a qualifying examination, and an advanced topic examination. A language exam may be required at the discretion of the doctoral committee. The Ph.D. in Applied Mathematics qualifying examination tests the student’s command of Statistics and Applied Probability or of Real Analysis and Differential Equations. The content of the advanced topic examination is determined by a department committee. A general examination, the doctoral dissertation, and its defense complete the work for the Ph.D. degree.

Each candidate's plan of work must be approved by a special committee of the department. A Ph.D. student is required to have 18 credits of approved graduate level coursework beyond the master's level. After completion of 18 credits a student is required to take at least one course per academic year other than MATH 409, MATH 410, and MATH 499.
Mathematics Courses

MATH 000 Preparation for Calculus I 2 Credits
Intensive review of fundamental concepts in mathematics utilized in calculus, including functions and graphs, exponentials and logarithms, and trigonometry. This course is for students who need to take MATH 51, 81, or 21, but who require additional preparation in precalculus. The credits for this course do not count toward graduation, but do count toward GPA and current credit count. Consent of department.
Attribute/Distribution: MA

MATH 005 Introduction to Mathematical Thought 3 Credits
Meaning, content, and methods of mathematical thought illustrated by topics that may be chosen from number theory, abstract algebra, combinatorics, finite or non-Euclidean geometries, game theory, mathematical logic, set theory, topology.
Attribute/Distribution: MA

MATH 009 Introduction to Finite Mathematics 4 Credits
Systems of linear equations, matrices, introduction to linear programming. Sets, counting methods, probability, random variables, introduction to Markov chains.
Attribute/Distribution: MA

MATH 012 Basic Statistics 4 Credits
A first course in the basic concepts and methods of statistics with illustrations from the social, behavioral, and biological sciences. Descriptive statistics; frequency distributions, mean and standard deviation, two-way tables, correlation and regression; random sampling, rules of probability, probability distributions and parameters, parameter estimation, confidence intervals, hypothesis testing, statistical significance. Note: Mathematics and Statistics majors may not receive credit for both MATH 012 & ECO 045.
Attribute/Distribution: MA

MATH 021 Calculus I 4 Credits
Functions and graphs; limits and continuity; derivative, differential, and applications; indefinite and definite integrals; trigonometric, logarithmic, exponential, and hyperbolic functions.
Attribute/Distribution: MA

MATH 022 Calculus II 4 Credits
Applications of integration; techniques of integration; separable differential equations; infinite sequences and series; Taylor's Theorem and other approximations; curves and vectors in the plane.
Prerequisites: MATH 021 or MATH 076
Attribute/Distribution: MA

MATH 023 Calculus III 4 Credits
Vectors in space; partial derivatives; Lagrange multipliers; multiple integrals; vector analysis; line integrals; Green's Theorem, Gauss's Theorem.
Prerequisites: MATH 022
Attribute/Distribution: MA

MATH 031 Honors Calculus I 4 Credits
Same topics as in MATH 021, but taught from a more thorough and rigorous point of view.
Attribute/Distribution: MA

MATH 032 Honors Calculus II 4 Credits
Same topics as in MATH 022, but taught from a more thorough and rigorous point of view.
Prerequisites: MATH 031 or MATH 021
Attribute/Distribution: MA

MATH 033 Honors Calculus III 4 Credits
Same topics as in MATH 023, but taught from a more thorough and rigorous point of view.
Prerequisites: MATH 022 or MATH 032
Attribute/Distribution: MA

MATH 043 Survey of Linear Algebra 3 Credits
Matrices, vectors, vector spaces and mathematical systems, special kinds of matrices, elementary matrix transformations, systems of linear equations, convex sets, introduction to linear programming.
Attribute/Distribution: MA

MATH 051 Survey of Calculus I 4 Credits
Limits. The derivative and applications to extrema, approximation, and related rates. Exponential and logarithmic functions, growth and decay. Integration. Trigonometric functions and related derivatives and integrals.
Attribute/Distribution: MA

MATH 052 Survey of Calculus II 3 Credits
Prerequisites: MATH 051 or MATH 021 or MATH 076 or MATH 081
Attribute/Distribution: MA

MATH 075 Calculus I, Part A 2 Credits
Covers the same material as the first half of MATH 021. Meets three hours per week, allowing more class time for each topic than does MATH 021.
Attribute/Distribution: MA

MATH 076 Calculus I, Part B 2 Credits
Continuation of MATH 075, covering the second half of MATH 021.
Meets three hours per week.
Prerequisites: MATH 075
Attribute/Distribution: MA

MATH 081 Calculus with Business Applications 4 Credits
Limits and continuity; exponential, logarithmic and trigonometric functions; derivatives; extrema; approximations; indefinite and definite integrals. Applications with emphasis on business and economics.
Attribute/Distribution: MA

MATH 082 Mathematics for Analytical Finance 4 Credits
Integration by parts, Riemann sums; differential equations; series; Taylor series. Vectors, inner products and projections; functions of several variables, partial derivatives. Multiple integrals; vector-valued functions. Applications with emphasis on finance and economics.
Prerequisites: MATH 081 or MATH 021 or MATH 076 or MATH 051
Attribute/Distribution: MA

MATH 114 (PHIL 114) Symbolic Logic 4 Credits
A first course in logical theory, introducing the notions of logical consequence and proof, as well as related concepts such as consistency and contingency. Formal systems taught may include: term, sentence logic, and predicate logic.
Attribute/Distribution: MA

MATH 130 (BIOS 130) Biostatistics 4 Credits
Elements of statistics and probability with emphasis on biological applications. Statistical analysis of experimental and observational data.
Prerequisites: MATH 052 or MATH 022

MATH 163 Introduction to Mathematical Reasoning 3 Credits
An introduction to the discipline of mathematics for students considering a major in mathematics. Provides an introduction to rigorous mathematical reasoning, including basic proof techniques (e.g., basic propositional calculus, induction, contradiction) and key concepts which recur throughout mathematics (e.g., universal and existential quantifiers, equivalence classes, basic set theory). Students majoring in mathematics should complete this course before MATH 242, MATH 243 or MATH 301 and are encouraged to complete this course in the first or second year of study.
Prerequisites: MATH 021

MATH 171 Readings 1-3 Credits
Study of a topic in mathematics under individual supervision. Intended for students with specific interests in areas not covered in the listed courses. Consent of department chair required.
Attribute/Distribution: MA

MATH 201 Problem Solving 1 Credit
Practice in solving challenging mathematics problems using a variety of techniques. Permission of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: MA
MATH 202 Actuarial Exam I 1 Credit
Preparation for the first actuarial exam – probability. Problems in calculus and probability with insurance applications.
Prerequisites: (MATH 023 or MATH 052 or MATH 082) and (MATH 231 or MATH 263)

MATH 203 Actuarial Exam II - Financial Mathematics 2 Credits
Preparation for the second actuarial exam - financial mathematics. Mathematics of interest and investments, interest rate measurement, present value, annuities, loan repayment schemes, bond valuation, introduction to derivative securities. Practice in solving problems from past exams.
Prerequisites: MATH 022 or MATH 082
Attribute/Distribution: MA

MATH 205 Linear Methods 3 Credits
Linear differential equations and applications; matrices and systems of linear equations; vector spaces; eigenvalues and application to linear systems of differential equations.
Prerequisites: MATH 022

MATH 208 Complex Variables 3 Credits
Functions of a complex variable; calculus of residues; contour integration; applications to conformal mapping and Laplace transforms.
Prerequisites: MATH 023

MATH 214 (PHIL 214) Topics in Philosophical Logic 4 Credits
Topics may include the many systems of non-classical logic, truth theory, the impact of incompleteness and undecidability results on philosophy, the foundational projects of various philosopher/mathematicians, or the work of an important figure in the history of philosophical logic. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: MA

MATH 229 Geometry 3-4 Credits
Discussion of geometry as an axiomatic system. Euclid's postulates. History of and equivalent versions of Euclid's fifth postulate. Finite projective geometries. Non-Euclidean geometries based upon negation of the fifth postulate: Geometry on the sphere; hyperbolic and elliptic geometries. Examination of the concepts of "straight", angle, parallel, symmetry and duality in each of these geometries. Applications of the different geometries will be considered.
Attribute/Distribution: MA

MATH 230 Numerical Methods 3 Credits
Representation of numbers and rounding error; polynomial and spline interpolation; numerical differentiation and integration; numerical solution of nonlinear systems; numerical solution of initial and boundary value problems; Monte Carlo methods. Knowledge of MATLAB or PYTHON or C required.
Prerequisites: MATH 205 or MATH 241 or MATH 242

MATH 231 Probability and Statistics 3 Credits
Probability and distribution of random variables; populations and random sampling; chi-square and t distributions; estimation and tests of hypotheses; correlation and regression theory of two variables. Not available for credit to students who have completed both MATH 263 and MATH 264.
Prerequisites: MATH 022 or MATH 052 or MATH 082

MATH 234 Fractal Geometry 3 Credits
Metric spaces and iterated function systems; various types of fractal dimension; Julia and Mandelbrot sets. Other topics such as chaos may be included. Small amount of computer use.
Prerequisites: MATH 023

MATH 241 Applied Linear Algebra 3-4 Credits
The theoretical basis for applying linear algebra in other fields, including statistics. Topics will include systems of equations, vector spaces, matrices, and linear transformations. Additional topics will include matrix factorizations (including LU, QR, eigen-decomposition, and SVD) and how they can be used in computer analysis of data sets. Some students may optionally choose to take MATH 205 as preparation for this course. Not available for credit to students who have completed MATH 242 or STAT 342.
Prerequisites: MATH 022

MATH 242 Linear Algebra 3-4 Credits
An introduction to the study of vector spaces and linear transformations, with emphasis on mathematical rigor. Not available for credit to students who have completed MATH 241 / STAT 342.
Prerequisites: MATH 022 and MATH 163

MATH 243 Algebra 3-4 Credits
Introduction to basic concepts of modern algebra: groups, rings, and fields.
Prerequisites: MATH 242

MATH 252 Introduction to Combinatorics and Graph Theory 3 Credits
Topics in combinatorics and graph theory chosen to introduce the subjects and some of their common proof techniques. Sequences and recursive formulas; counting formulas; bijections; inclusion/exclusion; the Pigeonhole Principle; generating functions; and equivalence relations. Graph theory topics include trees, connectivity, traversability, matching and coloring. Not available for credit to students who have completed MATH 305.
Prerequisites: MATH 022

MATH 261 (CSE 261) Discrete Structures 3 Credits
Topics in discrete mathematical structures chosen for their applicability to computer science and engineering. Sets, propositions, induction, recursion; combinatorics; binary relations and functions; ordering, lattices and Boolean algebra; graphs and trees; groups and homomorphisms.
Prerequisites: MATH 021 or MATH 076

MATH 263 Introduction to the Theory of Probability 3 Credits
An introduction to the basics of Calculus-based theory of Probability. Includes combinatorial techniques, events, independence, and conditional probability; most important discrete and continuous probability distributions, expectation and variance; joint distributions and covariance; moment generating functions; basic form of the Laws of Large Numbers and the Central Limit Theorem. Focuses on use of concepts to solve problems. Prior knowledge of Probability not required. Not available for credit to students who have completed (MATH 231 and MATH 264) or MATH 309.
Prerequisites: MATH 023 or MATH 052 or MATH 082
Can be taken Concurrently: MATH 023

MATH 264 Introduction to Statistical Reasoning and Methods 4 Credits
Introduction to the basic concepts, logic and issues involved in statistical reasoning and statistical methods used to analyze data and evaluate studies. Topics include descriptive statistics and exploratory data analysis; elementary probability and statistical inference. Examples drawn from various areas of application. Use of computer software (e.g., Minitab, R) to facilitate understanding and to complete data analysis. Three lectures and one computer laboratory. Not available for credit to students who have completed both MATH 231 and MATH 263.
Prerequisites: MATH 021 or MATH 051 or MATH 081

MATH 271 Readings 1-3 Credits
Study of a topic in mathematics under individual supervision. Intended for students with specific interests in areas not covered in the listed courses. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: MA

MATH 291 Undergraduate Research 1-4 Credits
Research in mathematics or statistics under the direction of a faculty member. Department permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

MATH 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

MATH 301 Principles of Analysis 1-3-4 Credits
Existence of limits, continuity and uniform continuity; HeineBorel Theorem; existence of extreme values; mean value theorem and applications; conditions for the existence of the Riemann integral; absolute and uniform convergence; emphasis on theoretical material from the calculus of one variable.
Prerequisites: MATH 023
MATH 302 Principles of Analysis II 3-4 Credits
Continuation of MATH 301. Functions of several variables; the implicit function theorem, and further topics with applications to analysis and geometry.
Prerequisites: MATH 301
Attribute/Distribution: MA

MATH 303 (PHIL 303) Mathematical Logic 3-4 Credits
Detailed proofs are given for the basic mathematical results relating the syntax and semantics of firstorder logic (predicate logic): the Soundness and Completeness (and Compactness) Theorems, followed by a brief exposition of the celebrated limitative results of Gödel, Turing, and Church on incompleteness and undecidability. The material is conceptually rigorous and mathematically mature; the necessary background is a certain degree of mathematical sophistication or a basic knowledge of symbolic logic. Consent of instructor required.
Attribute/Distribution: MA

MATH 304 Axiomatic Set Theory 3-4 Credits
A development of set theory from axioms; relations and functions; ordinal and cardinal arithmetic; recursion theorem; axiom of choice; independence questions. Consent of instructor required.
Attribute/Distribution: MA

MATH 305 Enumerative Combinatorics 3 Credits
An introduction to basic theoretical results and techniques of enumerative combinatorics such as combinatorial identities, generating functions, inclusion/exclusion, recurrence relations, bijective proofs and permutations. Additional topics will be covered as time permits.
Prerequisites: MATH 242

MATH 307 General Topology I 3-4 Credits
An introductory study of topological spaces, including metric spaces, separation and countability axioms, connectedness, compactness, product spaces, quotient spaces, function spaces.
Prerequisites: MATH 301
Attribute/Distribution: MA

MATH 309 Probability with Applications and Simulations 3 Credits
Foundations of Probability; Random Variables; Probability Models; Expectations and Moment Generating Functions; Joint and Conditional Distributions; Functions of Random Variables. Introduction to fundamental ideas and techniques of stochastic modeling, with an emphasis on the applications. The last part of the course is devoted to techniques and methods of Monte Carlo simulation. R or other software will be used in this course.
Prerequisites: MATH 023 or MATH 052 or MATH 082

MATH 310 Random Processes and Applications 3-4 Credits
Prerequisites: MATH 263 or MATH 309 or (MATH 231 and (MATH 205 or MATH 241), )

MATH 311 Graph Theory 3 Credits
An introduction to basic theoretical results and techniques of graph theory such as trees, connectivity, matchings, coloring, planar graphs and Hamiltonicity. Additional topics will be covered as time permits.
Prerequisites: MATH 163 or MATH 252 or CSE 140

MATH 312 Statistical Computing and Applications 3-4 Credits
Use of statistical computing packages; exploratory data analysis; Monte Carlo methods; randomization and resampling, application and interpretation of a variety of statistical methods in real world problems.
Prerequisites: MATH 012 or MATH 231 or MATH 264

MATH 316 Complex Analysis 3-4 Credits
Concept of analytic function from the points of view of the Cauchy-Riemann equations, power series, complex integration, and conformal mapping.
Prerequisites: MATH 301
Attribute/Distribution: MA

MATH 319 Introduction to Differential Equations 3 Credits
An introductory, yet rigorous treatment of topics in differential equations chosen to prepare students for advanced work in mathematics or applied mathematics. Homogeneous and non-homogeneous linear differential equations, existence and uniqueness theorems, Gronwall's inequality; systems of first order linear differential equations; autonomous first-order systems; critical points, stability, bifurcation; series and periodic solutions, Fourier series and their convergence; introduction to numerical simulation methods.
Prerequisites: MATH 242 or MATH 205 or MATH 241

MATH 320 Ordinary Differential Equations 3-4 Credits
The analytical and geometric theory of ordinary differential equations, including such topics as linear systems, systems in the complex plane, oscillation theory, stability theory, geometric theory of nonlinear systems, finite difference methods, general dynamical systems.
Prerequisites: MATH 023 and (MATH 205 or MATH 319)

MATH 321 Topics in Discrete Mathematics 3 Credits
Selected topics in areas of discrete mathematics. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: MA

MATH 322 Methods of Applied Analysis I 3 Credits
Fourier series, eigenfunction expansions, Sturm-Liouville problems, Fourier integrals and their application to partial differential equations; special functions. Emphasis is on a wide variety of formal applications rather than logical development.
Prerequisites: MATH 205 or MATH 319

MATH 323 Methods of Applied Analysis II 3 Credits
Green's functions; integral equations; variational methods; asymptotic expansions, method of saddle points; calculus of vector fields, exterior differential calculus.
Prerequisites: MATH 322
Attribute/Distribution: MA

MATH 327 Groups and Rings 3-4 Credits
An intensive study of the concepts of group theory including the Sylow theorems, and of ring theory including unique factorization domains and polynomial rings.
Prerequisites: MATH 242 and MATH 243
Attribute/Distribution: MA

MATH 329 Computability Theory 3-4 Credits
Core development of classical computability theory: enumeration, index and recursion theorems, various models of computation and Church's Thesis, uncomputability results, introduction to reducibilities and their degrees (in particular, Turing degrees, or degrees of uncomputability), computable operators and their fixed points.
Attribute/Distribution: MA

MATH 331 Differential Geometry of Curves and Surfaces 3 Credits
Local and global differential geometry of curves and surfaces in Euclidean 3space. Frenet formulas for curves, isoperimetric inequality, 4vertex theorem; regular surfaces, first fundamental form, Gauss map, second fundamental form; curvatures for curves and surfaces and their relations; The Gauss-Bonnet theorem.
Prerequisites: MATH 023 and (MATH 205 or MATH 242)

MATH 334 Mathematical Statistics 3-4 Credits
Populations and random sampling; sampling distributions; theory of statistical estimation; criteria and methods of point and interval estimation; theory of testing statistical hypotheses.
Prerequisites: MATH 263 or MATH 309

MATH 338 Linear Models in Statistics with Applications 3-4 Credits
Least square principles in multiple regression and their interpretations; estimation, hypotheses testing, confidence and prediction intervals, modeling, regression diagnostic, multicollinearity, model selection, analysis of variance and covariance; logistic regression. Introduction to topics in time series analysis such as ARMA, ARCH, and GARCH models. Applications to natural sciences, finance and economics. Use of computer packages.
Prerequisites: (MATH 012 or MATH 231 or MATH 264) and (MATH 043 or MATH 205 or MATH 242 or STAT 342)
MATH 340 (CSE 340) Design and Analysis of Algorithms 3 Credits
Algorithms for searching, sorting, manipulating graphs and trees, finding shortest paths and minimum spanning trees, scheduling tasks, etc.; proofs of their correctness and analysis of their asymptotic runtime and memory demands. Designing algorithms: recursion, divide-and-conquer, greediness, dynamic programming. Limits on algorithm efficiency using elementary NP-completeness theory.
Prerequisites: (MATH 021 or MATH 031 or MATH 076) and CSE 140 and CSE 017

MATH 341 Mathematical Models and Their Formulation 3 Credits
Mathematical modeling of engineering and physical systems with examples drawn from diverse disciplines. Emphasis is on building models of real world problems and the analysis as well as numerical simulations of the models.
Prerequisites: MATH 205 or MATH 241 or MATH 242

MATH 342 Number Theory 3-4 Credits
Basic concepts and results in number theory, including such topics as primes, the Euclidean algorithm, Diophantine equations, congruences, quadratic residues, quadratic reciprocity, primitive roots, number-theoretic functions, distribution of primes, Pell's equation, Fermat's theorem, partitions. Consent of instructor required.
Attribute/Distribution: MA

MATH 343 Introduction To Cryptography 3,4 Credits
Attribute/Distribution: MA

MATH 350 Special Topics 3 Credits
A course covering special topics not sufficiently covered in listed courses. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: MA

MATH 371 Readings 1-3 Credits
The study of a topic in mathematics under appropriate supervision, designed for the individual student who has studied extensively and whose interests lie in areas not covered in the listed courses. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: MA

MATH 374 Statistical Project 3 Credits
Supervised field project or independent reading in statistics or probability. Consent of department chair required.
Attribute/Distribution: MA

MATH 391 Senior Honors Thesis 3 Credits
Independent research under faculty supervision, culminating in a thesis presented for departmental honor. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: MA

MATH 401 Real Analysis I 3 Credits
Set theory, real numbers; introduction to measures, Lebesgue measure; integration, general convergence theorems; differentiation, functions of bounded variation, absolute continuity; Lp spaces.
Prerequisites: MATH 301

MATH 402 Real Analysis II 3 Credits
Metric spaces; introduction to Banach and Hilbert space theory; Fourier series and Fejer operators; general measure and integration theory, Radon Nikodym and Riesz representation and theorems; Lebesgue Stieljes integral.
Prerequisites: MATH 307 or MATH 401

MATH 403 Topics in Real Analysis 3 Credits
Intensive study of topics in analysis with emphasis on recent developments. Requires permission of the department chair.
Repeat Status: Course may be repeated.

MATH 404 Topics in Mathematical Logic 3 Credits
Intensive study of topics in mathematical logic. Consent of instructor required.
Repeat Status: Course may be repeated.

MATH 405 Partial Differential Equations I 3 Credits
Classification of partial differential equations; methods of characteristics for first order equations; methods for representing solutions of the potential, heat, and wave equations, and properties of the solutions of these equations; maximum principles.
Prerequisites: MATH 319 or MATH 320

MATH 406 Partial Differential Equations II 3 Credits
Continuation of MATH 405. Emphasis on second order equations with variable coefficients and systems of first order partial differential equations.
Prerequisites: MATH 405

MATH 408 Algebraic Topology I 3 Credits
Polyhedra; fundamental groups; simplicial and singular homology.

MATH 409 Mathematics Seminar 1-6 Credits
An intensive study of some field of mathematics not offered in another course. Consent of department chair required.

MATH 410 Mathematics Seminar 1-6 Credits
Continuation of the field of study in MATH 409 or the intensive study of a different field. Consent of department chair required.

MATH 416 Complex Function Theory 3 Credits
Continuation of MATH 316.
Prerequisites: MATH 316

MATH 421 Introduction To Wavelets 3 Credits
Continuous and discrete signals; review of Fourier analysis; discrete wavelets; time frequency spaces; Haar and Walsh systems; multiresolution analysis; Hilbert spaces; quadratic mirror filters; fast wavelet transforms; computer code; applications to filtering, compression, and imaging.
Prerequisites: ECE 108 or MATH 205

MATH 423 Differential Geometry I 3 Credits
Differential manifolds, tangent vectors and differentials, submanifolds and the implicit function theorem. Lie groups and Lie algebras, homogeneous spaces. Tensor and exterior algebras, tensor fields and differential forms, de Rham cohomology, Stokes' theorem, the Hodge theorem. Must have completed MATH 301, or MATH 243 or MATH 205 with permission of instructor.

MATH 424 Differential Geometry II 3 Credits
Curves and surfaces in Euclidean space; mean and Gaussian curvatures, covariant differentiation, parallelism, geodesics, Gauss Bonnet formula. Riemannian metrics, connections, sectional curvature, generalized Gauss Bonnet theorem. Further topics.
Prerequisites: MATH 423

MATH 428 Fields And Modules 3 Credits
Field theory, including an introduction to Galois theory; the theory of modules, including tensor products and classical algebras.
Prerequisites: MATH 327

MATH 430 Numerical Analysis 3 Credits
Multistep methods for ordinary differential equations; finite difference methods for partial differential equations; numerical approximation of functions. Use of computer required.
Prerequisites: MATH 230

MATH 435 Functional Analysis I 3 Credits
Banach spaces and linear operators; separation and extension theorems; open mapping and uniform boundedness principles; weak topologies; local convexity and duality; Banach algebras; spectral theory of operators and compact operators.
Prerequisites: MATH 307 and MATH 401
MATH 441 (CSE 441) Advanced Algorithms 3 Credits
Algorithms for searching, sorting, manipulating graphs and trees, scheduling tasks, finding shortest path, matching patterns in strings, cryptography, matroid theory, linear programming, max-flow, etc., and their correctness proofs and analysis of their time and space complexity. Strategies for designing algorithms, e.g., recursion, divide-and-conquer, greediness, dynamic programming. Limits on algorithm efficiency are explored through NP completeness theory. Quantum computing is briefly introduced. Credit will not be given for both CSE 340 (MATH 340) and CSE 441 (MATH 441).

MATH 444 Algebraic Topology II 3 Credits
Continuation of MATH 408. Cohomology theory, products, duality.
Prerequisites: MATH 408

MATH 445 Topics in Algebraic Topology 3 Credits
Selected topics reflecting the interests of the professor and the students.
Prerequisites: MATH 444

MATH 449 Topics In Algebra 3 Credits
Intensive study of topics in algebra with emphasis on recent developments. Consent of department chair required.
Repeat Status: Course may be repeated.

MATH 450 Special Topics 3 Credits
Intensive study of some field of the mathematical sciences not covered in listed courses. Consent of department chair required.
Repeat Status: Course may be repeated.

MATH 455 Topics in Number Theory 3 Credits
Selected topics in algebraic and/or analytic number theory. Consent of instructor required.
Repeat Status: Course may be repeated.

MATH 461 Topics In Mathematical Statistics 3 Credits
An intensive study of one or more topics such as theory of statistical tests, statistical estimation, regression, analysis of variance, nonparametric methods, stochastic approximation, and decision theory.
Repeat Status: Course may be repeated.
Prerequisites: MATH 334 and MATH 401

MATH 462 Modern Nonparametric Methods in Statistics 3 Credits
Classical and modern methods of nonparametric statistics: order and rank statistics; tests based on runs, signs, ranks, and order statistics; distribution free statistical procedures for means, variances, correlations, and trends; relative efficiency; Kolmogorov-Smirnov statistics; statistical applications of Brownian process; modern techniques such as robust methods, nonparametric smoothing, and bootstrapping; additional topics such as nonparametric regression and dimension reduction.
Prerequisites: (MATH 334 or STAT 334) and (MATH 338 or STAT 338)

MATH 463 (STAT 463) Advanced Probability 3 Credits
Measure theoretic foundations; random variables, integration in a measure space, expectations; convergence of random variables and probability measures; conditional expectations; characteristic functions; sums of random variables, limit theorems.
Prerequisites: MATH 309 and MATH 401

MATH 464 Advanced Stochastic Process 3 Credits
Theory of stochastic processes; stopping times; martingales; Markov processes; Brownian motion; stochastic calculus; Brownian bridge, laws of supremum; Gaussian processes.
Prerequisites: MATH 309 and MATH 401

MATH 465 Topics in Probability 3 Credits
Selected topics in probability. Consent of department chair required.
Repeat Status: Course may be repeated.

MATH 467 Stochastic Calculus 3 Credits
Prerequisites: MATH 231 or MATH 309

MATH 468 Financial Stochastic Analysis 3 Credits
Basic mathematical concepts behind pricing of derivative securities. Hedging and pricing by arbitrage in the setting of binary trees and Black-Scholes model. Application of Stochastic Calculus to the pricing of a variety of financial instruments: multiple stock models, American and exotic options, and foreign currency interest rate. Heath-Jarrow-Morton model for the term structure of interest rates and short rate models. Applications of the theory to a variety of interest rates contracts including swaps, caps, floors, swap options.
Prerequisites: MATH 467

MATH 470 Proseminar 3 Credits
Preparation for entering the mathematics profession. Seminar will concentrate on methods of teaching mathematics, and will include other topics such as duties of a professor and searching for a job. Consent of department chair required.

MATH 471 Homological Algebra 3 Credits
Modules, tensor products, categories and functors, homology functors, projective and injective modules.
Prerequisites: MATH 428

MATH 472 Group Representations 3 Credits
Linear representations and character theory with emphasis on the finite and compact cases.
Prerequisites: MATH 428

MATH 475 Topics in Geometry 3 Credits
Selected topics in geometry, such as geometric analysis, algebraic geometry, complex geometry, characteristic classes, geometric flows or geometric measure theory, with emphasis on recent developments. Consent of department chair required.
Repeat Status: Course may be repeated.

MATH 485 Topics in Financial Mathematics 3 Credits
Selected topics in financial mathematics. Consent of department chair required.
Repeat Status: Course may be repeated.

MATH 490 Thesis 1-6 Credits

MATH 499 Dissertation 1-15 Credits
Repeat Status: Course may be repeated.

Statistics Courses

STAT 342 Applied Linear Algebra 3 Credits
The theoretical basis for applying linear algebra in other fields, including statistics. Topics will include systems of equations, vector spaces, matrices, and linear transformations. Additional topics will include matrix factorizations (including LU, QR, eigen-decomposition, and SVD) and how they can be used in computer analysis of data sets. Some students may optionally choose to take MATH 205 as preparation for this course. Not available for credit to students who have completed MATH 241 or MATH 242.
Prerequisites: MATH 022

STAT 408 Seminar in Statistics and Probability 1-6 Credits
Intensive study of some field of statistics or probability not offered in another course. Consent of department required.

STAT 409 Seminar in Statistics and Probability 1-6 Credits
Intensive study of some field of statistics or probability not offered in another course. Consent of department required.

STAT 410 Random Processes and Applications 3 Credits
See MATH 310.

STAT 412 Advanced Applied Statistics 3 Credits
Selected advanced topics in applied statistics. Possible topics include nonparametric statistics, multivariate statistics, generalized linear model, survival analysis, time series analysis or other modern applied statistical methods with application to real world problems. Topics could vary from one semester to another depending on the interests of the faculty member and the students.
Repeat Status: Course may be repeated.

STAT 434 Mathematical Statistics 3 Credits
See MATH 334.

STAT 438 Linear Models In Statistics with Applications 3 Credits
See MATH 338.
Modern Languages and Literatures

STAT 461 Topics In Mathematical Statistics 3 Credits
See MATH 461.

STAT 462 Modern Nonparametric Methods in Statistics 3 Credits
See MATH 462.

STAT 463 (MATH 463) Advanced Probability 3 Credits
See MATH 463.
Prerequisites: MATH 309 and MATH 401

STAT 464 Advanced Stochastic Processes 3 Credits
See MATH 464.

STAT 471 Topics in Statistical Learning and Computing 3 Credits
Selected advanced topics in statistical learning and computing. Possible topics include linear and nonlinear regression, applied spatial statistics, applied multivariate and longitudinal data analysis, functional data analysis, survival analysis, data analytics, statistical methods that use intensive-computing or simulations, data mining techniques, with application and interpretation of a variety of statistical methods in real world problems. Topics could vary from one semester to another depending on the interests of the faculty member and the students.
Repeat Status: Course may be repeated.

Modern Languages and Literatures

Knowledge of other languages opens the door to other cultures, traditions, and perspectives on the world, and promotes deeper insight into one's own language and culture. Proficiency in modern languages is indispensable in a broad range of professions such as journalism, government, international affairs, law, the armed forces, and business. A bachelor of arts degree with a major in languages provides excellent preparation for professional careers in law, business, and the media. Language study is required for graduate study in many disciplines, as well as for research in science and technology. International experience is personally enriching and enhances career prospects.

Languages offered
Lehigh offers Arabic, Mandarin Chinese, French, German, Hebrew, Japanese, Russian, and Spanish. Courses include oral, reading, and writing skills, literature, film, culture, civilization, and professional areas such as business and health careers. A number of literature and culture courses are given in English, but most offerings stress classroom use of the target language.

Language requirements
The Global Studies major, the Joint IR/MLL major, the Asian Studies Major as well as the major in Latin American and Latino Studies require language study. The minors in Latin American and Latino Studies, and Asian Studies require language study. Some doctoral programs also require competence in a language other than English, usually assessed by the Department of Modern Languages and Literatures.

Advising
Professors. Marie-Helene Chabut, PHD (University of California, San Diego); Constance A. Cook, PHD (University of California, Berkeley); Kiri Lee, PHD (Harvard University); Mary A. Nicholas, PHD (University of Pennsylvania)

Associate Professors. Marie-Sophie Armstrong, PHD (University of Oregon); Taieb Berrada, PHD (Northwestern University); Matthew R. Bush, PHD (University of Colorado Boulder); Antonio Prieto, PHD (Princeton University); Vera S. Stegmann, PHD (Indiana University Northwest)

Assistant Professors. Thomas Chen, PHD (University of California Los Angeles); Olivia Landry, PHD (Indiana University Bloomington); Lilia Adriana Perez Limon, PHD (University Wisconsin-Madison); Sara Lindsey Reuben, MA (Columbia University); Nobuko Yamasaki, PHD (University of Washington)

Lecturer. Jessica Racines Brandt, MA (Lehigh University)

Professors Of Practice. Eunice Cortez, PHD (Temple University); Limei Shan, MS (East China Normal University); Kyoko Taniguchi, PHD (Emory University)

Emeriti. Linda S. Lefkowitz, PHD (Princeton University); David W. Pankenier, PHD (Stanford University); Anje C. Van Der Naald, PHD (University of Illinois at Urbana-Champaign); Lenora D. Wolfgang, PHD (University of Pennsylvania)

Major Programs
The department offers major programs in Chinese, French and Francophone Studies, German, Spanish and Hispanic Studies, and Joint IR/MLL. The candidate for the major is expected to demonstrate adequate written and oral command of the language, as well as knowledge of its literature and culture. A period of study abroad is strongly recommended.

Double majors and Arts-Engineering majors including a language component are well-received by employers. Studies in the two areas are carefully coordinated by major advisors.

Major in Chinese
The major in Chinese will require 36 credits: a minimum of 24 credits in courses taught in Chinese, including 8 credits at the 200 or 300 level of Chinese language and literature (marked CHIN). Courses offered in English in MLL on Chinese literature and history may be included in the major and a maximum of two courses outside of MLL in the Asian Studies Program that are concerned specifically with China, such as those available in International Relations, Political Science, Religion, Sociology, etc., by approval of the major adviser. Majors in Chinese are strongly encouraged to study abroad in a Chinese speaking country.

Major in German

Major in German
The major in German requires 32 credits in German language, literature, and culture beyond GERM 002. This includes GERM 011, GERM 012, and any German courses that are 100 level and above. At least 8 of these credits must be at the 200 level or 300 level. Two courses may be taken in English when the class is taught by a German faculty member and when the writing assignments are completed in German.

Majors in German are strongly encouraged to participate in a study abroad program in a German speaking country for the equivalent of one semester or more. A maximum of 16 credits of study abroad (24 for the honors major) may be transferred toward the major, with a maximum of 8 credits for summer, 12 credits for a semester, and 16 credits for a year of study abroad (24 for the honors major). In order to have credits from foreign institutions count toward their major, students must obtain approval from the German major advisor prior to their departure.

Transfer students may transfer up to 12 credits from another college or university toward the major. Credits from Advanced Placement (AP) exams and SAT subject tests count toward graduation but NOT toward the major in German.

Departmental Honors Major in German (40 credits)
Requirements are the same as for the regular major in German, plus 8 additional hours in advanced literature and culture studies in German, to be completed as course work or with an honors thesis of a comprehensive type.

Major in French and Francophone Studies
The major in French and Francophone Studies requires 31-32 credits in French language, literature and culture beyond French 011 (intermediate 1).

Core Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>FREN 012</td>
<td>Intermediate French I</td>
</tr>
<tr>
<td>FREN 143</td>
<td>Advanced Written French</td>
</tr>
<tr>
<td>FREN 144</td>
<td>Advanced Oral French</td>
</tr>
<tr>
<td>FREN 152</td>
<td>Introduction to Literary Analysis</td>
</tr>
</tbody>
</table>

One of the following

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>FREN 259</td>
<td>Contemporary France</td>
</tr>
<tr>
<td>FREN 255</td>
<td>Introduction to the Francophone World</td>
</tr>
<tr>
<td>FREN 133</td>
<td>Lehigh in Martinique: Globalization and Local Identity</td>
</tr>
</tbody>
</table>

Advanced course work 12
Three courses (200 or 300 level), with at least two courses at the 300 level. One of these courses may be taken in English when taught by a French faculty member.

Majors in French and Francophone Studies are strongly encouraged to participate in a study program in a French-speaking part of the world for the equivalent of one semester or more. Up to 12 credits for courses taken abroad (16 credits for an honors major) may count toward the major. In order to have credits from foreign institutions count toward their major, students must obtain approval from the French major adviser prior to their departure.

Requirements for the Departmental Honors Major (39-40 credits):
Requirements as for the major, plus 8 additional hour of advanced literature (honors thesis of a comprehensive type) and maintenance of a 3.20 average in the major.

Advanced Placement: Advanced Placement and CEEB credits count towards graduation but NOT towards the major. Transfer students may transfer up to 12 credits towards the major.

Major in Japanese
The major in Japanese Studies requires 35 credits: a minimum of 23 credits in Japanese languages beyond JPNS 002; 3 credits from Study Abroad in Japan, and a minimum of 9 credits (or 3 courses) in Japanese literature and culture courses offered in English in MLL (electives). For elective courses, a maximum of two courses can be taken outside of MLL, either from study-abroad or the list of Japanese-related courses offered in the Asian Studies program. If a student is financially or academically unable to fulfill the study abroad requirement, other options could be negotiated with an advisor’s approval.

Requirements:
1. Japanese language courses (see recommended sequence below) = 23 credits
2. Study Abroad (3) = 3 credits
If a student is financially or academically unable to fulfill this requirement, other options could be negotiated with an advisor’s approval.

3. Electives: Courses on Japan taught in English. 3 courses = Minimum of 9 credits
Electives can include credits from study abroad. Maximum of two courses offered outside of MLL are allowed. The following courses in the Asian Studies program cover topics related to Japan:

ASIA 010; ASIA 012; ASIA 061; ASIA 068; ASIA 119; ASIA 127; ASIA 140; ASIA 142; ASIA 162; ASIA 164; ASIA 170; ASIA192; ASIA 193; ASIA 337; ASIA 340

Total: 35 credits
Students must take the Elementary Japanese I (JPNS001) in the first semester upon arrival at Lehigh unless they have previously studied the Japanese language equivalent to JPNS 1 and 2. The following is the recommended semester-by-semester roster.
Semester 1: JPNS 001 (prerequisite)
Semester 2: JPNS 002 (Prerequisite)
Semester 3: JPNS 011, One course in MLL/Asia
Semester 4: JPNS 012, One Course in MLL/Asia
Semester 5: JPNS 131&151, One course in MLL/Asia OR Study Abroad
Semester 6: JPNS 132&152,
Semester 7: JPNS 231
Semester 8: JPNS 232, JPNS 290 (Major Paper)

Major in Spanish and Hispanic Studies
Spanish and Hispanic Major

Core Courses
<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPAN 141</td>
<td>Advanced Spanish Grammar</td>
<td>12</td>
</tr>
<tr>
<td>SPAN 151</td>
<td>Cultural Evolution Of Spain</td>
<td>4</td>
</tr>
<tr>
<td>SPAN 152</td>
<td>Cultural Evolution of Latin America</td>
<td>4</td>
</tr>
</tbody>
</table>

Advanced Coursework
or three courses at the 300 level.

Electives
at the 100 or 200 level.

Collateral Requisites
6-8 from a list of approved courses taken in other programs and departments. These courses must be approved by the Spanish major adviser.

Majors in Spanish and Hispanic Studies are strongly encouraged to participate in a study program in a Spanish-speaking country for the equivalent of one semester or more. Up to 12 credits for courses taken during one semester abroad (16 credits during one year) may count toward the major. In order to have credits from foreign institutions count toward their major, students must obtain approval from the Spanish major adviser prior to their departure.

Requirements for the Departmental Honors Major (40 credits)
Requirements as for the major, plus 8 additional hours of advanced literature (honors thesis of a comprehensive type) and maintenance of a 3.20 average in the major.

Joint International Relations/Modern Languages and Literatures Major
For more information please visit the joint IR/MLL Major. (p. 178)

Minor Programs
The department offers minor programs in Chinese, French, German, International Film, Japanese, Russian, and Spanish, and coordinates these studies with a student’s major requirements in any college.

Requirements for the Minor
French, German, Spanish: Sixteen credit hours are required above Intermediate II; one or two courses at the 200 level, one or two courses at the 300 level.
Chinese, Japanese, Russian: A minimum of 16 credit hours.
See end of department section for International Film.
A maximum of 8 credits may be transferred for the minor.

Related Programs
These are available in Asian Studies, Global Studies, Jewish Studies, Latin American Studies, and Women, Gender, and Sexuality Studies. Students are urged to take elective courses on related subjects, either within or outside the department, as approved by their adviser.

Preliminary Courses
These may be replaced by other courses when a student qualifies for advanced standing.
Elementary I (4) Intermediate I (4)
Elementary II (4) Intermediate II (4)

Advanced Courses
Except where otherwise noted, 200 or 300-level courses are open to students having completed eight credit hours beyond Intermediate II. Exceptions require the consent of the instructor.

Language of Instruction
All courses are taught in the target language except MLL courses listed under “International Cultures and Literatures Taught in English.” Students thereby become accustomed to considering the language as an active means of communication and not solely as an object of study.

Language Placement
Students are normally placed in language courses on the basis of years of a language taken in high school, CEEB Achievement Test score, or the departmental equivalent (instructor’s test, interview, or questionnaire). Students may change levels within a language during the first two weeks of class. Students who consider themselves capable of higher-level performance may apply to the instructor during the first two
Courses in English

The department offers elective courses in English on literary, cultural, and social subjects listed under “International Culture and Literature Taught in English.”

These courses may, in most cases, be taken to fulfill preliminary distribution requirements. One of these courses may be included in the major.

Minor in International Film

**Description**

The minor in International Film affords students the opportunity to examine a wide cross-section of world cinema. It is designed to provide a critical understanding of historical trends and current issues in film across various regions of the world. Covering national cinemas from Asia, Europe, and Latin America, course offerings will allow students to explore diverse approaches to film that are rooted in the history, culture, and society of different countries in each region.

The minor consists of 16 credits. All students must take a required core course (MLL 100), and the remaining courses are to be chosen from the list of electives below, in consultation with the minor advisor. (One course may be taken outside of the MLL department with the minor advisor’s approval.)

**Core course**

MLL 100 Introduction to International Film 4

**Elective courses**

MLL/ASIA/WGSS/GCP 073 Film, Fiction, and Gender in Modern China 4

FREN 322 Contemporary French Films 4

GERM/GCP/MLL 231 New German Cinema 4

SPAN 265 Spanish and Latin American Cinema 4

**Study Abroad and Travel Grants**

The department encourages students of languages to spend a summer, a semester, or a full year on an approved program of study abroad. Exchange agreements with partner institutions are continually being developed. The department offers a limited number of travel grants for study abroad to qualified students. Applications should be submitted by the first week of November for the spring and summer semesters and by the first week of April for summer and fall. Applications for Study Abroad in Asia are also reviewed by the Asian Studies faculty when funds are available. For credit, transfer students must consult in advance with their major adviser, language adviser, other appropriate departments, the Office of International Education, and when appropriate, the Office of Financial Aid.

Lehigh offers summer programs through the Lehigh in Shanghai Internship Program. The Lehigh Valley Association of Independent Colleges (LVAIC) offers programs in international locations for eight credits each. A faculty member acting as program director accompanies the students. Courses are taught at intermediate and advanced levels by qualified instructors from host institutions. Summer programs sponsored by the Lehigh-LVAIC Center for Jewish Studies include Hebrew in Israel. Credits are fully transferable under normal LVAIC cross-registration procedures. Interested students should consult with the Department of Modern Languages and Literatures, Williams Hall.

These courses are offered by Lehigh or under the Cooperation agreement with the Lehigh Valley Association of Independent Colleges. Summer or semester study abroad at approved programs may be incorporated into language majors and minors with the permission of the appropriate advisor to a maximum of 16 credits toward the major and eight credits toward the minor.

**INTERNATIONAL CULTURES AND LITERATURES TAUGHT IN ENGLISH**

These courses on international cultures and comparative topics carry no prerequisites; knowledge of the language is not required.

Language majors may count one MLL course taught in English for credit toward a major requirement. Interested students should consult their language major advisors. For course descriptions, see under each language area below.

**HEBREW**

The department offers courses both separately and in the context of the Jewish studies minor (p. 175).

Modern Hebrew is taught in the Department of Modern Languages and Literature. Biblical Hebrew is taught in the Department of Religion Studies.

**Arabic Courses**

**ARAB 001 Elementary Arabic I 4 Credits**

The general objective of this course is to familiarize students with the sounds and the letters of Arabic, along with basic communication skills. Students are required to use Arabic in class discussion. Attendance and class participation are necessary to achieve the above-stated goals. Upon completion of this course, students will be able to read, write, speak, and understand Arabic at the elementary level.

**Attribute/Distribution:** HU

**ARAB 002 Elementary Arabic II 4 Credits**

Continuation of ARAB 001. Emphasis on communicative ability in oral and writing skills and use of the language. Students develop ability to communicate with native speakers on a variety of everyday topics; introductions, descriptions of people and things, disseminating information, stating preferences, describing locations, etc. Students will be able to read, write, speak, and understand authentic materials on familiar topics, as well as recognize and understand various grammatical rules and their application in context, and expand their cultural awareness.

**Attribute/Distribution:** HU

**ARAB 011 Intermediate Arabic I 4 Credits**

Development of communication skills and cultural awareness through reading materials and viewing films. Grammar is presented in context. Emphasis on communicative ability in oral and writing skills, and on the use and cultural aspects of the language through authentic materials. Students learn how to communicate effectively and appropriately while satisfying their intellectual curiosity to learn about the civilization and culture, current as well as historical dimensions.

**Prerequisites:** ARAB 002

**Attribute/Distribution:** HU

**ARAB 012 Intermediate Arabic II 4 Credits**

Enhancement of communication skills, proficiency, competence, and use of the language. Students will enhance and develop their ability to understand the spoken word and to converse on a variety of topics; discuss, narrate, and read authentic materials that cover a variety of issues and topics; e.g., educational, cultural, and factual; write short paragraphs; recognize and use grammatical rules in context; and expand cultural awareness through class discussion and reading materials. Frequently taught in the target language to emphasize and reinforce classroom use. Students will be able to read, write, speak, and understand Arabic at the upper intermediate level.

**Attribute/Distribution:** HU

**ARAB 099 Special Topics 1-4 Credits**

**Repeat Status:** Course may be repeated.

**ARAB 190 Special Topics I 1-4 Credits**

Develop communication skills, emphasize and reinforce classroom use. Translate articles from newspapers, write short stories, and converse on a variety of topics. Directed study, reading, and writing. Periodic consultations and reports.

**Repeat Status:** Course may be repeated.

**Attribute/Distribution:** HU

**ARAB 191 Special Topics II 1-4 Credits**

Continuation of ARAB 190. Literary and linguistic topics not covered in regular classes.

**Attribute/Distribution:** HU
ARAB 231 Third Year Arabic I 4 Credits
Enhance fluency, particularly conversational Arabic. Emphasis on comprehension of written and spoken language. Dialogue, reading, and analysis of texts to enhance critical thinking, as well as promote mastery of the language. Immersion in overall increase in fluency. Advanced level geared towards command and comprehension of conversation and written texts, textbooks, and media (i.e., newspaper, magazine).

Attribute/Distribution: HU

ARAB 232 Third Year Arabic II 4 Credits
Continuation of Third Year Arabic I. Emphasis on comprehension of written and spoken language. Dialogue, reading, and analysis of texts to enhance critical thinking, as well as promote mastery of the language. Immersion in overall increase in fluency. Advanced level geared towards command and comprehension of conversation and written texts, textbooks, and media (i.e., newspaper, magazine).

Attribute/Distribution: HU

ARAB 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

ARAB 341 Fourth Year Arabic I 4 Credits
Enhance fluency, particularly conversational and written Arabic. Reading and analysis of texts to enhance critical thinking, and promote mastery of the language. Immersion and overall increase in fluency. Students will be expected to communicate with classmates and the instructor in Arabic and to make presentations in Arabic pertaining to current events. Increased use of Arabic during classroom instruction. Students expected to come prepared to present something that utilizes the language: poems, personal stories or experiences, current event articles etc.

Attribute/Distribution: HU

ARAB 342 Fourth Year Arabic II 4 Credits
Continuation of Fourth Year Arabic I. Enhance fluency, particularly conversational and written Arabic. Emphasis on reading and analysis of texts to enhance critical thinking, promote mastery of the language. Immersion and overall increase in fluency. Students will be expected to communicate with classmates and the instructor in Arabic and to make presentations in Arabic pertaining to current events. Increased use of Arabic during classroom instruction. Students expected to come prepared to present something that utilizes the language: poems, personal stories or experiences, current event articles etc.

Attribute/Distribution: HU

Chinese Courses
CHIN 001 Beginning Chinese Reading and Writing I 2 Credits
Introduction to the Chinese writing system and beginning character acquisition; reading practice with pinyin transcription system. (Fall)
Non-heritage speakers are strongly encouraged to take the Spoken of the same level during the same semester as this Reading and Writing course.

Attribute/Distribution: HU

CHIN 002 Beginning Chinese Reading and Writing II 2 Credits
Continuation of CHIN 001: continued character acquisition, reading practice in pinyin and simple character texts. Non-heritage speakers are strongly encouraged to take the Spoken of the same level during the same semester as this Reading and Writing course.

Attribute/Distribution: HU

CHIN 003 Beginning Spoken Chinese I 2 Credits
Introduction to Mandarin Chinese pronunciation, the pinyin transcription system, and modern colloquial Chinese; emphasis on oral proficiency. Not open to native speakers. Students are strongly encouraged to take Reading and Writing course of the same level during the same semester as this Spoken course.

Attribute/Distribution: HU

CHIN 004 Beginning Spoken Chinese II 2 Credits
Continuation of CHIN 003: further practice with text based dialogues in modern colloquial Chinese; emphasis on oral proficiency. Not open to native speakers. Students are strongly encouraged to take Reading and Writing course of the same level during the same semester as this Spoken course.

Attribute/Distribution: HU

CHIN 011 Intermediate Chinese Reading and Writing I 2 Credits
Continued focus on vocabulary/character acquisition and text-based reading and writing exercises using Chinese characters. Non-heritage speakers are strongly encouraged to take the Spoken course of the same level during the same semester as this Reading and Writing course.

Attribute/Distribution: HU

CHIN 012 Intermediate Chinese Reading and Writing II 2 Credits
Continuation of CHIN 011: vocabulary/character acquisition and text-based reading and writing exercises using Chinese characters. Non-heritage speakers are strongly encouraged to take the Spoken course of the same level during the same semester as this Reading and Writing course.

Attribute/Distribution: HU

CHIN 013 Intermediate Spoken Chinese I 2 Credits
Further development of communicative skills in Chinese using situational dialogues and class discussion; emphasis on oral proficiency. Not open to native speakers. Students are strongly encouraged to take the Spoken course of the same level during the same semester as this Spoken course.

Attribute/Distribution: HU

CHIN 014 Intermediate Spoken Chinese II 2 Credits
Continuation of CHIN 013: further development of communicative skills in Chinese using situational dialogues and class discussion; emphasis on oral proficiency. Not open to native speakers. Students are strongly encouraged to take the Spoken course of the same level during the same semester as this Spoken course.

Attribute/Distribution: HU

CHIN 021 Survival Chinese 2 Credits
A brief introduction to the language and culture. Focus on speaking and listening skills. Lessons based on practical situations for living or traveling in China.

Attribute/Distribution: HU

CHIN 091 Chinese Language & Culture Abroad I 1-8 Credits
Introductory intensive study of conversation in the language of the country; reading, development of writing skills and selected aspects of the culture.

Attribute/Distribution: HU

CHIN 092 Chinese Language and Culture Abroad I (Part TWO) 3 Credits
Intensive study of conversation in Chinese, rapid review of the basic grammar, reading and analysis of basic interactive dialogues, development of writing skills, familiarity with select aspects of the culture.

Attribute/Distribution: HU

CHIN 111 Advanced Intermediate Chinese Reading & Writing I 2 Credits
Reading, translation, and writing practice using text-based exercises, short stories, essays, and other selected materials. Non-heritage speakers are strongly encouraged to take the Spoken course of the same level during the same semester as this Reading and Writing course.

Attribute/Distribution: HU

CHIN 112 Advanced Intermediate Chinese Reading & Writing II 2 Credits
Continuation of CHIN 111: reading, translation, writing exercises using text-based exercises, short stories, essays, and other selected materials. Non-heritage speakers are strongly encouraged to take the Spoken course of the same level during the same semester as this Reading and Writing course.

Attribute/Distribution: HU

CHIN 113 Advanced Intermediate Spoken Chinese I 2 Credits
Topical discussions and oral presentations in Chinese. Students are strongly encouraged to take Reading and Writing course of the same level during the same semester as this Spoken course.

Attribute/Distribution: HU

CHIN 114 Advanced Intermediate Spoken Chinese II 2 Credits
Continuation of CHIN 113: topical discussions and oral presentations in Chinese. Students are strongly encouraged to take Reading and Writing course of the same level during the same semester as this Spoken course.
CHIN 119 Writing Skills in Chinese 2 Credits
Students above the intermediate level of spoken and written Chinese work individually with the instructor on topics of their own choice.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

CHIN 122 Intermediate Business Chinese 2 Credits
Introduction to Chinese business environment and business terminology. Emphasis on reading comprehension and translation.
Attribute/Distribution: HU

CHIN 134 Chinese Short Stories 2 Credits
Supplementary reading designed for students at the intermediate level.
Attribute/Distribution: HU

CHIN 191 Chinese Language & Culture Abroad II 1-8 Credits
Intensive study of conversation in the language of the country; rapid review of basic grammar, the reading and analysis of moderately difficult texts, development of rudimentary writing skills, supplemented study of selected aspects of contemporary civilization. Consent of department required. Must have proficiency examination in the target country.
Attribute/Distribution: HU

CHIN 251 Chinese Special Topics 1-4 Credits
Materials not covered in regular courses. Students help design the course.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

CHIN 252 Advanced Business Chinese 2 Credits
Prerequisites: CHIN 112 or CHIN 114
Attribute/Distribution: HU

CHIN 253 Chinese Fiction 2 Credits
Students read modern Chinese short stories or a novel. Emphasis on reading comprehension and translation.
Repeat Status: Course may be repeated.
Prerequisites: CHIN 112 or CHIN 114
Attribute/Distribution: HU

CHIN 254 Intensive Chinese Conversation 2 Credits
Conversational practice based on topical readings. For advanced speakers only.
Prerequisites: CHIN 112 or CHIN 114
Attribute/Distribution: HU

CHIN 255 Newspaper Readings In Chinese 2 Credits
Prerequisites: CHIN 112 or CHIN 114
Attribute/Distribution: HU

CHIN 256 Electric Shadows: Chinese Cinema and Culture 4 Credits
The learning objectives and outcomes include the strengthening of all four language skills—reading, writing, speaking, and listening—and a richer understanding of Chinese culture and society through a deeper appreciation of its films and their history. Students will read and present on film scholarship, watch and discuss Chinese movies, compose brief essays on them, and write a final paper that integrates primary and secondary materials. The language of instruction is Chinese.
Attribute/Distribution: HU

CHIN 291 Chinese Language & Culture Abroad III 1-8 Credits
Intensive practice of speaking and writing in the language of the country aimed at providing the student with extensive proficiency of expression and the ability to discriminate linguistic usage. Idiomatic expressions and an introduction to stylistics. Reading and analysis of more difficult texts, supplemented by in-depth study of selected aspects of contemporary civilization. Consent of department required. Must have proficiency examination in the target country.
Attribute/Distribution: HU

CHIN 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

CHIN 371 Advanced Readings in Chinese 1-4 Credits
Directed study of an author, genre, or period not covered in regular courses. Can be combined with select Asian Studies courses to include relevant readings in English. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

CHIN 384 Research in Chinese Language and Culture Abroad 1-8 Credits
For students with advanced language skills to do research or work abroad in Chinese (above the third year level). Independent Study.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

French Courses

FREN 001 Elementary French I 4 Credits
Multimedia approach to the study of French. Introduction to French conversation, grammar, and culture.
Attribute/Distribution: HU

FREN 002 Elementary French II 4 Credits
Continuation of FREN 001.
Attribute/Distribution: HU

FREN 011 Intermediate French I 4 Credits
Further acquisition of the fundamentals of French conversation, writing, and culture. Multimedia approach.
Attribute/Distribution: HU

FREN 012 Intermediate French II 0.4 Credits
Continuation of FREN 011.
Attribute/Distribution: HU

FREN 099 French Special Topics 1-6 Credits

FREN 133 (AAS 133, HIST 133, LAS 133, MLL 133, POLS 133)
Lehigh in Martinique: Globalization and Local Identity 3-4 Credits
History, culture, and politics of the French Caribbean island of Martinique, from its position as a key site of the 18th century Atlantic World economy to becoming an official French department and outpost of the European Union. Interdisciplinary perspectives on the complex nature of social identity, historical memory and impact of globalization. No French is required. Offered during winter inter-term through Lehigh Study Abroad.

FREN 143 Advanced Written French 4 Credits
Intensive practice in written French and introduction to literary criticism.
Attribute/Distribution: HU

FREN 144 Advanced Oral French 4 Credits
Emphasis on comprehension and oral performance of the French language. Student acquires confidence in speaking French through discussions of current issues, articles, novels, movies, and other topics. Required for French majors.
Attribute/Distribution: HU

FREN 152 Introduction to Literary Analysis 4 Credits
Exposure to representative French and Francophone works from the Middle Ages to the Twenty-First Century offering various critical strategies needed to read and interpret a literary text.
Attribute/Distribution: HU

FREN 199 French Special Topics 1-6 Credits

FREN 237 Introduction to the Francophone World 4 Credits
Introduction to the Francophone world through a series of texts, films, articles, etc. from Francophone Europe, North Africa, sub-Saharan Africa, Canada, Vietnam, and the Caribbean. Students will become acquainted with Francophone cultures and literatures while developing their interpretative and writing skills. In French.
FREN 242 The Harem in French and Francophone Literature and Film 4 Credits
Explore representations of this forbidden and secret feminine space, the harem, starting with French theater from the 17th century all the way to 20th-21st century Francophone North African novels and film. We will attempt a comparative study between the French and Francophone traditions and will be looking at the harem as a visual as well as textual feminine space from which narratives emerge and the extent to which they constitute a counter-discourse that questions dominant power structures.
Attribute/Distribution: HU

FREN 251 Postcolonizing France: North African Immigration 4 Credits
Depictions of North African immigrants (legal or illegal) and French citizens of North African descent in postcolonial France in novels, film, and Rap music. Explore key concepts such as hospitality, minority ethnic settlement, multiculturalism, nationality and citizenship, racism, extreme-right politics, and anti-discrimination policy, and attempt to see how North African postcolonial identities are articulated in relation to perceptions of French national identity, republican values, universalism, etc.
Attribute/Distribution: HU

FREN 255 Introduction to the Francophone World 4 Credits
Introduction to the Francophone world through a series of texts, films, articles, etc. from Francophone Europe, North Africa, Sub-Saharan Africa, Canada, Vietnam, and the Caribbean. Students will become acquainted with Francophone cultures and literatures while developing their interpretative and writing skills. In French.

FREN 259 (GS 259) Contemporary France 3-4 Credits
How is France defining itself today as a European nation in a global world? Issues to be explored include: family, gender, race and religion, the education and social systems, immigration, and politics. Strongly recommended for students who plan to study abroad in France.
Attribute/Distribution: HU

FREN 271 French Readings 4 Credits
Study of the works of some author or group of authors, or of a period, or of a literary theme.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

FREN 272 French Culture of Business 4 Credits
A course on the fundamentals of business in France. We will learn about banking, marketing, advertising, the stock market, and many other aspects of business in France. We will learn about foreign ventures in France, such as Disney and McDonald’s. We will learn how to open a bank account, apply for a job, and what life is like in a French company. Ideal for someone who wants to intern or work for an international company or a company with a French connection. Taught in French.

FREN 281 French Cultural Program 1-6 Credits
A program in a French-speaking country offering formal language courses and cultural opportunities.
Attribute/Distribution: HU

FREN 299 French Special Topics 1-6 Credits

FREN 300 Apprentice Teaching 1-4 Credits
FREN 311 French Classicism 4 Credits
French classical theater, novel, and criticism, with emphasis on Corneille, Racine, Moliere, Pascal, Lafayette, Malherbe, and Boileau.
Attribute/Distribution: HU

FREN 312 (AAS 312) Modernity in the Maghreb 4 Credits
Emergence of the modern self through a comparative study of textual as well as visual representations of postcolonial subjects by male and female writers and film makers. Study of the way the sociopolitical context of countries such as Morocco, Algeria, and Tunisia informs the constitution of subjectivity within a multicultural and multilingual community. Issues such as patriarchy, nationalism, colonialism, postcolonialism, identity, gender, and Islam in North African literature and film from Franco-Arab traditions.
Attribute/Distribution: HU

FREN 313 The Age Of Enlightenment 4 Credits
The Philosophes and Encyclopédistes of the eighteenth century, with emphasis on Voltaire, Rousseau, Montesquieu, and Diderot.
Attribute/Distribution: HU

FREN 316 Nineteenth Century French Literature 4 Credits
Study of major nineteenth century novelists and poets.
Attribute/Distribution: HU

FREN 318 French Drama in the Twentieth Century 3 Credits
Contemporary French drama with an analysis of its origins and movements.
Attribute/Distribution: HU

FREN 320 Contemporary French Fiction 4 Credits
Reading and discussion of contemporary works of fiction (post1980). Study of how these works fit into the context of French literature and relate more specifically to major literary currents of the twentieth century.
Attribute/Distribution: HU

FREN 321 Twentieth-Century French Short Fiction 4 Credits
Examination, within the framework of short fiction, of the major literary currents that have made up twentieth-century literature. Works by Sartre, Camus, Robbe-Grillet, Le Clézio, Echenoz, Sallenave, Toussaint, Diebar, Ben Jelloun, and others.
Attribute/Distribution: HU

FREN 322 (FILM 322) Contemporary French Films 4 Credits
French Films from the late 1950s to the present. Introduction to cinematographic language and exploration of the issues of gender, power, and madness. Films by Truffaut, J-L Godard, C. Denis, A. Varda, J-J Beineix, E. Rohmer, and others.
Attribute/Distribution: HU

FREN 324 The Outsider In French Fiction 4 Credits
Focus on otherness/difference in French fiction from the eighteenth to the twentieth century. Reading and discussion of short stories and novels by Graffigny, Diderot, Maupassant, Gide, Camus, Duras, Beauvoir, Le Clézio and others.
Attribute/Distribution: HU

FREN 325 (FILM 325) Illegal immigration in Francophone Literature and Film 4 Credits
This course examines representations of illegal immigrants in postcolonial francophone literature and film. We will be looking at visual and textual narratives from and about those who decided to leave their African homeland to seek a better future in Europe despite the very restrictive policies adopted by most of the European Union on illegal immigration. The course will explore issues of postcolonial identity, the notions of borders, displacement, exile, trauma and how they relate to the act of writing.
Attribute/Distribution: HU

FREN 327 (WGSS 327) Women Writing In French 4 Credits
Reading and discussion of works written by women in French. The emphasis is on 19th and 20th century writers, such as G. Sand, Colette S. de Beauvoir, M. Duras, and Andrée Chédid.
Attribute/Distribution: HU

FREN 369 French Readings 4 Credits
Advanced study of an author, period, or theme. Topics vary. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

FREN 370 French Internship 1-8 Credits
Designed to give advanced qualified students the chance to acquire field experience and training with selected firms and governmental agencies in French-speaking countries. Assigned readings, written reports, and employer performance evaluations are required. Consent of instructor required.
Attribute/Distribution: HU

FREN 371 French Independent Study 1-8 Credits
Special topics under faculty guidance, including honors thesis. for credit. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU
GERM 001 Elementary German I 4 Credits
Fundamentals of German; reading and simple texts; simple conversation and composition; vocabulary building. Three class hours plus one laboratory or drill hour each week. No previous German required.
Attribute/Distribution: HU

GERM 002 Elementary German II 4 Credits
Continuation of GERM 1, including reading of more advanced texts. Three class hours plus one laboratory or drill hour each week.
Attribute/Distribution: HU

GERM 011 Intermediate German I 4 Credits
Review of grammar, composition, reading of intermediate texts, vocabulary building.
Attribute/Distribution: HU

GERM 012 Intermediate German II 4 Credits
Continuation of GERM 011.
Attribute/Distribution: HU

GERM 091 German Language & Culture I Abroad 1-8 Credits
Intensive study of conversation in the language of the country; reading, development of writing skills and selected aspects of the culture.

GERM 163 German Civilization and Culture 4 Credits
Cultural, historical, and political evolution of Germany and German-speaking countries in Europe.
Attribute/Distribution: HU

GERM 165 German Through Graphic Novels 4 Credits
This course introduces students to the wide world of German-language graphic novels. In their ever-growing popularity, graphic novels have become a dynamic medium to explore both ordinary and serious topics, such as love, memory, culture, history, trauma, identity, gender, and sexuality. At the same time, graphic novels offer the advanced language-learner an accessible and expressive means to engage with German literature through both text and image. A component of this course will be to review and build on German-language skills.
Attribute/Distribution: HU

GERM 167 German Conversation and Composition 4 Credits
Intensive practice in spoken and written German.
Attribute/Distribution: HU

GERM 169 Business German 4 Credits
German in business, the professions, international, and social relations. Letter writing, comprehension of technical texts, specialized vocabulary, and grammar review.
Attribute/Distribution: HU

GERM 181 German Cultural Program 1-8 Credits
Summer program abroad. Formal instruction in the language and the culture of a German-speaking country.
Attribute/Distribution: HU

GERM 191 German Language & Culture II Abroad 1-8 Credits
Intensive study of conversation in the language of the country; rapid review of basic grammar, the reading and analysis of moderately difficult texts, development of rudimentary writing skills, supplemented study of selected aspects of contemporary civilization. Consent of chair and proficiency examination in the target country is required.

GERM 211 German Drama 4 Credits
Drama as a literary genre; plays from various periods of German literature.
Attribute/Distribution: HU

GERM 218 (MLL 218) Goethe's "Faust" 4 Credits
Study of Goethe's play with an introduction to the Faust tradition and Faustian themes in modern literature.
Attribute/Distribution: HU

GERM 231 (FILM 231, MLL 231) New German Cinema 4 Credits
Viewing, discussion, and written analysis of selected German films.
Attribute/Distribution: HU

GERM 240 Contemporary Germany 4 Credits
Readings and conversations in German about topics including the social and natural sciences, technology, the environment, politics, daily life, and sports. Practice in spoken and written German.
Attribute/Distribution: HU

GERM 250 German Special Topics 1-4 Credits
Literary and linguistic topics not covered in regular courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

GERM 267 Advanced German Conversation and Composition 4 Credits
A continuation of GERM 167. Practice of speaking and writing skills in German through readings of more complex texts.
Attribute/Distribution: HU

GERM 269 Advanced Professional German 4 Credits
A continuation of Business German with an emphasis on specific economic issues affecting contemporary Germany, Switzerland, and Austria. Preparation for the national exam “Certificate for the Professions” and the “International Business German Examination”.
Attribute/Distribution: HU

GERM 281 German Cultural Program 1-8 Credits
Study abroad. Formal instruction in German and direct contact with the people and the culture during at least one month in a German-speaking country. Consent of German study abroad adviser required.
Attribute/Distribution: HU

GERM 291 German Language Culture II Abroad 1-8 Credits
Intensive practice of speaking and writing in the language of the country aimed at providing the student with extensive proficiency of expression and the ability to discriminate linguistic usage. Idiomatic expressions and an introduction to stylistics. Reading and analysis of more difficult texts, supplemented by in-depth study of selected aspects of contemporary civilization. Consent of chair and proficiency examination in the target country is required.

GERM 300 Apprentice Teaching 1-4 Credits

GERM 301 Survey Of German Literature 4 Credits
An overview of German literary traditions through the nineteenth century, focusing on the Middle Ages, Renaissance, Reformation, Baroque, Enlightenment, Classicism, Romanticism, Realism, and Naturalism.
Attribute/Distribution: HU

GERM 303 (ENGL 303, MLL 303, WGSS 303) Grimms' Fairy Tales: Folklore, Feminism, Film 4 Credits
This intercultural history of the Grimms’ fairy tales investigates how folktale types and gender stereotypes developed and became models for children and adults. The course covers the literary fairy tale in Germany, Europe and America. “Little Red Riding Hood”, “Cinderella”, or “Sleeping Beauty” exist not only in the Grimms’ collection but in many forms of world literature/film. Modern authors have rewritten fairy tales in feminist ways, promoting social change. Taught in English. German language students may receive a German component.
Attribute/Distribution: HU

GERM 305 Modern German Literature 4 Credits
Topics in German literature of the twentieth and twenty-first century.
Attribute/Distribution: HU

GERM 310 Transnational Germany 4 Credits
Long before Germany opened up its citizenship laws in the year 2000, it has been a culturally diverse nation. From a historical and cultural perspective, this course will guide students through two significant periods of immigration in Germany’s postwar history: from the wave of labor migration to Germany in the late 1950s, 60s, and early 70s to the arrival of asylum seekers in the 2010s. Engaging with a wide range of media, including historical and legal documents, literature, film, and...
GERM 320 Berlin: Transformations of a Metropolis 4 Credits
A literary and cultural history of Berlin from its foundation to the present. After a historical overview, we will focus on the modern period that covers the Weimar Republic, the Third Reich, the divided city of the postwar era, the fall of the wall, and the continuing process of redefining Berlin’s identity as Germany’s old and new capital.
Attribute/Distribution: HU

GERM 345 German Short Stories 4 Credits
Readings of short prose texts in German.
Attribute/Distribution: HU

GERM 350 German Special Topics 1-4 Credits
Literary or linguistic topics not covered in regular courses. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

GERM 370 German Internships 1-8 Credits
Designed to give advanced qualified students the chance to acquire field experience and training with selected firms and governmental agencies in German-speaking countries. Assigned readings, written reports, and employer performance evaluations are required. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

Hebrew Courses

HEBR 001 Elementary Modern Hebrew I 4 Credits
Class instruction will focus on the introduction of the Hebrew alphabet and basic vocabulary. Instruction will also emphasize the basics of Hebrew listening comprehension, vocabulary, reading, writing, grammar and speaking. Class activities are planned for an inclusive approach to different styles of learning. No previous study of Hebrew required.
Attribute/Distribution: HU

HEBR 002 Elementary Modern Hebrew II 4 Credits
Continuation of HEBR 1. Instruction will focus on expanding Hebrew vocabulary and grammar; introduction of the past tense. Class activities are planned for an inclusive approach to different styles of learning. Hebrew 1 or previous background in Hebrew required.
Attribute/Distribution: HU

HEBR 011 Intermediate Modern Hebrew I 4 Credits
Class instruction will focus on developing fundamental patterns of conversation and expanding grammar. Hebrew 1 and Hebrew 2, or previous background in Hebrew required.
Attribute/Distribution: HU

HEBR 012 Intermediate Modern Hebrew II 4 Credits
Continuation of HEBR 011. Class instruction will focus on developing fundamental patterns of conversation and expanding grammar. Hebrew 1 and Hebrew 2, or previous background in Hebrew required.
Attribute/Distribution: HU

HEBR 151 Hebrew Special Topics 1-4 Credits
Class instruction will focus on cultural, ethnic, and religious dimensions of Israeli society through film. Class discussion and writing in Hebrew will be based on related topics. Consent of instructor required. Taught in Hebrew.
Repeat Status: Course may be repeated.

HEBR 152 Hebrew Special Topics II 4 Credits
Continuation of HEBR 151. Class instruction will focus on cultural, ethnic, and religious dimensions of Israeli society through film. Class discussion and writing in Hebrew will be based on related topics. Consent of instructor required. Taught in Hebrew.
Repeat Status: Course may be repeated.

Japanese Courses

JPNS 001 Elementary Japanese I 4 Credits
This course introduces the basic grammatical structures commonly found in daily situations in Japan. All four aspects of language skills are introduced. Hiragana, Katakana, and approximately 50 Kanji are introduced.
Attribute/Distribution: HU

JPNS 002 Elementary Japanese II 4 Credits
Continuation of JPNS 001. Approximately 100 Kanji are introduced.
Prerequisites: JPNS 001
Attribute/Distribution: HU

JPNS 011 Intermediate Japanese I 4 Credits
Continuation of JPNS 002. This course introduces more complex grammatical structures and develops all four aspects of language skills. Slightly more emphasis on reading and writing. Approximately 100 Kanji are introduced.
Prerequisites: JPNS 002
Attribute/Distribution: HU

JPNS 012 Intermediate Japanese II 4 Credits
Continuation of JPNS 011.
Prerequisites: JPNS 011
Attribute/Distribution: HU

JPNS 099 Japanese Special Topics 1-4 Credits

JPNS 131 Advanced Japanese Reading and Writing I 3 Credits
Reading, translation, and writing practice using authentic Japanese materials.
Prerequisites: JPNS 012
Attribute/Distribution: HU

JPNS 132 Advanced Japanese Reading and Writing II 3 Credits
Continuation of Advanced Japanese Reading and Writing I.
Prerequisites: JPNS 141 or JPNS 131
Attribute/Distribution: HU

JPNS 141 Advanced Japanese I 4 Credits
This course emphasizes advanced reading comprehension on topics related to Japan. Approximately 100 Kanji are introduced.
Prerequisites: JPNS 012
Attribute/Distribution: HU

JPNS 142 Advanced Japanese II 4 Credits
Continuation of JPNS 141.
Prerequisites: JPNS 141
Attribute/Distribution: HU

JPNS 151 Advanced Spoken Japanese 1 Credit
Emphasis on comprehension and oral performance of the Japanese language through discussion of current issues and other topics.
Repeat Status: Course may be repeated.
Prerequisites: JPNS 012
Attribute/Distribution: HU

JPNS 152 Advanced Spoken Japanese II 1 Credit
Continuation of JPNS 151. Emphasis on comprehension and oral performance of Japanese language through discussion of current issues and other topics. Variable content.
Repeat Status: Course may be repeated.
Prerequisites: JPNS 151
Attribute/Distribution: HU

JPNS 199 Japanese Special Topics 1-4 Credits

JPNS 231 Advanced Japanese Reading and Writing I 3 Credits
Reading, translation, and writing practice using authentic Japanese materials.
Prerequisites: JPNS 142 or JPNS 132
Attribute/Distribution: HU

JPNS 232 Advanced Japanese Reading and Writing II 3 Credits
Continuation of Advanced Japanese Reading and Writing I.
Prerequisites: JPNS 142 or JPNS 231
Attribute/Distribution: HU

JPNS 290 Japanese Special Topics 1-4 Credits
Literary or linguistic topics not covered in regular courses. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS
JPNS 291 Advanced Japanese and Culture Abroad 1-8 Credits
Intensive practice of speaking and writing in the language of the country aimed at providing the student with extensive proficiency of expression and the ability to discriminate linguistic usage. Idiomatic expressions and an introduction to stylistics. Reading and analysis of more difficult texts, supplemented by in-depth study of selected aspects of contemporary civilization. Consent of chair and proficiency examination in the target country required. 
Attribute/Distribution: HU

JPNS 299 Japanese Special Topics 1-4 Credits

JPNS 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

JPNS 390 Japanese Special Topics 1-4 Credits
Literary or linguistics topics not covered in regular courses. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

Modern Languages Literatures Courses

MLL 006 Globalization and Cultures 4 Credits
This course is a reflection on the processes of globalization and their consequences, both good and bad, on the world’s societies and on our concepts of culture and identity. It provides a multidisciplinary examination of what cultures gain and lose from their interaction with the rest of the world and what it means to be a citizen of a globalized yet diverse world. 
Attribute/Distribution: HU

MLL 015 (ASIA 015, WGSS 015) Sex, War, Women, Art 4 Credits
Through the study of selected visual and literary works in their historical and social contexts, students will gain knowledge of cultures in Japan. This course examines various cultures from the perspectives of gender and sexuality as constitutive factors of Japanese society. Materials include a film depicting a romantic life of samurai, art works by contemporary artists, and writings on sex workers impacted by the Japanese empire. No prior knowledge of Japanese language is required. An introductory course taught in English. 
Attribute/Distribution: HU

MLL 027 Russian Classics 4 Credits
Russian classics in translation. 
Attribute/Distribution: HU

MLL 051 Contemporary Hispanic-American Literature 4 Credits
Reading and discussion of distinguished Latin American writers: Borges, García Márquez, Cortázar, and Vargas Llosa. 
Attribute/Distribution: HU

MLL 053 This Hispanic World and its Culture 4 Credits
Characteristics and values of the people of Spain and Latin America in literary works and other material. Hispanic cultural contributions to Western civilization. 
Attribute/Distribution: HU

MLL 068 (ASIA 068) Japanese Language: Past and Present 4 Credits
Historical and contemporary aspects of the Japanese language, including the origins of Japanese in relation to Korean, the influence of Chinese, syntactic features which reflect the hierarchical character of Japanese society, differences in female and male speech, and use of foreign loan words. 
Prerequisites: JPNS 001 
Attribute/Distribution: HU

MLL 071 (ASIA 071, HIST 071) Understanding Hong Kong 4 Credits
This course introduces Hong Kong, from its history as a vibrant British colony to its current status as a bustling territory mediating between China and the world. The learning objectives and outcomes consist not only of a knowledge of Hong Kong's significance for global commerce and culture but also of the ability to analyze primary and secondary sources as well as to conduct independent research. All course materials are available in English. 
Attribute/Distribution: HU

MLL 072 (ASIA 072) Ghosts, Monsters, and J-Horror 4 Credits
What’s behind our fascination with the ghost stories? What are some of the social issues that the horror stories examine? What makes us afraid? Examining Japan’s long tradition of horror stories of ghosts and monsters, this course introduces students to various Japanese horror stories, ranging from the classical texts to “J-Horror,” and explores how contemporary forms of popular culture such as anime, manga, and films draw on, or depart from, the traditional images of supernatural beings. 
Attribute/Distribution: HU

MLL 073 (ASIA 073, WGSS 073) Film, Fiction, and Gender in Modern China 4 Credits
Study of the struggle for an individual “modern” identity out of traditionally defined roles for men and women as depicted by Chinese writers and filmmakers. Class, texts, and films in English. Students interested in setting up a corollary Chinese language component for credit as CHIN 371 or CHIN 251, may discuss this possibility with the professor. 
Attribute/Distribution: HU

MLL 074 (ASIA 074) Chinese Cultural Program 1-8 Credits
A summer program in China, taught in English. 
Attribute/Distribution: HU

MLL 075 (ASIA 075, HIST 075) Chinese Civilization 4 Credits
The development of traditional Chinese thought, beliefs, technology, and institutions from a historical perspective. 
Attribute/Distribution: HU, SS

MLL 076 (ASIA 076, HIST 076) Understanding Contemporary China 4 Credits
An overview of recent history, politics, economy, religion, problems of modernization, popular culture. Contemporary Chinese society viewed against the backdrop of tradition and the tumultuous history of twentieth-century China. 
Attribute/Distribution: SS

MLL 078 (ASIA 078) Asian-American Studies 4 Credits
A survey of issues concerning Asians living in the United States from the perspectives of history, language, literature, and film. 
Attribute/Distribution: HU

MLL 099 Modern Languages & Literature Special Topics 1-6 Credits
Repeat Status: Course may be repeated. 

MLL 100 (FILM 100) Introduction to International Film 4 Credits
An introduction to international film traditions and theory. We look at the importance of cinema as both art and entertainment and consider the social, political, and economic role of film in national and global contexts. 
Attribute/Distribution: HU

MLL 110 (ASIA 110, REL 110) Drinking and Immortality 4 Credits
This class explores modes of transcendence and their expression in literature and art, but most especially poetry. The primary focus is the role of drinking alcoholic beverages in traditional Chinese society and religion, but also on other modes and what is meant by the search for immortality - and the use of inner versus outer alchemy - will be examined. 
Attribute/Distribution: HU

MLL 127 (ASIA 127) ORIENTATIONs: Approaches to Modern Asia 4 Credits
An introduction to East, Southeast, and South Asia at the beginning of the 21st century. How is globalization transforming Asian societies? How are Asians represented (or misrepresented) in the West? How do Asian peoples view Western influences on them? What distinguishes our perspectives on politics, individual liberty, civic responsibility, religious faith and practice, work, etc? How is the trend toward globalization in the coming “Asian Century” likely to be affected by the growing assertiveness of nations like China and India? (H/S).
MLL 128 (GS 128) World Stories: Fictional Expressions of Globalization 4 Credits
An introduction to fiction as it reflects and discusses major issues related to globalization. The readings will include a selection of fiction from a diversity of world regions and will introduce the students to a theoretical reflection on the role of literary writing in a globalizing world. Students will be able to gain appreciation for the written fictional text as it takes on a diversity of issues related to globalization in a variety of world regions and cultural perspectives.
Attribute/Distribution: HU

MLL 129 (GS 129) The Global Workplace: Preparing to Work around the World 4 Credits
This course uses modern literature and film to explore current theories of global and intercultural competence as well as practical approaches to the acquisition and development of skills needed to function effectively across cultural boundaries. We'll investigate changing definitions of work over time and across cultures and actively engage with contemporary global issues and the complexities of diverse cultural traditions.
Attribute/Distribution: HU

MLL 130 (ASIA 130, REL 130) Monkey Business 4 Credits
Read and discuss in English the premodern Chinese enlightenment odyssey, the Journey To The West, featuring the famous mischievous and magical martial arts master, the Monkey King. Familiarize yourself with a cultural icon that has entertained and inspired since the 16th century and continues to inspire spin-off dramas, comics, acrobatic and TV shows, movies, and video games.
Attribute/Distribution: HU

MLL 133 (AAS 133, FREN 133, HIST 133, LAS 133, POLS 133) Lehigh in Martinique: Globalization and Local Identity 3-4 Credits
History, culture, and politics of the French Caribbean island of Martinique, from its position as a key site of the 18th century Atlantic world economy to becoming an official French department and outpost of the European Union. Interdisciplinary perspectives on the complex nature of social identity, historical memory, and impact of globalization. No French is required. Offered during winter inter-term through Lehigh Study Abroad.

MLL 140 (ANTH 140, COGS 140) Introduction to Linguistics 4 Credits
Relationship between language and mind; formal properties of language; language and society; how languages change over time. May not be taken pass/fail.
Attribute/Distribution: SS

MLL 165 (ASIA 165) Love and Revolution in Shanghai 4 Credits
Project-based course examines human relationships and political-economic changes in Shanghai through the lens of literature, film, and a selection of other readings. Discussion of conflicts between and influences of pre-communist, communist, and capitalist systems as played out in the Shanghai urban arena.
Attribute/Distribution: HU

MLL 177 (ASIA 177) China Enters the Modern Age 4 Credits
The collapse of the imperial order and China’s agonizing transformation into a modern nation-state over the past 150 years. The impact of imperialism, war, radical social change, and protracted revolution on Chinese traditions, values, and institutions.
Attribute/Distribution: HU, SS

MLL 199 Modern Languages & Literature Special Topics 1-4 Credits
MLL 202 (ENGL 202, GS 202, LAS 202) Latin America In Fact, In Fiction 4 Credits
This class couples a survey of Latin American literature in translation with an interdisciplinary approach to the study of Latin America. Departing initially from readings of literary and cinematographic works, our analyses will engage methodologies from multiple disciplines including history, sociology, and cultural studies. Accordingly, this course will examine critical developments in Latin American aesthetics along with the cultural climates in which they matured. This course assumes no prior study of Spanish, Portuguese, or Latin American culture.
Attribute/Distribution: HU

MLL 211 German Drama 4 Credits
Drama as a literary genre; plays from various periods of German literature.
Attribute/Distribution: HU

MLL 218 (GERM 218) Goethe’s "Faust" 4 Credits
Study of Goethe’s play with an introduction to the Faust tradition and Faustian themes in modern literature.
Attribute/Distribution: HU

MLL 231 (FILM 231, GERM 231) New German Cinema 4 Credits
Viewing, discussion, and written analysis of selected German films.
Attribute/Distribution: HU

MLL 299 Modern Languages & Literature Special Topics 1-6 Credits
MLL 300 Apprentice Teaching 1-4 Credits
MLL 302 (ENGL 302, GS 302, LAS 302) Travel and Adventure in Latin American Fiction 4 Credits
Centering on a corpus of works presenting tales of travel and adventure, this class offers an overview of Latin American narrative genres (including “fantastic” narrative, magical realism, and postmodern fiction) from the mid 20th century to present day. Through close readings of works by Adolfo Bioy Casares and Roberto Bolaño, among others, and the analysis of filmic representations of travel in Latin America, we will examine differing modes of perceiving the region defined as Latin America.
Attribute/Distribution: HU

MLL 303 (ENGL 303, GERM 303, WGSS 303) Grimm’s Fairy Tales: Folklore, Feminism, Film 4 Credits
This intercultural history of the Grimm’s fairy tales investigates how folktales types and gender stereotypes developed and became models for children and adults. The course covers the literary fairy tale in Germany, Europe and America. “Little Red Riding Hood”, “Cinderella”, or “Sleeping Beauty” exist not only in the Grimm’s collection but in many forms of world literature/film. Modern authors have rewritten fairy tales in feminist ways, promoting social change. Taught in English. German language students may receive a German component.

MLL 321 (GS 321) Intercultural Communication 4 Credits
Language is ambiguous by nature and discourse is interpreted in cultural and linguistic contexts. This course covers different cultural and linguistic strategies individuals use to communicate with each other, essential concepts for interacting with individuals from other cultural and linguistic backgrounds, and different strategies of communication as defined by specific cultures. Covering the theory and practice of intercultural interaction, this course examines assumptions about language and culture, and includes practical advice to help students develop the cultural sensitivity essential for.
Attribute/Distribution: HU

MLL 326 Modernity in the Maghreb 4 Credits
The emergence of the modern self through a comparative study of textual as well as visual representations of post colonial subjects by male and female writers and film makers. How the sociopolitical context of countries such as Morocco, Algeria and Tunisia informs the construction of subjectivity within a multicultural and multilingual community. Issues of patriarchy, nationalism, colonialism, post colonialism, identity, gender and religion in North African literature and film from Franco-Arab Traditions Taught in French.
Attribute/Distribution: HU

MLL 389 (IR 389) IR/MLL Capstone Project 4 Credits
A research project on international politics that will include original research in at least one foreign language under the joint supervision of an adviser in IR and one in the relevant language in MLL. Consent of department required.
Attribute/Distribution: SS
RUSS 391 Russian Special Topics 1-4 Credits
Independent study of research under faculty guidance on a literary, linguistic, or methodological topic for credit. May be used to satisfy the doctoral language requirement. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

Spanish Courses
SPAN 001 Elementary Spanish I 4 Credits
Basic conversational Spanish illustrating essential grammatical principles. Reading of simple texts and writing.
Attribute/Distribution: HU
SPAN 002 Elementary Spanish II 4 Credits
Continuation of SPAN 1.
Attribute/Distribution: HU
SPAN 011 Intermediate Spanish I 4 Credits
Limited review of elementary grammar concepts and introduction to more advanced grammar and vocabulary. Emphasis on discussion, reading, and writing about short literary works and current topics in the Spanish-speaking world.
Attribute/Distribution: HU
SPAN 012 Intermediate Spanish II 4 Credits
Continuation of SPAN 011.
Attribute/Distribution: HU
SPAN 091 Spanish Language & Culture Abroad 1-8 Credits
Intensive study of conversation in the language of the country; reading, development of writing skills and selected aspects of the culture.
SPAN 133 Spanish Phonetics and Pronunciation 4 Credits
Comparison of Spanish and English sounds; descriptions of Spanish vowels and consonants in their various positions. Oral practice with special emphasis on accent and intonation patterns.
Attribute/Distribution: HU
SPAN 141 Advanced Spanish Grammar 4 Credits
Intensive review of Spanish grammar with stress on finer points. Analysis of syntax and style. Improvement of grammar through composition. Heritage speakers should substitute with another 100-level class.
Attribute/Distribution: HU
SPAN 142 Advanced Conversational Spanish 4 Credits
Conversational practice stressing the building of vocabulary based on literary texts and topics of general interest. Designed to stimulate fluent and spontaneous use of spoken Spanish. does not count toward completion of major.
Attribute/Distribution: HU
SPAN 151 Cultural Evolution Of Spain 4 Credits
The historical and cultural evolution of Spain. Discussion of representative literary works in their cultural and historical contexts.
Attribute/Distribution: HU
SPAN 152 (LAS 152) Cultural Evolution of Latin America 4 Credits
The historical and cultural evolution of Latin America. Discussion of representative literary works in their cultural and historical contexts.
Attribute/Distribution: HU
SPAN 191 (ALLN 191) Spanish Language & Culture Abroad II 1-8 Credits
Intensive study of conversation in the language of the country; rapid review of basic grammar, the reading and analysis of moderately difficult texts, development of rudimentary writing skills, supplemented study of selected aspects of contemporary civilizations. Prerequisites: Consent of adviser and proficiency examination in the target country.
Attribute/Distribution: HU
SPAN 199 Spanish Special Topics 3-4 Credits
For students who take a course, not offered at Lehigh, at another institution. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU
SPAN 211 (LAS 211) Business Spanish 4 Credits
An introduction to business concepts and vocabulary in Spanish. Specialized professional vocabulary and business culture in Spanish-speaking countries.
Prerequisites: SPAN 141
Attribute/Distribution: HU

SPAN 212 Spanish Writing Skills 4 Credits
Improving writing proficiency through practice in composition and translation.
Prerequisites: SPAN 141
Attribute/Distribution: HU

SPAN 213 (FILM 213, LAS 213) Introduction to Hispanic Literature and Film 4 Credits
An introduction to the analysis of Latin American and Spanish cultural productions.
Prerequisites: SPAN 141
Attribute/Distribution: HU

SPAN 243 (LAS 243) Indigenous Cultures in Spanish America 4 Credits
A survey of Spanish American narratives that deal with the relationship between indigenous and occidental cultures. While examining works created from the late 19th century up until present day, we analyze the construction of cultural identity in several countries including Bolivia, Ecuador, and Mexico. Analysis will include works of poetry, short story, novel, essay, and film by several influential artists: Clorinda Matto de Turner, Jorge Icaza and José María Arguedas, to name just a few.
Prerequisites: SPAN 141
Attribute/Distribution: HU

SPAN 263 (LAS 263) The Spanish American Short Story 4 Credits
Comparative study of representative works by major writers such as Quiroga, Borges, and Cortazar, among others.
Attribute/Distribution: HU

SPAN 265 (FILM 265, LAS 265) Spanish and Latin American Cinema 4 Credits
Prerequisites: SPAN 141
Attribute/Distribution: HU

SPAN 270 Communicating in Spanish for Medical Personnel 4 Credits
For prospective medical personnel communicating with Spanish-speaking patients. Healthcare vocabulary, patient-provider interaction, and cultural background of the Latino patient.
Prerequisites: SPAN 141
Attribute/Distribution: HU

SPAN 275 (LAS 275, WGSS 275) Introduction to Hispanic Women Writers 4 Credits
The objective of this class is to introduce students to Hispanic contemporary female authors from Latin America, Spain, and the United States through the analysis of all literary genres (novel, short story, poetry, essay, and drama). This class provides students with a solid introduction to Hispanic women’s writing from the last years of the Nineteenth Century to the present, as well as to feminist literary theory.
Attribute/Distribution: HU

SPAN 276 (LAS 276) Contemporary Literature Of The Southern Cone 4 Credits
This course focuses on the literature of Argentina, Chile, and Uruguay from the beginning of the 20th Century to the present. It analyzes the works of major authors through different genres studying how they represent history and culture, particularly during periods of political instability and state violence. Texts by Jorge Luis Borges, Pablo Neruda, Manuel Puig, Griselda Gambaro, Cristina Peri Rossi, and Antonio Skarmeta, among others, are studied.
Attribute/Distribution: HU

SPAN 290 Spanish Special Topics 2-4 Credits
Study of an author or theme, or completion of a special project. Topics may vary. for credit.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

SPAN 291 (ALLN 291) Spanish Language & Culture Abroad III 1-8 Credits
Intensive practice of speaking and writing in the language of the country aimed at providing the student with extensive proficiency of expression and the ability to discriminate linguistic usage. Idiomatic expressions and an introduction to stylistics. Reading and analysis of more difficult texts, supplemented by in-depth study of selected aspects of contemporary civilization. Consent of chair and proficiency examination in the target country.

SPAN 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

SPAN 307 (LAS 307) Border-Crossers: The Migrant Experience in Contemporary Mexican and Central American Literature 4 Credits
In recent times, we find ourselves bombarded with highly emotional political opinions about the fate of undocumented immigrants in the United States, many of whom have arrived from Mexico and Central America. In this course we analyze a select list of literary texts and films by Mexican and Central American artists that aim at documenting the factors that cause the exodus of people from these regions of the world and their border-crossing experiences.
Attribute/Distribution: HU

SPAN 308 Literature, Theater, and Film of Post-War Spain 4 Credits
While Franco’s dictatorship caste devastation on an already fragile nation, cultural production born from these oppressive years is some of the richest in modern Spanish history. In examining works by Carmen Laforet, Antonio Buero Vallejo, and Carlos Saura, among others, we will explore the ways in which the genres of literature, theater, and film worked to promote or contest ideologies during times of terror and censorship.
Attribute/Distribution: HU

SPAN 320 (LAS 320) Literature of the Spanish Caribbean 4 Credits
Study of representative works with emphasis on Cuba and Puerto Rico. Writers include Barret, Carpentier, and Rodriguez Julià.
Attribute/Distribution: HU

SPAN 321 (LAS 321) Children and Adolescents in Contemporary Spanish American Literature 4 Credits
Discussion of narrative techniques and the category of the self as they relate to the images of adolescence and childhood in works by such authors as Vargas Llosa, Reinaldo Arenas, José Bianco, Silvina Ocampo.
Prerequisites: LAS 152 or SPAN 152
Attribute/Distribution: HU

SPAN 322 (LAS 322) The Short Novel in Contemporary Spanish American Literature 4 Credits
Reading and discussion of representative works by García Márquez, Onetti, Ruflo, and Böhy Casares, among others.
Attribute/Distribution: HU

SPAN 323 (LAS 323) Literature and Revolution in Contemporary Cuba 4 Credits
Study of literary works and films created after 1959 by dissident, nondissident, and exiled authors and film makers (Edmundo Desnoes, Tomas Gutiérrez Alea, Zoé Valdés, and Pedro Juan Gutiérrez, among others).
Attribute/Distribution: HU

SPAN 324 Narratives of Crisis in Spain: 1898 to the Present 4 Credits
While the economic crisis in Spain has piqued international awareness, the concept of crisis itself is better understood in the larger frame of Spanish modernization. This course will study poetry, literature, and visual culture that attend to distinct moments of crisis that have shaped and contested the formation of Spain from the end of the nineteenth century to the present.
Attribute/Distribution: HU
SPAN 325 (LAS 325) Hispanic Literature of The United States 4 Credits
Discussion of fiction, poetry, drama, and film from the main groups in the U.S. Hispanic population. Discussion of Hispanic ethnic identity, bilingualism, and minority issues.
Attribute/Distribution: HU

SPAN 326 (LAS 326, WGSS 326) Tradition and Resistance: Women Writers of Latin America 4 Credits
Study of poetry and narrative works by Latin American women writers. Authors include Rosario Ferré, Rosario Castellanos, Elena Poniatowska, and Cristina Peri Rossi, among others.
Prerequisites: SPAN 152.
Attribute/Distribution: HU

SPAN 342 (LAS 342) The New Narrative in Spanish American Literature 4 Credits
Critical evaluation of distinguished works of Spanish American prose fiction of the 1960's and 70's. Readings by Donoso, Fuentes, García Márquez, and Vargas Llosa, among others.
Attribute/Distribution: HU

SPAN 345 (LAS 345) Testimonial Writing of the Hispanic World 4 Credits
This course explores the genre testimonio, which confronts the official history of the Latin American and Spanish dictatorships and portrays the experiences and struggles of those who suffered political repression. The course focuses on the analysis of both literary and visual testimonios from the Hispanic world, as well as on theoretical issues concerning discourses of truth.
Attribute/Distribution: HU

SPAN 346 (LAS 346, WGSS 346) Contemporary Hispanic Women Writers: The Novelistas 4 Credits
This course explores the works of Hispanic women writers who have been oppositional to hegemonic cultural politics during the Twentieth Century in Latin America and Spain. Within their particular contexts, we examine issues these writers define as important in their work, their literary and political impact, use of literature to empower minority positions, and their narratives' effects on the changing literary canon. Selected topics include: historical interpretations, exile, forms of violence and repression, expressions of desire, and sexuality.
Attribute/Distribution: HU

SPAN 379 Spanish Internship 2-4 Credits
Designed to give advanced qualified students the chance to acquire field experience and training with selected firms and governmental agencies in Spanish-speaking countries or U.S. agencies serving the Hispanic community. Assigned readings, written reports, and employer performance evaluations are required. Students must be registered through an educational institution to receive credit. Consent of instructor required.
Attribute/Distribution: HU

SPAN 389 Honors Project 1-8 Credits
Repeat Status: Course may be repeated.
SPAN 390 Spanish Special Topics 2-4 Credits
Study of an author, theme or period. Topics vary. for credit. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

SPAN 391 (LAS 391) Melodrama in Contemporary Spanish American Narrative 4 Credits
From the earliest works of Latin American narrative onward, melodrama has served as a fundamental tool for the structuring of dramatic conflict. Ranging from the programmatic social novel to the most parodic contemporary works, we will carefully examine the aims of melodramatic narration in works by Roberto Arlt and Mario Vargas Llosa, among others, as well as in various films and telenovelas.
Attribute/Distribution: HU

SPAN 392 (LAS 392) The City and the Country in Spanish American Narrative 4 Credits
Across the history of the region defined as Latin America, urbanization, on the one hand, and the isolation of national interiors, on the other, have contributed to a problematic relationship between the city and the country. In examining works by the likes of Roberto Arlt, José Donoso, and Mario Bellatin, among others, this course examines the dialogue between the ostensibly separate environs of city and country, and questions they ways in which they influence one another.
Attribute/Distribution: HU

SPAN 393 (LAS 393) The Boom and Beyond 4 Credits
This class will examine works from the so-called Boom of Spanish American literature in the 1960s alongside texts produced following this crucial moment of artistic and social change throughout Latin America. Moving from the Boom toward the postmodern, we will consider works by Gabriel García Márquez, Manuel Puig, and Mario Levrero, among others.
Attribute/Distribution: HU

Music

The study of music develops skills which will serve the student well in any career: self-discipline, teamwork, problem solving and leadership. A student graduating with the B.A. degree in music will have a strong foundation in music theory and substantial exposure to western music from the Middle Ages to the present. A music major or minor taken in conjunction with a business major may lead to a variety of careers in arts management or in the recording and music publishing industries. For some a double major or a minor in music will not lead to a career but to a lifelong involvement with an art form that gives lasting satisfaction. This curriculum will prepare students who wish to continue in music for graduate studies in musicology, music theory, composition, jazz, conducting, or performance.

The music department (http://music.cas2.lehigh.edu) also offers all students in the university significant performance experiences in instrumental and vocal ensembles, large and small, and in private instruction. The Zoellner Arts Center (http://zoellner.cas2.lehigh.edu) facilities include a Listening Library, practice rooms, a composition and digital class piano studio, a fine recording studio, classrooms and rehearsal rooms. Most importantly, the center boasts its concert facility, Baker Hall. With its 1000-seat capacity and excellent acoustics, it is flexible both on the stage (concert or theater mode) and in seating arrangements. The fully adjustable pit can serve opera or musical theatre, can provide additional seating, or can become an extension of the stage.

For more information, contact: HU 210, Room 117, 768-3020

Professors.
David B. Diggs, MMUS (State University of NY at Stony Brook); Michael Jorgensen, DMUS (University of Wisconsin); William Warfield, MMUS (Manhattan School of Music)

Associate Professor. Eugene A. Albulescu, AD (Indiana University Bloomington)

Professor Of Practice. David B. Diggs, MMUS (State University of NY at Stony Brook); Michael Jorgensen, DMUS (Florida State University); Sun Min Lee, MMUS (Westminster Choir College)

Emeritus. Nadine J. Sine, PHD (New York University)

MAJOR PROGRAM
The Bachelor of Arts in Music (36-credit minimum) is for those students who wish to have double majors, who might choose a related field (e.g., arts management, part-time performance careers in orchestras) or who simply want a concentrated exposure to music study. Students choose between five different concentrations: performance; history and literature; theory and composition; jazz; conducting. For those who intend to pursue graduate study in music or a performing career, the major program should be viewed as the minimum requirement. Such students should regularly seek the advice of department faculty in expanding their program to suit their particular needs and goals.

Performance Concentration
Theory and Musicianship Skills
MUS 005 Keyboard Skills 1
MUS 007 Aural Skills 1
### Music History

Select two of the following:

<table>
<thead>
<tr>
<th>Course</th>
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<th>Credits</th>
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<tbody>
<tr>
<td>MUS 233</td>
<td>Medieval and Renaissance Music</td>
<td>3</td>
</tr>
<tr>
<td>MUS 234</td>
<td>Baroque and Classical Music</td>
<td>3</td>
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<tr>
<td>MUS 235</td>
<td>Romantic Music</td>
<td>3</td>
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<tr>
<td>MUS 236</td>
<td>Music Since 1900</td>
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</tr>
<tr>
<td>MUS 336</td>
<td>Seminar in the History of Musical Style</td>
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**Additional Requirements**

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<tr>
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<td>Lessons, ensembles and recitals</td>
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<td>Music electives</td>
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The student must perform a half recital in the junior year, a full recital in the senior year, and juries during the sophomore and junior years. Jury Requirement: see website at [http://www.lehigh.edu/music](http://www.lehigh.edu/music). Students must also complete three semesters of MUS 100 (0 credit P/F) or its equivalent.

### History Concentration

**Theory and Musicianship Skills**

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<td>MUS 007</td>
<td>Aural Skills</td>
<td>1</td>
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<td>MUS 081</td>
<td>Foundations of Western Music</td>
<td>4</td>
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<td>MUS 082</td>
<td>Elementary Harmony</td>
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</tr>
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<td>MUS 083</td>
<td>Advanced Harmony</td>
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<tr>
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<td>MUS 370</td>
<td>Capstone Project</td>
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</table>

1. At least three must be in performance.
2. The students must produce a major research project during the senior year.

Students must also complete three semesters of MUS 100 (0 credit P/F) or its equivalent.

### Composition and Theory Concentration

**Theory**

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<tr>
<td>MUS 007</td>
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<td>MUS 082</td>
<td>Elementary Harmony</td>
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<td>MUS 083</td>
<td>Advanced Harmony</td>
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<tr>
<td>MUS 137</td>
<td>Musicianship I</td>
<td>1</td>
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<td>MUS 138</td>
<td>Musicianship II</td>
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<td>MUS 243</td>
<td>Compositional Practices from 1600-1900</td>
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<td>MUS 245</td>
<td>Classical and Romantic Forms</td>
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**Music History**

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<td>Select one of the following:</td>
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</tr>
<tr>
<td>MUS 233</td>
<td>Medieval and Renaissance Music</td>
<td></td>
</tr>
<tr>
<td>MUS 234</td>
<td>Baroque and Classical Music</td>
<td></td>
</tr>
<tr>
<td>MUS 235</td>
<td>Romantic Music</td>
<td></td>
</tr>
<tr>
<td>MUS 236</td>
<td>Music Since 1900</td>
<td></td>
</tr>
</tbody>
</table>

**Composition**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUS 253</td>
<td>Twentieth Century Composition and Orchestration</td>
<td>4</td>
</tr>
<tr>
<td>MUS 254</td>
<td>Composition II</td>
<td>4</td>
</tr>
</tbody>
</table>

**Additional Requirements**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUS 270</td>
<td>Capstone Preparation</td>
<td>1-4</td>
</tr>
<tr>
<td>MUS 370</td>
<td>Capstone Project</td>
<td>1-4</td>
</tr>
<tr>
<td></td>
<td>Lessons or ensembles</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td></td>
<td>36-42</td>
</tr>
</tbody>
</table>

Students must produce a substantial composition or theoretical analysis under the direction of department faculty during the senior year. A keyboard test is required to enter composition class. Students must also complete three semesters of MUS 100 (0 credit P/F) or its equivalent.

### Jazz Concentration

**Music Theory and Musicianship Skills**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUS 005</td>
<td>Keyboard Skills</td>
<td>1</td>
</tr>
<tr>
<td>MUS 007</td>
<td>Aural Skills</td>
<td>1</td>
</tr>
<tr>
<td>MUS 082</td>
<td>Elementary Harmony</td>
<td>3</td>
</tr>
<tr>
<td>MUS 083</td>
<td>Advanced Harmony</td>
<td>3</td>
</tr>
</tbody>
</table>

**Jazz History**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUS 127</td>
<td>Elements of Jazz and Commercial Music</td>
<td>3</td>
</tr>
<tr>
<td>MUS 139</td>
<td>Jazz Theory I</td>
<td>3</td>
</tr>
<tr>
<td>MUS 140</td>
<td>Jazz Theory II</td>
<td>3</td>
</tr>
</tbody>
</table>

**Small Jazz groups**

Select a minimum of 4 credits:

- MUS 049 Small Jazz Ensembles

**Jazz Performance**

Select six credits:

- MUS 024 Jazz Ensemble
- MUS 027 Jazz Orchestra

**Additional Requirement**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUS 270</td>
<td>Capstone Preparation</td>
<td>1-4</td>
</tr>
<tr>
<td>MUS 370</td>
<td>Capstone Project</td>
<td>1-4</td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td></td>
<td>35-41</td>
</tr>
</tbody>
</table>

Students must also complete three semesters of MUS 100 (0 credit P/F) or its equivalent.

1. Under faculty direction.

### Conducting Concentration

**Music Theory and Musicianship Skills**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUS 005</td>
<td>Keyboard Skills</td>
<td>1</td>
</tr>
<tr>
<td>MUS 007</td>
<td>Aural Skills</td>
<td>1</td>
</tr>
<tr>
<td>MUS 082</td>
<td>Elementary Harmony</td>
<td>3</td>
</tr>
<tr>
<td>MUS 083</td>
<td>Advanced Harmony</td>
<td>3</td>
</tr>
</tbody>
</table>

**Music History**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUS 336</td>
<td>Seminar in the History of Musical Style</td>
<td>3</td>
</tr>
</tbody>
</table>

Select two of the following:

- MUS 233 Medieval and Renaissance Music
- MUS 234 Baroque and Classical Music
- MUS 235 Romantic Music
- MUS 236 Music Since 1900

**Conducting**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MUS 321</td>
<td>Conducting I</td>
<td>2</td>
</tr>
<tr>
<td>MUS 322</td>
<td>Conducting II</td>
<td>2</td>
</tr>
</tbody>
</table>

Select at least two of the following:

- MUS 311 Conducting Internship (one must be in orchestra)

**Additional Requirement**

<table>
<thead>
<tr>
<th>Course</th>
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<th>Credits</th>
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<tbody>
<tr>
<td>MUS 270</td>
<td>Capstone Preparation</td>
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</tr>
<tr>
<td>MUS 370</td>
<td>Capstone Project</td>
<td>1-4</td>
</tr>
</tbody>
</table>
A piano proficiency exam must be completed before the end of the sophomore year. The student must undertake a senior project under faculty direction. Students must also complete three semesters of MUS 100 (0 credit P/F) or its equivalent.

**BACHELOR OF ARTS IN MUSIC COMPOSITION**

The Bachelor of Arts in Music Composition is designed for students committed to pursuing music composition beyond the undergraduate level. It is an intensive composition program with a 54-credit minimum.

**Music Theory**
- MUS 082 Harmony I 3
- MUS 003 Keyboard Harmony II 1
- MUS 007 Aural Skills 1
- MUS 083 Harmony II 3
- MUS 004 Keyboard Harmony III 1
- MUS 008 Aural Skills II 1
- MUS 139 Jazz Theory 3
- MUS 243 Counterpoint 4
- MUS 137 Musicianship I 1
- MUS 245 Classical and Romantic Forms 4
- MUS 138 Musicianship II 1

**Music History**
- MUS 236 Music Since 1900 3
- MUS 336 Seminar in the History of Musical Style 3

Select one of the following:
- MUS 129 Jazz History II
- MUS 233 Medieval and Renaissance Music
- MUS 234 Baroque and Classical Music
- MUS 235 Romantic Music

**Composition**
- MUS 253 Composition I 4
- MUS 254 Composition II 4

Select two semesters of the following:
- MUS 353 Composition Seminar
- MUS 321 Conducting I (one semester) 2

**Electives**
- Select six credits of music electives. 6

Total Credits 54

**MINOR PROGRAMS**

**Minor in Music**

The minor requires a minimum of 17 credits. The program is designed to be flexible but must include:

- MUS 005 Keyboard Skills 1
- MUS 007 Aural Skills 1
- MUS 011 Basic Musicianship 2
- MUS 082 Elementary Harmony 3

4-6 credits from department offerings 4-6

Select two performance courses: 2

Total Credits 16-18

Students who test out of any courses (such as MUS 005), may take any course as electives to make a total of 17 credits. Students must also complete three semesters of MUS 100 (0 credit P/F) or its equivalent.

**MINOR IN MUSIC INDUSTRY**

The music industry minor is intended to provide exposure to basic information, issues and skills useful for students who may want to pursue entry level positions in the music business or to promote their own work. The Music Industry Minor is currently in Review and therefore on Hiatus for the 2019-20 academic year, but the courses are still being offered.

There are six required courses:

- MUS 161 Production and Marketing of Sound Recording 3
- MUS 164 Management Of Careers in Performing Arts 3
- MUS 261 Recording Techniques I 3
- MUS 010 Basic Skills in Music 2
  - or MUS 011 Basic Musicianship 3
- MUS 361 Music Internship 3
- ACCT 108 Fundamentals of Accounting 3
  - or ACCT 151 Introduction to Financial Accounting 3

Total Credits 17

**MUSIC OPTION**

Although Music and Engineering/Science is not a major in itself, Lehigh attracts many engineering and science students who wish to continue their active involvement in music and the music department. For those students who are interested in pursuing this option, music can be taken as a dual degree (B.S. or B.A.), minor or elective.

**CONCERT REQUIREMENT**

Majors and minors must enroll in MUS 100 and attend concerts approved by the music department for a minimum of three semesters.

**DEPARTMENTAL HONORS**

A student must have a 3.75 average in courses in the major to pursue honors. Candidates for departmental honors should submit to the department chair a written proposal, prepared in consultation with a faculty project adviser by the end of the junior year. The project which must go beyond required course work could result in a research paper, a composition or a performance. Upon acceptance of the proposal by the department faculty, the student should register for MUS 350 for one to six credits, which may be taken all at once or over the senior year. The awarding of departmental honors will be contingent on the quality of the completed project. Students who complete two concentrations in the major may also petition for consideration.

**PRIVATE LESSONS**

Lessons in most instruments and voice may be taken for one credit per semester; students may also enroll for no credit to avoid overloading. Lessons must be arranged through the department at set fees that are not included in tuition. Please note that registering for lessons cannot guarantee availability due to difficulties in scheduling.

**PERFORMING GROUPS**

Admission to performing ensembles is by audition (except Choral Union, Symphonic Band and Marching 97). Students receive one credit per semester by registering for the appropriate course number. Students may also register for zero credit as indicated in the catalog. Although there is no limit to the number of these courses that may be taken, students should check with their adviser to determine the number that may be applied toward graduation.

**COURSE OFFERINGS**

PLEASE NOTE: The course offerings are currently under revision and may not all be available at the time of registration. Please see the Music Department Webpage (https://music.cas2.lehigh.edu) for more information regarding Courses and Programs.
Courses

MUS 002 Keyboard Harmony I 1 Credit
For intended majors and minors only. Beginning piano skills designed to enable the student to use the piano as a tool. Major and minor scales in both hands, forming chords, elementary sight reading. Students may test out upon examination.
Corequisites: MUS 011
Attribute/Distribution: HU

MUS 003 Keyboard Harmony II 1 Credit
Continuation of MUS 2. Diatonic progressions in major and minor and more advanced sight reading. Students may test out upon examination.
Prerequisites: MUS 011
Corequisites: MUS 082
Attribute/Distribution: HU

MUS 004 Keyboard Harmony III 1 Credit
Additional keyboard skills, including progressions with secondary chords, modulations, and sight reading. Students may test out upon examination.
Prerequisites: MUS 0082
Corequisites: MUS 083
Attribute/Distribution: HU

MUS 005 Keyboard Skills 0.1 Credits
For intended music minors and majors only. Piano competence including scales, prepared pieces, sight reading and other skills. Leading to the Piano Proficiency exam requirement for all majors. Course may be repeated until Piano Proficiency exam passed.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 007 Aural Skills 0.1 Credits
Intended for both music majors and minors only, this course focuses on singing, playing, and writing melodies/rhythms/harmonies in different tonalities and scales. It also explores chromaticism, mixed meters, singing and playing two-part music simultaneously, and singing together in parts. Leads to Aural Proficiency exam for all majors.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 008 Aural Skills II 1 Credit
Continuation of MUS 007.
Prerequisites: MUS 0082
Corequisites: MUS 083
Attribute/Distribution: HU

MUS 010 Introduction to Western Music 3 Credits
Music can express that which cannot be said in words. This is part of the reason that it has been cherished in every culture in the history of humanity. By learning and applying active listening skills through a survey of Western Art Music, students develop an ability to think critically about music and to write intelligently about a wide range of musical experience. Intended for those not planning to major or minor in music.
Attribute/Distribution: HU

MUS 011 Basic Musicianship 2 Credits
For intended majors and minors. Development of basic skills in using notation, sight singing and ear training.
Corequisites: MUS 002
Attribute/Distribution: HU

MUS 012 Surveys In Music 3 Credits
An introductory level course on a variety of topics in music. Repeatable as course topic changes.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 013 Music Cultures of the World 3 Credits
An introduction to different musical styles and the aesthetic and humanistic approaches in understanding art, folk, traditional and popular music of the world.
Attribute/Distribution: HU

MUS 021 Marching Band 0.1 Credits
No audition required for admission.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 022 Wind Ensemble 0.1 Credits
Admission by audition.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 023 Symphonic Band 0.1 Credits
No audition required for admission.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 024 Jazz Ensemble 0.1 Credits
Up to six credits may be used for graduation credit in CEAS and CBE. Admission by audition.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 027 Jazz Orchestra 0.1 Credits
Student/community/professional musicians performing classic, contemporary and original big band literature.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 030 University Choir 0.1 Credits
Admission by audition.
Repeat Status: Course may be repeated.
Corequisites: MUS 031
Attribute/Distribution: HU

MUS 032 Choral Union 0.1 Credits
No audition required for admission.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 033 Freshman Lab Choir 0 Credits
Admission by audition.
Attribute/Distribution: HU

MUS 035 Dolce Women's Choir 0.1 Credits
Women from university choir sing treble music.
Repeat Status: Course may be repeated.
Corequisites: MUS 031
Attribute/Distribution: HU

MUS 037 Scenes from Opera 0.1 Credits
Work on stage movement, characterization, etc. Leading to a performance at the end of the semester. By audition only.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 038 Chamber Music Collegium 0.1 Credits
Admission by audition.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 049 Small Jazz Ensembles 0.1 Credits
Admission by audition.
Repeat Status: Course may be repeated.
Attr
MUS 067 Class Drum Set for Beginners 0,1 Credits
Rudiments of drum set playing for students with less than a year of drum instruction. Fees associated with course.
Attribute/Distribution: HU

MUS 068 Class Piano for Beginners I 0,1 Credits
Instruction for beginning piano students, including rudiments of musical notation in relation to the keyboard; beginning pieces for solo piano and the group. Fees associated with course.
Attribute/Distribution: HU

MUS 071 Private Piano Study 0,1 Credits
Up to six credits may be used for graduation credit in CEAS and CBE. Fees associated with course.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 072 Private Vocal Study 0,1 Credits
Private instruction. Fees associated with course.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 073 Private String Study 0,1 Credits
Private instruction. Fees associated with course.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 074 Private Woodwind Study 0,1 Credits
Private instruction. Fees associated with course.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 075 Private Brass Study 0,1 Credits
Private instruction. Fees associated with course.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 076 Private Percussion Study 0,1 Credits
Private instruction. Fees associated with course.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 077 Private Organ Study 0,1 Credits
Private instruction. Fees associated with course.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 078,0,1 Credits
Private instruction. Fees associated with course.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 079 Private Electric Guitar Study 0,1 Credits
Private instruction. Fees associated with course.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 081 Foundations of Western Music 4 Credits
Introduction to the elements of Western music: pitch and rhythm recognition, intervals, scales, keys, diatonic harmonies, etc. Overview of Western music's history and forms. Analysis of a masterpiece from various points of view. Getting into the habit of attending, reporting on, and enjoying live concerts. Students should be able to read music.
Attribute/Distribution: HU

MUS 082 Elementary Harmony 3 Credits
Exercises in writing in four-part chorale style. This includes all diatonic chords and non-harmonic tones. Elementary modulation and secondary dominants are introduced. Open to majors or non-majors.
Prerequisites: MUS 081
Attribute/Distribution: HU

MUS 083 Advanced Harmony 3 Credits
Continuation of Elementary Harmony – Includes advanced modulation, chromatic chords and harmony, and introduction to 20th century harmonic idioms. Course will prepare students continuing on to graduate school to take harmony exams for placement.
Prerequisites: MUS 082
Attribute/Distribution: HU

MUS 084 Private Drumset Study 0,1 Credits
Private Instruction. Fees associated with the course.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 087 Class Drum Set for Intermediate Players 0,1 Credits
Continuation of MUS 067: Class Drum Set for Beginners.
Prerequisites: MUS 067
Attribute/Distribution: HU

MUS 088 LehighArts LIVE (1) 1 Credit
Offered in the second half of the semester, this course is run entirely through Course Site. It requires students to attend seven arts events and write reaction papers on each along with a final essay.

MUS 100 Concert Requirement 0 Credits
Three concerts approved by the department (for majors and minors).
Repeat Status: Course may be repeated.

MUS 120 Beethoven: The Composer as Hero 3 Credits
An introduction to Beethoven's life and works in the context of the rapid transformation of European Society and its systems of government and religion, from Enlightenment to Revolution to Early Romanticism.
Attribute/Distribution: HU

MUS 121 Master Works 1-4 Credits
Works of one or more composers studied in depth. Repeatable as course topic changes.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 122 Piano Literature 3 Credits
Survey of keyboard music from 1600 through today. Emphasis on major composers from Baroque, Classical, Romantic and Modern styles, as well as developments of keyboard instruments and their influence on compositional styles.
Attribute/Distribution: HU

MUS 123 Symphonic Literature 3 Credits
A study of the history of orchestra literature from Baroque to the 21st Century, the orchestra as an ensemble and the orchestra as social construct.
Attribute/Distribution: HU

MUS 125 Dark Romanticism in Music: The Sublime, the Uncanny, and the Psychological Confession 3 Credits
This course will examine works by Western classical music composers that were engaged with philosophical and emotional concepts of Romanticism in the nineteenth-century. As a response to the rational Enlightenment culture of the 1700s, composers wrote about the power of Nature, emotions, primitive instincts, and a fascination with the grotesque and gothic. In addition to listening to works, students will consider related works of visual art, literature and philosophical essays. They will be required to attend exhibits, lectures, performances.
Attribute/Distribution: HU

MUS 126 Music and the Creative Arts 3 Credits
This course examines collaborations, convergences and cross-influences between musicians, visual artists and other creatives in late 19th-early 20th century Europe and America. Students explore ways artists responded as individuals and collaborators, gain perspective on aesthetic movements including romanticism, realism, impressionism, symbolism, expressionism, futurism, dada, surrealism, and how these movements shaped the development of modernist culture. Students work with materials in the Music Department and LU Art Galleries teaching collection, studying the connections between music and visual works.
Attribute/Distribution: HU

MUS 127 Elements of Jazz and Commercial Music 3 Credits
Introductory course intended for music majors or non music majors. A synopsis and exploration of the social history and musical foundations of jazz and how they relate to contemporary popular music today.
Attribute/Distribution: HU
MUS 128 (AAS 128) Jazz History I 3 Credits
A study of the roots of jazz. Starting in West Africa, the course traces the synthesis of African and European elements to 1945. Musicians covered are Gottshalk, Bolden, Morton, Armstrong, Hawkins, Basie, Ellington and others.
Attribute/Distribution: HU

MUS 129 (AAS 129) Jazz History II 3 Credits
A survey of modern jazz from 1945 to the present. Musicians covered include Parker, Gillespie, Monk, Davis, Coltrane, Hancock, and Coleman. Can be taken independently of Jazz History I, but the first course would be helpful.
Attribute/Distribution: HU

MUS 130 Jazz Masters 3 Credits
An in-depth study of the music of a single major figure in jazz history, such as Miles Davis, Ornette Coleman, Duke Ellington. May be repeated for credits as title varies.
Attribute/Distribution: HU

MUS 137 Musicianship I 1 Credit
Continuation of keyboard and aural skills.
Corequisites: MUS 243

MUS 138 Musicianship II 1 Credit
Continuation of keyboard and aural skills.
Corequisites: MUS 243
Attribute/Distribution: HU

MUS 139 Jazz Theory I 3 Credits
Study of the Jazz/Commercial Music theory that is the foundation of a good jazz solo, composition or arrangement. A course designed to give instruction in basic chord progressions, functional analysis of jazz tunes, and ear training.
Prerequisites: MUS 081 and MUS 127
Attribute/Distribution: HU

MUS 140 Jazz Theory II 3 Credits
The course is designed as an in-depth exploration of the elements, origins and practical application of Jazz music theory.
Prerequisites: MUS 139
Attribute/Distribution: HU

MUS 149 The String Quartet 3 Credits
The string quartet has often been the medium for Western composers’ most complex and personal music. The course will examine the literature for the string quartet starting from the works of Haydn and ending with contemporary works by living American composers. In analyzing these works, the student should gain an understanding of the evolution of style in Western music through the lens of the string quartet, as well as an understanding how the string quartet reflects the internal evolution of the.
Prerequisites: MUS 081
Attribute/Distribution: HU

MUS 151 Vocal Diction 1 Credit
Introduction to the use of the International Phonetic Alphabet. Application to French, Italian, German and English diction using art song repertoire. Preparation of a song in each language.
Attribute/Distribution: HU

MUS 156 Survey of Western Music 3 Credits
A chronological survey of the development of western art music from chant to the 21st century with emphasis on analysis of forms, genres, and musical language viewed in cultural context. Open to anyone who can read music.
Attribute/Distribution: HU

MUS 161 Production and Marketing of Sound Recordings 3 Credits
Foundations for organizing a recording project to be carried out by the class, which works in teams. This course will focus especially on artist negotiations, recording techniques, music publishing and manufacturing.
Attribute/Distribution: ND

MUS 164 Management Of Careers in Performing Arts 3 Credits
An overview of what performing artists and managers experience during cycles of career development. Topics include recognition of talent, positioning in the marketplace, creating support structures and attainment of personal goals. Students will be required to apply practical techniques in furthering the career of a chosen artist.
Attribute/Distribution: ND

MUS 167 Intermediate Drum Set Class 0,1 Credits
For students who have taken MUS 067: Beginner drum set class. Fees associated with the course.
Prerequisites: MUS 067
Attribute/Distribution: HU

MUS 170 Private Instruction for Performance Concentrators 2 Credits
Lesson fees apply. Repeatable for credit. Restricted to music majors concentrating in performance.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 213 Drum and Gongs: Asian Music Cultures 3 Credits
A study of Asian music history, theory, aesthetics and cultures through hands-on performance workshops, lectures and seminars.
Attribute/Distribution: HU

MUS 222 Conducting I 2 Credits
Beginning study of conducting techniques, including score reading and preparation, analysis, conducting patterns and gestures. Open to anyone who can read music.
Attribute/Distribution: HU

MUS 233 Medieval and Renaissance Music 3 Credits
Development of musical style from early Christian chant to the sacred and secular forms of the late 16th century, viewed in cultural contexts.
Attribute/Distribution: HU

MUS 234 Baroque and Classical Music 3 Credits
The major genres and composers of the 17th and 18th centuries studied in their cultural context.
Attribute/Distribution: HU

MUS 235 Romantic Music 3 Credits
Study of the major composers and their works from late Beethoven to Mahler and Strauss.
Attribute/Distribution: HU

MUS 236 Music Since 1900 3 Credits
Beginning with the major trends at the turn of the century, a study of the important composers and works of the last century to the present.
Attribute/Distribution: HU

MUS 243 Compositional Practices from 1600-1900 4 Credits
The analysis and composition of pieces in the standard forms of the Baroque, Classical, and Romantic eras in Western music. Exercises in chromatic harmony. During the course students will write Chorale Variations, a Two-Part Invention, a Fugue, a Song, a Minuet, and an Intermezzo. They will analyze pieces in the following forms: Fugue, Variations, and Sonata Allegro.
Prerequisites: MUS 082
Attribute/Distribution: HU

MUS 245 Classical and Romantic Forms 4 Credits
Analyzing and writing pieces in classical and romantic forms. Exercises in chromatic harmony.
Prerequisites: MUS 243
Corequisites: MUS 138
Attribute/Distribution: ND

MUS 247 Advanced Musicianship 1 Credit
To teach students advanced exercises in sight singing and ear training.
Prerequisites: MUS 008

MUS 251 Special Topics 1-3 Credits
Study of musical topics in history or composition not covered in regular courses. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU
MUS 253 Twentieth Century Composition and Orchestration 4 Credits
Writing for the standard Western orchestral instruments based on 20th
century models. Use of the computer for score preparation and as a tool
for music composition. Students will be required to purchase the Sibelius
music-writing software.
Prerequisites: MUS 082
Attribute/Distribution: HU

MUS 254 Composition II 4 Credits
Continuation of MUS 253.
Prerequisites: (MUS 253)
Attribute/Distribution: ND

MUS 261 Recording Techniques I 3 Credits
Recording music in various popular and classical styles using state of
the art studio equipment. Topics include microphone choice, placement,
mixing, effects processing, digital editing and post production.
Attribute/Distribution: ND

MUS 262 Recording Techniques II 3 Credits
Continuation of Recording Techniques I.
Prerequisites: (MUS 261)
Attribute/Distribution: ND

MUS 270 Capstone Preparation 1-4 Credits
Students will work closely with a faculty supervisor toward planning and
implementing their final Capstone project in the areas of performance,
composition, research thesis or some combination agreed upon. For Music Majors only. May be taken in the Junior year.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 291 Independent Study 1-3 Credits
Individually supervised work in history or composition, or continuation of
projects begun in regular courses. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 300 Apprentice Teaching 1-3 Credits
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

MUS 311 Conducting Internship 2 Credits
Work under the direction of one of the faculty directors to learn the
organization and musical tasks required of directors as they prepare
ensembles for performance.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 312 Advanced Choral Composition 2 Credits
Intensive, weeklong seminar/workshop for individual study with
international faculty. Joint seminars and lab choir rehearsals on choral
literature; rehearsals and premieres of student works. New works
and repertoire presented in final concert conducted by faculty and
participants.

MUS 321 Conducting I 2 Credits
Beginning study of conducting techniques, including score reading and
preparation, analysis, conducting patterns and gestures.
Prerequisites: (MUS 083)
Attribute/Distribution: HU

MUS 322 Conducting II 3 Credits
Continuation of MUS 222.
Prerequisites: MUS 222 and MUS 243
Attribute/Distribution: HU

MUS 336 Seminar in the History of Musical Style 3 Credits
Study and analysis of the development of musical language and genre
from the middle ages to the present.
Prerequisites: MUS 083
Can be taken Concurrently: MUS 083
Attribute/Distribution: ND

MUS 350 Senior Project 1-6 Credits
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

MUS 353 Composition Seminar 3 Credits
Seminar review of original compositions alternating with private lessons
in composition. The seminar is intended for students doing either
independent work in composition or senior projects.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

MUS 361 Music Internship 3 Credits

MUS 370 Capstone Project 1-4 Credits
The Capstone Project is the final assessment for the music major in the
areas of performance, composition, research thesis or a combination
thereof as agreed with the faculty supervisor. For Music Majors only.
Repeat Status: Course may be repeated.
Prerequisites: MUS 270
Attribute/Distribution: HU

MUS 389 Honors Project 1-8 Credits
Repeat Status: Course may be repeated.

MUS 412 Advanced Choral Composition 2 Credits
Intensive, weeklong seminar/workshop for individual study with
international faculty. Joint seminars and lab choir rehearsals on choral
literature; rehearsals and premieres of student works. New works
and repertoire presented in final concert conducted by faculty and
participants.

Philosophy

Don’t Prepare for One Career—Prepare for Any Career—Philosophy
does more than prepare you for a single career - it gives you the skills
and information necessary for a lifetime of work. In fact, studying
philosophy promotes the proficiencies that are increasing necessary to
a full and prosperous human life: Logical Argument, Critical Thinking,
Creativity and A Fundamental Understanding Of What It Means To
Be A Moral Agent. These skills are the cornerstones of all human
endeavors and actively support the varied careers of the future worker,
who, according to the Pew Research Center (2017), must “learn to
deploy creativity, collaborative activity, abstract and
systems thinking, complex communication and the ability to thrive in
diverse environments.”

With a major or minor in philosophy, it will become “…second nature,
for the student to view everything from the perspective of systematic
inquiry, see individual things not in isolation but rather in their
intellectual interconnection and place them in a larger context” (Friedrich
Schleiermacher, 1808). Philosophical proficiencies will provide one with
the expertise to navigate through the challenges of the present, but,
in providing an understanding of the evolution of critical thought and
its application to human beings as agents in the economic and socio-
political world, also prepare students for challenges and lives not yet
imagined.

Originally encompassing all fields of study, philosophy remains the
foundational discipline of all the disciplines at the university and the
core of a liberal arts education. At once both highly theoretical and
profondly practical, philosophical thinking is reflective and critical
conceptual activity concerned with some of the most enduring and
challenging of fundamental questions about the nature, meaning, and
possibilities of human existence, the world, and the ways we think
about them. What makes humans human? What is the best way to
live? What can we know? What really exists? How can we think well?
What are goodness, truth, beauty, space, time, causation, language,
consciousness, happiness, freedom, rationality, justice? Philosophers
are gripped by such questions and seek to address them through
creatively critical thinking, reasoned analysis and argumentation, and
thoughtful discussion, instead of making assumptions or accepting
answers to them based on opinion or prejudice. The study of philosophy
develops skills in careful and flexible thinking, critical analysis, sound
reasoning and argumentation, objective evaluation, clear and persuasive
writing, and the toleration of uncertainty.
**Professors.** Gordon C. F. Bearn, PHD (Yale University); Mark H. Bickhard, PHD (University of Chicago); Robin S. Dillon, PHD (University of Pittsburgh); John Martin Gillroy, PHD (University of Cambridge); Roslyn E. Weiss, PHD (Columbia University); Aladdin M. Yaqub, PHD (University of Wisconsin)

**Associate Professor.** Chad Kautzer, PHD (State University of NY at Stony Brook)

**Assistant Professors.** Ricki L. Bliss, PHD (University of Melbourne); Filippo Gabrio Edoardo Casati, PHD (University of St Andrews); Patrick Connolly, PHD (University of North Carolina Chapel Hill)

**Emeriti.** Robert F. Barnes, Jr., PHD (University of California, Berkeley); Steven L. Goldman, PHD (Boston University); J. Ralph Lindgren, PHD (Marquette University); Norman P. Melchert, PHD (University of Pennsylvania)

**THE MAJOR PROGRAM**

The major program in philosophy is designed to provide a broad exposure to the major areas of philosophy as well as a strong grounding in the history of the western philosophical tradition. The program emphasizes the close reading and critical evaluation of classic texts from ancient times to the present, and students can expect to develop sophisticated analytic and expository skills that will enable them to engage in original, critical reflection on their own. The major program provides excellent preparation for graduate study in philosophy as well as a solid foundation for any career that places a premium upon clear, careful thinking, rigorous conceptual and analytical skills, and effective written and oral communication.

The major consists of a minimum of 40 credits in philosophy. Independent study courses cannot be used to satisfy the requirement for advance courses (those at or above the 200 level) in either the major or the minor. Under special circumstances a student may petition the department for a one-course exception to this rule.

**Major Requirements**

**Thesis and Methods**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>PHIL 292</td>
<td>Philosophical Methods</td>
<td>2</td>
</tr>
<tr>
<td>or PHIL 301</td>
<td>Philosophical-Policy &amp; Legal Design: Methods &amp; Applications</td>
<td>2</td>
</tr>
<tr>
<td>PHIL 390</td>
<td>Senior Thesis I</td>
<td>2</td>
</tr>
<tr>
<td>PHIL 391</td>
<td>Senior Thesis II</td>
<td>4</td>
</tr>
</tbody>
</table>

**Disciplinary Areas**

**Logic**

Select one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHIL 114</td>
<td>Symbolic Logic</td>
</tr>
<tr>
<td>PHIL 214</td>
<td>Topics in Philosophical Logic</td>
</tr>
<tr>
<td>PHIL 303</td>
<td>Mathematical Logic</td>
</tr>
</tbody>
</table>

**Ethics**

Select one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>PHIL 105</td>
<td>Ethics</td>
</tr>
<tr>
<td>PHIL 116</td>
<td>Bioethics</td>
</tr>
<tr>
<td>PHIL 205</td>
<td>Contemporary Ethics</td>
</tr>
<tr>
<td>PHIL 206</td>
<td>Figures/Themes in Ethics</td>
</tr>
</tbody>
</table>

**History of Philosophy**

Select two of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>PHIL 131</td>
<td>Ancient Philosophy</td>
</tr>
<tr>
<td>PHIL 132</td>
<td>Hellenistic Philosophy</td>
</tr>
<tr>
<td>PHIL 133</td>
<td>Medieval Philosophy</td>
</tr>
<tr>
<td>PHIL 135</td>
<td>Modern Philosophy</td>
</tr>
<tr>
<td>PHIL 137</td>
<td>Nineteenth Century Philosophy</td>
</tr>
<tr>
<td>PHIL 139</td>
<td>Contemporary Philosophy</td>
</tr>
<tr>
<td>PHIL 231</td>
<td>Figures and Themes in Ancient Philosophy</td>
</tr>
<tr>
<td>PHIL 232</td>
<td>Figures/Themes in Hellenistic Philosophy</td>
</tr>
<tr>
<td>PHIL 233</td>
<td>Figures/Themes in Medieval Philosophy</td>
</tr>
<tr>
<td>PHIL 235</td>
<td>Figures/Themes in Modern Philosophy</td>
</tr>
<tr>
<td>PHIL 237</td>
<td>Figures/Themes in Nineteenth Century Philosophy</td>
</tr>
<tr>
<td>PHIL 239</td>
<td>Figures/Themes in Contemporary Philosophy</td>
</tr>
</tbody>
</table>

**Advanced Courses**

Select 12 credits of courses at the 200-level or above

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHIL 200</td>
<td>Ways of Knowing</td>
<td>4</td>
</tr>
<tr>
<td>PHIL 201</td>
<td>Reflecting on Reality</td>
<td>4</td>
</tr>
<tr>
<td>PHIL 250</td>
<td>Philosophy of Mind</td>
<td>4</td>
</tr>
</tbody>
</table>

**Total Credits**

40

**Writing-Intensive Requirement**

Majors are strongly encouraged to fulfill their junior writing-intensive requirement by taking a WI-designated philosophy course.

**SENIOR THESIS**

The senior thesis is a year-long independent project during which philosophy majors, with the consent and under the guidance of a philosophy faculty advisor, investigate a topic of special interest to them. The topic may be historical or non-historical, pure or applied, disciplinary or interdisciplinary; the only constraint is that the topic must be approved by the thesis advisor. Seniors take PHIL 390 in the fall, devoting their energies to refining the topic, working through the bulk of the essential literature, and producing a paper on the thesis topic. PHIL 391 is taken in the spring semester of the senior year and is focused on investigating the topic more intensively, expanding, revising, and refining the fall paper into a substantial senior thesis.

**HONORS**

Departmental honors in philosophy are awarded to graduating seniors who satisfy the following two criteria:

1. at the start of their final semester, their overall GPA is 3.25 or higher and their GPA in philosophy is 3.5 or higher, and
2. their senior thesis receives an A from the thesis advisor and then is judged by the whole department faculty to be well-researched, well-argued, well-organized, well-written, and to exhibit original philosophical thinking.

3. Meeting the deadline is part of the honors process, so that while a late thesis would be retroactively considered for graduation, it would not be considered for honors. The sole exception is for a student that through no fault of their own within extenuating circumstances was unable to finish on time. This student may petition the Department explaining their situation.

Majors planning to pursue graduate study in philosophy are strongly encouraged to strive for Honors and to include the following courses in their programs:

<table>
<thead>
<tr>
<th>Course</th>
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</thead>
<tbody>
<tr>
<td>PHIL 105</td>
<td>Ethics</td>
<td>4</td>
</tr>
<tr>
<td>PHIL 114</td>
<td>Symbolic Logic</td>
<td>4</td>
</tr>
<tr>
<td>PHIL 131</td>
<td>Ancient Philosophy</td>
<td>4</td>
</tr>
<tr>
<td>PHIL 135</td>
<td>Modern Philosophy</td>
<td>4</td>
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</table>

And at least one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>PHIL 220</td>
<td>Ways of Knowing</td>
</tr>
<tr>
<td>PHIL 221</td>
<td>Reflecting on Reality</td>
</tr>
<tr>
<td>PHIL 250</td>
<td>Philosophy of Mind</td>
</tr>
</tbody>
</table>

**Total Credits**

24

**THE MINOR PROGRAM**

Minor programs are planned in conjunction with the departmental advisor who will help the student plan a program compatible with his or her interests. Minor programs may be, but do not have to be, focused in a particular area such as ethics or the history of philosophy or philosophy of mind.

The minor in philosophy consists of a minimum of 16 credits.

At least one course at the 200-level or above

<table>
<thead>
<tr>
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</thead>
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<tr>
<td>PHIL 200</td>
<td>Ways of Knowing</td>
<td>4</td>
</tr>
<tr>
<td>PHIL 201</td>
<td>Reflecting on Reality</td>
<td>4</td>
</tr>
<tr>
<td>PHIL 250</td>
<td>Philosophy of Mind</td>
<td>4</td>
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</table>

At least two courses taught by a member of the Philosophy Department

<table>
<thead>
<tr>
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<th>Credits</th>
</tr>
</thead>
<tbody>
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<td>PHIL 200</td>
<td>Ways of Knowing</td>
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</tr>
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<td>PHIL 201</td>
<td>Reflecting on Reality</td>
<td>4</td>
</tr>
<tr>
<td>PHIL 250</td>
<td>Philosophy of Mind</td>
<td>4</td>
</tr>
</tbody>
</table>

**Total Credits**

8
Independent studies may be taken to satisfy the minor requirements.

Total Credits 16

Courses

PHIL 002 Philosophical Questions: An Introduction to Philosophy 4 Credits
One way of understanding philosophy is as the rational attempt to formulate, understand, and answer fundamental questions. This course explores basic philosophical questions such as: What is the meaning of life? What is it to be a human person? Is human nature fundamentally good or evil? How should we live our lives? What makes a society just? Is knowledge possible? What is really real? Is there a God? Do we have free will? Course not open to seniors. Attribute/Distribution: HU

PHIL 003 (ETH 003, REL 003) Global Religion, Global Ethics 4 Credits
Introduction to philosophical and religious modes of moral thinking, with attention given to ethical issues as they arise cross-culturally in and through religious traditions. The course will reference the United Nations Millennium Goals to consider family life and the role of women, social justice, the environment, and ethical ideals. Particular focus varies but may include one or more of the following: abortion and reproductive health, the death penalty, religiously motivated violence, and problems of personal disorder (heavy drinking, anorexia, vengeance). Course not open to seniors. Attribute/Distribution: HU

PHIL 004 Belief, Knowledge, and Action: An Introduction to Philosophy 4 Credits
Through reading selected texts in philosophy, from the ancient period to the modern Enlightenment and Romantic reaction, we shall introduce ourselves to some of the central epistemological, ontological, ethical, and socio-political positions developed in relation to their historical and material contexts. A unifying theme thus will be the emergence and evolution of rational thought and its relation to belief, knowledge, and action. Course not open to seniors. Attribute/Distribution: HU

PHIL 005 (ETH 005) Contemporary Moral Problems: An Introduction to Philosophy 4 Credits
An examination of contemporary issues that raise questions about right and wrong, good and bad, both for individuals and for social policy, using the methods, theories, and concepts of moral philosophy. Course not open to seniors. Attribute/Distribution: HU

PHIL 006 (ETH 006) Conduct and Character: An Introduction to Philosophy 4 Credits
How should we live our lives? How should we act? What kinds of persons should we be? What should we care about? These are among the central questions of philosophy because they are among the most central questions of human existence. This explores answers that have been proposed by thinkers throughout history and across cultures. Course not open to seniors. Attribute/Distribution: HU

PHIL 007 Emerson, Thoreau, and Beyond: An Introduction to Philosophy 4 Credits
The literary power of Emerson and Thoreau, of Frederick Douglass, Margaret Fuller and Walt Whitman, is widely recognized, but their philosophical vocation is still repressed. This introduction to philosophy will be through the doors offered by these American authors and their impact on other prominent thinkers. Course not open to seniors. Attribute/Distribution: HU

PHIL 008 Intro: Ethics In Global Perspectives 4 Credits
Examination of the moral perspectives of a variety of different ethical outlooks, including Euro-American, Hindu, Buddhist, Confucian, African, and Islamic traditions, and of serious moral problems arising from globalization, including the increasing gap between the rich so-called First World nations and the poor so-called Third World nations, global environmental degradation, war and terrorism. Course not open to seniors. Attribute/Distribution: HU

PHIL 010 (ASIA 010, REL 010) Intro to Buddhism: Love Death and Freedom 4 Credits
This course will introduce students to Buddhist practices, philosophical systems, and cultural forms, from Buddhism's Indian origins to its spread in East Asia and Tibet. Students will explore how Buddhists have approached the problem of death, the possibility of freedom, and that of the nature of being. Course materials include poetry, biographies, philosophical writings, art and film. Attribute/Distribution: HU

PHIL 014 Reasoning and Critical Thinking 4 Credits
Most intellectual endeavors involve reasoning. Whether in everyday discussion about right and wrong, friendly political disagreements, ordinary explanations of natural phenomena, and short letters to editors, or in sophisticated legal debates, national political campaigns, complex treatises, and intricate scientific theories, reasons are constantly invoked to support or criticize points of view. This course develops skills needed to reason well, to analyze and critique others' reasoning, to distinguish reasoning from mere rhetoric, and to become a savvy consumer of information. Attribute/Distribution: HU

PHIL 015 Friendship: An Introduction to Philosophy 4 Credits
Because of the importance of friendship to be happy and fulfilled human life, philosophers, from ancient times to the present have devoted considerable attention to it. In this course, we shall read and discuss a variety of philosophical conceptions of friendship and its value. Among the philosophical classics to be considered are works by Plato, Aristotle, Cicero, Augustine, Aquinas, Montaigne, Kant, Thoreau, and Kierkegaard. We shall also consider several contemporary treatments of the subject. Course not open to seniors. Attribute/Distribution: HU

PHIL 016 Free Will and Responsibility: An Introduction to Philosophy 4 Credits
Do we choose who we become as we mature, or is who we become foreordained? Are we born with a unique self, or is the self produced by our interaction with external forces? Are we free agents who can be held responsible for our actions, or is free will an illusion? This course explores these questions and the implications of answers for moral, political, and social values. Course not open to seniors. Attribute/Distribution: HU

PHIL 020 The Examined Life in Film and Literature: An Introduction to Philosophy 4 Credits
Socrates claimed the "the unexamined life is not worth living" and Western philosophers have for 2400 years agreed. But there are other ways of examining the human condition philosophically than in the writings of philosophers. This course uses works of literature and film that address issues that Western philosophers have addressed and continue to address: the natures of truth, justice, the good, reality, the self, happiness, the meaningfulness of life. Course not open to seniors. Attribute/Distribution: HU

PHIL 023 Artists on Art and Life: An Introduction to Philosophy 4 Credits
One of the peculiarities of the philosophical study of art, Aesthetics, is that philosophers ignore the writings of artists on art. This introduction to philosophy does not. Aestheticians spend much of their time writing about what art is. Artists are more interested in what art does and how it works, and those questions, and artists and their works, will be the focus of this course. Course not open to seniors. Attribute/Distribution: HU

PHIL 024 God, Good, and Evil: An Introduction to Philosophy 4 Credits
How is God related to good and evil? If the world is not perfectly good or is even evil, how can it be that God is both all-good (omnibenevolent) and all-powerful (omnipotent)? We can solve the problem of God and evil by saying that God is not all good or not all powerful. But what if we don't want to relinquish God's goodness or power? We'll explore what great philosophers and religious thinkers have proposed. Course not open to seniors. Attribute/Distribution: HU
PHIL 100 (GS 100, POLS 100) Introduction to Political Thought 4 Credits
A critical examination of political ideologies: Liberalism, Marxism, Fascism, and Islamism.

PHIL 101 Ancient Political Heritage 4 Credits
Important Political thinkers from the pre-Socratic to early, modern political theorists like Machiavelli.
Attribute/Distribution: SS

PHIL 105 (ETH 105) Ethics 4 Credits
Examination of right and wrong, good and bad, from classic sources such as Plato, Aristotle, Hume, Kant, Mill and Nietzsche.

PHIL 114 (MATH 114) Symbolic Logic 4 Credits
A first course in logical theory, introducing the notions of logical consequence and proof, as well as related concepts such as consistency and contingency. Formal systems taught may include: term logic, sentence logic, and predicate logic.
Attribute/Distribution: MA

PHIL 116 (ETH 116, HMS 116, REL 116) Bioethics 4 Credits
Moral issues that arise in the context of health care and related biomedical fields in the United States today, examined in the light of the nature and foundation of moral rights and obligations. Topics include: confidentiality, informed consent, euthanasia, medical research and experimentation, genetics, and the distribution of health care.
Attribute/Distribution: HU

PHIL 117 (AAS 117) Race, Racism, and Philosophy 4 Credits
An introduction to the philosophy born of struggle against racism and white supremacy. We will read the work of philosophers, mostly European, who quietly made modern racism possible by inventing the category of race, but we will concentrate on the work of philosophers, mostly of African descent, who for 200 years have struggled to force a philosophical critique of the category of race and the practice of white supremacy.
Attribute/Distribution: HU

PHIL 120 (FILM 120) Philosophy and Film 4 Credits
This seminar course will explore a variety of themes, genres, and movements within cinema from a philosophical perspective. Regular screenings of films from silent era to present. Content may vary depending upon instructor.
Attribute/Distribution: HU

PHIL 121 Philosophy and Literature 4 Credits
Exploration of philosophical themes through the study of literature and film. Authors may include: Homer, Euripides, Dante, Rimbaud, Sterne, George Eliot, Valery, Joyce, Melville, T.S. Eliot, Rilke, Proust, Musil, Stevens, Cummings, Camus, Sartre, Beckett, Morrison, Barthelme.
Attribute/Distribution: HU

PHIL 122 Philosophy Of Law 4 Credits
Analysis of the conceptual foundations of our legal system. Special attention devoted to the nature of law and legal obligation, liberty and privacy in constitutional litigation, justice and contractual obligation, theories of punishment in criminal law, and the nature and scope of responsibility in criminal law.
Attribute/Distribution: HU

PHIL 123 Art, Beauty, and Aesthetic Experience 4 Credits
Theories, classical and modern, of the nature of beauty and the aesthetic experience. Practical criticism of some works of art, and examination of analogies between arts, and between art and nature.
Attribute/Distribution: HU

PHIL 124 (REL 124) Philosophy Of Religion 4 Credits
Critical examination, from a philosophical perspective, of some fundamental problems of religion, the nature of religious experience and belief, reason and revelation, the existence and nature of God, the problem of evil, and religious truth.
Attribute/Distribution: HU

PHIL 125 Social & Political Philosophy 4 Credits
Examination of visions of good social life and values that should shape society so that people are able to live good lives together. Issues covered may include the nature of freedom, how the facts of gender, race, class, ethnic, and cultural differences should be taken into account in social and political relations, the limits of religious tolerance, war, world hunger.
Attribute/Distribution: HU

PHIL 127 Existentialism 4 Credits
Investigation of the historical development of existentialism from its origins in the 19th century (Kierkegaard, Nietzsche) through its marriage to phenomenology in the early 20th (Heidegger, Sartre, Merleau-Ponty), and out the other side as a vigorous dimension of much literary, psychological, and artistic work produced in the last 50 years.
Attribute/Distribution: HU

PHIL 128 Philosophy Of Science 4 Credits
Science obviously works, and newer theories surely are better than the theories they replace, but why does science work, how does it work, and in what sense is it progressive? Is science a revelation of reality, or an account of evolving human experience? Are scientists rational? Is scientific reasoning logical? This course surveys the wide range of 20th century responses to these surprisingly elusive, and surprisingly still open, questions.
Attribute/Distribution: HU

PHIL 129 (JST 129, REL 129) Jewish Philosophy 4 Credits
Consideration of how major Jewish thinkers from the first to 21st centuries confronted questions at the intersection of religion and philosophy: the existence and nature of God, free will, evil, divine providence, miracles, creation, revelation, and religious obligation.
Attribute/Distribution: HU

PHIL 131 (CLSS 131) Ancient Philosophy 4 Credits
Historical survey of selected texts and issues in the classical world, from the pre-Socratics through Aristotle, with emphasis on the origins of the western philosophical traditions in ethics, metaphysics, and epistemology.
Attribute/Distribution: HU

PHIL 132 (CLSS 132) Hellenistic Philosophy 4 Credits
Historical survey of selected texts and issues in post-Aristotelian Greek and Roman philosophy from the fourth century B.C. to the third century A.D. Areas of focus may include epicureanism, stoicism, academic and pyrrhonian scepticism, and neoplatonism.
Attribute/Distribution: HU

PHIL 133 Medieval Philosophy 4 Credits
Historical survey of selected texts and issues in western philosophy from the fourth to 14th centuries. Attention will be given to the relation between developments in medieval philosophy and major currents in ancient and modern thought. Figures may include Augustine, Erigena, Anselm, Aquinas, Ockham, and Nicholas of Autrecourt.
Attribute/Distribution: HU

PHIL 135 Modern Philosophy 4 Credits
Historical survey of selected texts and issues in 17th and 18th century European philosophy with particular emphasis on developments in epistemology and metaphysics. Attention will be given to the relation of the “modern period” to developments in late medieval philosophy and the rise of the experimental sciences. Figures may include Descartes, Leibniz, Locke, Hume, and Kant.
Attribute/Distribution: HU

PHIL 137 Nineteenth Century Philosophy 4 Credits
Historical survey of selected texts and issues in 19th century philosophy. Areas of focus may include post-Kantian idealism; period-specific critiques of religion, politics, and morality; theories of history; the origins of utilitarianism, pragmatism, existentialism, and mathematical logic; etc. Figures may include Hegel, Marx, Kierkegaard, Mill, Peirce, Frege, Nietzsche, James, etc.
Attribute/Distribution: HU
PHIL 139 Contemporary Philosophy 4 Credits
Philosophical thought from the late 19th century to the present; pragmatism, linguistic analysis, existentialism, and Marxism. Truth and knowledge, values and moral judgment, meaning, the place of the individual in the physical world and society, and the impact of the scientific method upon all of these.
Attribute/Distribution: HU

PHIL 140 (ASIA 140) Eastern Philosophy 4 Credits
Survey of selected texts and issues in the eastern philosophical traditions. Attention will be given to the development and interrelations of these traditions as well as a comparison of western and eastern treatments of selected issues. Areas of focus may include Confucianism, Taoism, and Zen Buddhism.
Attribute/Distribution: HU

PHIL 141 (REL 141) Islamic Philosophy 4 Credits
An introduction to Islamic philosophy examining various subjects including its contribution to science, mathematics, theology, philosophy, logic, jurisprudence and how it has influenced philosophical thought from its roots in the Greek intellectual tradition, through its affects on European thoughts during the Middle Ages and beyond.
Attribute/Distribution: HU

PHIL 142 (ASIA 142) Zen and Art of the Everyday 4 Credits
The Japanese conception of beauty is strikingly different to our own: it is associated with impermanence, imperfection, and austerity. Moreover, attention to beauty pervades every day activities in Japan, such as wrapping purchases at the dollar store or putting out garbage. This course explores principles that guide the Japanese aesthetic sensibility with an eye to its expression in Japanese literature, film, and traditional arts, such as the tea ceremony and gardening.
Attribute/Distribution: HU

PHIL 145 Philosophy and Technology 4 Credits
This course is an exploration of questions of metaphysics and morality in the digital age. Are new technologies changing our views of metaphysics (what's real) and morality (what's right)? Can classical and contemporary philosophical theories help us think more clearly and make better choices when faced with new technologies? To help answer these questions, students will read a variety of philosophical works that invite critical reflection on a broad array of topics at the intersection of philosophy and technology.
Attribute/Distribution: HU

PHIL 146 (WGSS 146) Philosophy of Sex and Gender 4 Credits
An examination of concepts, values, and assumptions relevant to gender and sex(uality) in our diverse society, investigating how they affect our lives in both concrete and symbolic ways. Intersections among gender, sex(uality), race, class, religion, ethnicity, etc., will be explored. Special attention will be paid to how gendered assumptions color our understandings of experiences of embodiment and emotion, reasoning and decision-making, knowledge production, and public and private relationships and activities.
Attribute/Distribution: HU

PHIL 150 Philosophy of Education 4 Credits
A historical survey of major views on the meaning and function of education, this course will address questions such as, What is the role of education in individual human development? What are the goals of education? What are the ideal approaches to meet those goals? What is the relationship between one’s view of learning and one’s view of teaching? What is the relationship between educational institutions and the state? Does everyone need the same type of education?
Attribute/Distribution: HU

PHIL 155 Philosophical Foundations of International Law 4 Credits
What philosophical principles lay at the essence of such contemporary international legal dilemmas as terrorism, humanitarian intervention, refugee displacement and global warming? Can changing the principles used to understand these dilemmas affect prospects of peace, human rights and the cooperation of states? Building on the pillars of international law (its sources, the recognition and responsibility of states, and the law of jurisdiction and immunity), we’ll examine the evolution of the idea of a ‘law of nations’ from Aquinas to Kant.
Attribute/Distribution: HU

PHIL 171 Independent Study 1-4 Credits
Individual philosophical investigation of an author, book, or topic, designed in collaboration with a philosophy professor. Tutorial meetings, substantial written work. Consent of faculty instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

PHIL 172 Philosophy of Economics 4 Credits
This course examines economic relations from a philosophical perspective. Topics include theories of property, labor, class, and markets in the history of philosophy as well as contemporary economic debates about distributive justice, commodification, gender, race, environmental sustainability, and the function of debt.

PHIL 180 Special Topics 1-4 Credits
Selected topics of philosophy not included in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

PHIL 192 (ASIA 192, REL 192) Lehigh in Japan: Kyoto I 3 Credits
This is one of 2 courses that will be part of an intensive international summer school course to take start Summer 2016 in Kyoto University. Students will study aspects of Western and Japanese philosophical thought in a small group led by local and international speakers. Participants in the class will also be local and international. Students will be expected to attend all classes for a number of hours over a period of two weeks.
Attribute/Distribution: HU

PHIL 193 (ASIA 193, REL 193) Lehigh in Japan: Kyoto II 3 Credits
A second component of the Philosophy summer school in Kyoto will involve a series of excursions to galleries, museums, temples, shrines, stores, and restaurants. Students can expect to develop their understanding of both Japanese aesthetics and the way in which the philosophical systems present in Japan have influenced the Japanese aesthetic sensibility. Students will be required to submit a series of shorter pieces of writing and a final project.
Attribute/Distribution: HU

PHIL 205 (ETH 205) Contemporary Ethics 4 Credits
Examination of significant questions addressed by contemporary moral philosophers. Topics vary, but might include: What is a good person? What kind of life is worth living? What moral issues are raised by gender, race, and class? Is morality relative or absolute? Is morality all that important?
Repeat Status: Course may be repeated.
Prerequisites: PHIL 105
Attribute/Distribution: HU

PHIL 206 (ETH 206) Figures/Themes in Ethics 4 Credits
This semester course will involve in-depth focus on a major figure in ethics (e.g., Plato, Aristotle, Hume, Kant, Mill, etc.) or on a theme such as relativism, free will, the intersection of religion and ethics, or war.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

PHIL 214 (MATH 214) Topics in Philosophical Logic 4 Credits
Topics may include the many systems of non-classical logic, truth theory, the impact of incompleteness and undecidability results on philosophy, the foundational projects of various philosopher/mathematicians, or the work of an important figure in the history of philosophical logic. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: MA

PHIL 217 Figures/Themes in Race, Racism, and Philosophy 4 Credits
An investigation of a significant figure in the philosophy of race (e.g., David Walker, W.E.B. DuBois, Alain Locke, Marcus Garvey, Jean-Paul Sartre, Franz Fanon, Cornel West) and/or an investigation of a significant theme in the philosophy of race (Racial Exploitation, Colonialism, Negritude, Afrocentrism, Black Nationalism, African Philosophy, Black Athena). Content Varies.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU
PHIL 220 Ways of Knowing 4 Credits
Recent work in theories of knowledge. Questions addressed include: What is knowledge? How does it differ from mere opinion and belief? If you can’t know whether you are dreaming, how can you know you have two hands? Can we know anything at all? Does knowledge require answers to all possible doubts or only reasonable doubts? How should we determine the horizon of the reasonable—psychologically or philosophically?
Attribute/Distribution: HU

PHIL 221 Reflecting on Reality 4 Credits
Metaphysics, the study of the basic structure of reality, seeks both to determine at a fundamental level what exists and what it means for something to be real, and to understand the nature of what exists, for example, whether what exists is mind-independent or depends on human thought, and whether different concepts, categories, or perspectives used to describe reality generate different realities. Topics might include social constructionism, universals and properties, identity and individuation, causation, necessity and possibility, realism and antirealism.
Attribute/Distribution: HU

PHIL 223 Figures/Themes in Aesthetics 4 Credits
An investigation of a significant figure in aesthetics (e.g., Burke, Kant, Hegel, Benjamin, Adorno, Goodman, Kivy, Derrida, Deleuze) and/or an investigation of a significant theme in aesthetics (e.g., sensuality, representation, politics, expressionism, cinematic gore, minimalism, architecture, postmodernism). Content varies.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

PHIL 224 (REL 224) Topics in the Philosophy of Religion 4 Credits
Selected problems and issues in the philosophy of religion.
Attribute/Distribution: HU

PHIL 226 (WGSS 226) Feminism and Philosophy 4 Credits
Analysis of the nature, sources, and consequences of the oppression and exploitation of women and justification of strategies for liberation. Topics include women’s nature and human nature, sexism, femininity, sexuality, reproduction, mothering. Must have completed one HU designated course in philosophy, or one course in Women, Gender, and Sexuality Studies.
Attribute/Distribution: HU

PHIL 228 Topics in the Philosophy of Science 4 Credits
Themes in the natural, life and social sciences.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

PHIL 231 (CLSS 231) Figures and Themes in Ancient Philosophy 4 Credits
This seminar course will involve in-depth focus upon a major ancient thinker (e.g. Plato, Aristotle, Sextus Empiricus, Plotinus, etc.) or the classical treatment of a particular theme (e.g., “human nature,” “the good life,” ethical or political theory, etc.). Content varies. May be repeated for credit if content differs from previous.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

PHIL 232 (CLSS 232) Figures/Thems in Hellenistic Philosophy 4 Credits
This seminar course will involve an in-depth focus upon a major movement in Hellenistic Philosophy (roughly 4th century B.C.E. to the 2nd Century C.E.) such as Epicureanism, Stoicism, Ancient Scepticism, or Neoplatonism, or the Hellenistic treatment of a particular theme (e.g. freedom from anxiety, the nature of the Cosmos and our place within it, or human nature). Content varies.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

PHIL 233 Figures/Thems in Medieval Philosophy 4 Credits
This seminar course will involve in-depth focus upon a major medieval thinker (e.g. Augustine, Boethius, Maimonides, Bonaventure, Dante, etc.) or the medieval treatment of a particular theme (e.g. the relation of “will” and “intelect,” the “problem of universals,” ethical or political theory, etc.). Content varies.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

PHIL 235 Figures/Thems in Modern Philosophy 4 Credits
This seminar course will involve in-depth focus upon a major 17th or 18th century thinker (e.g. Descartes, Leibniz, Berkeley, Kant, etc.) or the modern treatment of a particular theme (e.g. the nature of “ideas,” the roles of experience, reason, and revelation, ethical or political theory, etc.). Content varies.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

PHIL 237 Figures/Thems in Nineteenth Century Philosophy 4 Credits
This seminar course will involve in-depth focus upon a major 19th century thinker (e.g. Hegel, Marx, Kierkegaard, Mill, Peirce, Frege, Nietzsche, James, etc.) or the 19th century treatment of a particular theme (e.g. the end of history, revolution, nihilism, authenticity, origins of mathematical logic, infinity, etc.). Content varies.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

PHIL 239 Figures/Thems in Contemporary Philosophy 4 Credits
This seminar course will involve in-depth focus upon a major contemporary thinker (e.g. Russell, Whitehead, Husserl, Heidegger, Wittgenstein, Quine, Habermas, Rawls, Rorty, Derrida, Davidson, Foucault, Deleuze, Irigaray, etc.) or the contemporary treatment of a particular theme (e.g. logical positivism, naturalism, non-foundationalism, existential phenomenology, return to virtue, neopragmatism, hermeneutics, post-structuralism, postmodernism, neokantian political theory, the politics of identity, etc.). Content varies.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

PHIL 240 (ASIA 240) Figures/Thems in Eastern Philosophy 4 Credits
This seminar course will involve in-depth focus upon a major figure in Eastern thought or upon the Eastern treatment of a particular theme or set of themes. Content varies.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

PHIL 250 (COGS 250) Philosophy of Mind 4 Credits
An exploration of the mind-body problem. Are the body and mind distinct substances (dualism); or is there only body (materialism); or only mind (idealism)? Other views to be considered include behaviorism (the view that behavior can be explained without recourse to mental states), and the view that the mind is a complex computer.
Attribute/Distribution: HU

PHIL 260 Making Sense of Words 4 Credits
Issues in the philosophy of language, including analysis of the nature of the relation between the words we use and the world in which we live. We will aim to understand how words make sense and how we make sense of ourselves and the world through words. We will examine such central notions as truth, meaning, and reference, as understood in historically influential philosophical theories of language.
Attribute/Distribution: HU

PHIL 265 Philosophy of Mathematics 4 Credits
A survey of the main philosophical views on the nature of mathematics and mathematical knowledge, including the classical debate between the logicist, formalist, and intuitionist schools, and the recent debate between realism and antirealism. Some of the material makes use of logical theory.
Attribute/Distribution: HU

PHIL 271 Independent Study 1-4 Credits
Individual philosophical investigation of an author, book, or topic designed in collaboration with a philosophy professor. Tutorial meetings; substantial written work. Must have completed one HU designated course in philosophy. Consent of faculty instructor required.
Repeat Status: Course may be repeated.

PHIL 292 Philosophical Methods 2 Credits
Methods and approaches to philosophical research, reasoning, and writing, as preparation for senior thesis. Open only to junior philosophy majors. Department permission required.
Attribute/Distribution: HU
PHIL 300 Apprentice Teaching 1-4 Credits
Attribute/Distribution: ND

PHIL 301 (ES 301) Philosophical-Policy & Legal Design: Methods & Applications 4 Credits
A basic class on the idea of policy design, as opposed to standard economic analysis of public policy and its application to various domestic and international areas of law, including environmental law. The course will introduce Philosophical-Policy Methods, or the protocol employing integrated philosophical systems to justify specific policy-legal design arguments, through the use of a variety of distinct policy paradigms.

PHIL 303 (MATH 303) Mathematical Logic 3,4 Credits
Detailed proofs for the basic mathematical results relating the syntax and semantics of first-order logic (predicate logic): the Soundness and Completeness (and Compactness) Theorems, followed by a brief exposition of the celebrated limitative results of Gödel, Turing, and Church on incompleteness and undecidability. The material is conceptually rigorous and mathematically mature; the necessary background is a certain degree of mathematical sophistication or a basic knowledge of symbolic logic. Consent of instructor required.
Prerequisites: (PHIL 114)
Attribute/Distribution: MA

PHIL 333 (ES 333) International Environmental Law & Philosophical-Policy Design 4 Credits
This course studies international law and the natural environment assuming that the superficial legal structure and policy dilemmas of globally regulating the natural world are the result of the more essential philosophical ideas and concepts that have created both the international legal system and humanity’s evolving interrelationship with nature. Learning the current structure of the international-environmental legal system we shall comparatively apply theory to practice to both explain existing law and justifying policy change.
Attribute/Distribution: HU

PHIL 342 (ES 342) International Law & Philosophical-Policy Design 4 Credits
Using the techniques of Philosophical-Policy and Legal Design we will examine the evolution of those fundamental ideas from the 16th to the 19th centuries that have shaped our current understanding of international law. To assess both what law is, and what it ought to be, we will contrast narrow theories of international law with more comprehensive philosophical arguments that place the evolution of legal practice within a more universal concern for practical reason and human nature.
Attribute/Distribution: HU

PHIL 343 (ES 343) Comparative Environmental Law & Philosophical-Policy Design 4 Credits
Globalization is changing our perception of environmental policy as a strictly “domestic” issue. Those interested in humanity’s future interaction with nature need to understand not only the comparative practice of law and policy but the various philosophical principles that inform distinct approaches to environmental regulation within different political systems. We will explore both the components of the generic legal system and the range of alternatives for environmental law and policy design as practiced in various parts of the world.
Attribute/Distribution: HU

PHIL 347 (AMST 347, REL 347) American Religious Thinkers 3-4 Credits
An examination of the writings of key figures in the history of American religious thought (such as Edwards, Emerson, Bushnell, Peirce, James, Royce, Dewey and the Niebuhrs). Attention will be directed both to religious thought (such as Edwards, Emerson, Bushnell, Peirce, James, Royce, Dewey and the Niebuhrs). Attention will be directed both to

PHIL 350 Special Topics In Philosophy, Law & Public Policy 4 Credits
Themes, Techniques and Methods for the integration of Philosophy, Law and Public Policy. Considered from the standpoint of various core themes. These will change from offering to offering and may include, Healthcare, Bioethics, Race, Violence, The Market As An Allocation-Distribution Mechanism, Various Models of The State, and the juxtaposition between Constitutionalism and Democracy. May be repeated for credit as topic varies.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

PHIL 364 (POLS 364) Issues In Contemporary Political Philosophy 3-4 Credits
Selected topics in contemporary political philosophy, such as the Frankfurt school, existentialism, legitimation, authenticity, participatory democracy, and the alleged decline of political philosophy.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

PHIL 367 (POLS 367) American Political Thought 3-4 Credits
Critical examination of American political thought from the founding of the Republic to the present. Writings from Madison, Hamilton, and Jefferson to Emma Goldman, Mary Daly, Malcolm X, Henry Kariel, and others will be discussed.
Attribute/Distribution: SS

PHIL 371 Advanced Independent Study 1-4 Credits
Individual philosophical investigation of an author, book, or topic designed in collaboration with a philosophy professor. Tutorial meetings; substantial written work. Must have completed one HU designated philosophy course at 200-level or higher, and have consent of instructor.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

PHIL 390 Senior Thesis I 2 Credits
The first part of two semesters of intensive research and writing supervised by the philosophy faculty thesis advisor in anticipation of completing a senior thesis in philosophy. Individual tutorials; substantial written work. Senior standing as a philosophy major and permission of the philosophy faculty thesis advisor required.
Attribute/Distribution: HU

PHIL 391 Senior Thesis II 4 Credits
Continuation and completion of PHIL 390 under the guidance of the thesis advisor. Consent of thesis advisor required.
Prerequisites: PHIL 390
Attribute/Distribution: HU

PHIL 395 Philosophy Seminar 4 Credits
A basic class on the idea of policy design, as opposed to standard economic analysis of public policy and its application to various domestic and international areas of law, including environmental law. The course will introduce Philosophical-Policy Methods, or the protocol employing integrated philosophical systems to justify specific policy-legal design arguments, through the use of a variety of distinct policy paradigms.

PHYSICS

PHYSICS students study the basic laws of mechanics, heat and thermodynamics, electricity and magnetism, optics, relativity, quantum mechanics, and elementary particles. Students also study applications of the basic theories to the description of bulk matter, including the mechanical, electric, magnetic, and thermal properties of solids, liquids, gases, and plasmas, and to the description of the structure of atoms and nuclei. In addition, students develop the laboratory skills and techniques of the experimental physicist, skills that can be applied in the experimental search for new knowledge or in applications relating to known theories.

A majority of physics graduates go to graduate school in physics, often earning the Ph.D. degree. These graduates take university or college faculty positions, or work on research in a variety of university, government, or industrial laboratories. Some students choose employment immediately after the bachelor’s degree. They use their many approved and free electives to supplement their science background with applied courses, such as engineering, to develop the skills needed for a position in a particular area.

Because of the fundamental role of physics in all natural sciences, students also use the physics major as an excellent preparation for graduate study in many other scientific areas, such as optical engineering, applied mathematics, computer science, biophysics, molecular biology, astrophysics, geology and geophysics, materials science and engineering, meteorology, or physical oceanography. Attractive engineering areas with a high science content include optical
communications, aeronautical engineering, nuclear engineering, including both fission and fusion devices; electrical engineering, including instrumentation; electronics and solid-state devices, electrical discharges and other plasma-related areas; and mechanical engineering and mechanics, including fluids and continuum mechanics. The broad scientific background developed in the physics curriculum is also an excellent background for professional schools, such as law (particularly patent law), medicine, and optometry.

Lehigh offers three undergraduate degrees in physics and two undergraduate degrees in astronomy or astrophysics. The three physics degrees are the bachelor of arts with a major in physics and the bachelor of science in physics in the College of Arts and Sciences, and the bachelor of engineering physics in the College of Engineering and Applied Science. The B.A. with a major in astronomy and the B.S. in astrophysics are in the College of Arts and Sciences and are described in the Astronomy and Astrophysics section of this catalog.

In addition, there are several five-year, dual-degree programs involving physics: The Arts-Engineering program (see the Arts-Engineering section of this catalog), the combination of the bachelor of science program in the College of Arts and Sciences with electrical engineering (described below), and the combination of electrical engineering and engineering physics (see the Electrical Engineering and Engineering Physics section of this catalog).

The bachelor of science curriculum in the College of Arts and Sciences requires somewhat more physics and mathematics than the bachelor of arts major, while the latter provides more free electives and fewer hours for graduation. By making good use of the electives in these programs, students can pursue graduate work in physics or physical aspects of other science or engineering disciplines, or technical careers requiring a basic knowledge of physics. The bachelor of arts curriculum is particularly useful for those planning careers in areas where some knowledge of physics is needed or useful, but is not the main subject, such as science writing, secondary school teaching, patent law, or medicine. The bachelor of science in engineering physics curriculum in the College of Engineering and Applied Science requires an engineering concentration in either solid state electronics or optical sciences, in addition to regular physics and mathematics courses. This four-year program prepares students to do engineering work in an overlap area between physics and engineering. This may involve engineering in a forefront area in which it is desirable to have more physics knowledge than that typically provided in an engineering program. It may be a field of experimental physics which either relies heavily on forefront engineering or in which the nature of the problem dictates that scientists and engineers will accomplish more working together rather than separately.

Requirements and recommended course sequences are described below for programs in the College of Arts and Sciences and in the P. C. Rossin College of Engineering and Applied Science. Note that no more than 6 credits of military science may be applied toward any degree program.

Professors. Ivan Biaggio, PHD (ETH Zurich); Gary G. DeLeo, PHD (University of Connecticut); Volkmar R. Dierolf, PHD (University of Utah); Alvin S. Kanofsky, PHD (University of Pennsylvania); Yong W. Kim, PHD (University of Michigan); H. Daniel Ou-Yang, PHD (University of California Los Angeles); Jeffrey M. Rickman, PHD (Carnegie Mellon University); Michael J. Stavola, PHD (University of Rochester); Jean Toulouse, PHD (Columbia University); Dimitrios Vavylonis, PHD (Columbia University)

Associate Professors. Jerome C. Licini, PHD (Massachusetts Institute of Technology); M. Virginia McSwain, PHD (Georgia State University); Joshua Pepper, PHD (Ohio State University)

Assistant Professors. Sera Cremonini, PHD (Brown University); Chinedu E. Ekuma, PHD (Louisiana State University); Aurelia Honerkamp Smith, PHD (University of Washington); Rosi Jan Reed, PHD (University of California Davis); Bitan Roy, PHD (Simon Fraser Univ); Ariel T. Sommer, PHD (Massachusetts Institute of Technology); Timm Wrase, PHD (University of Texas at Austin)

Professor Of Practice. Paola Maria Cereghetti, PHD (Swiss Federal Institute of Technology)

Emeriti. Garold J Borse, PHD (University of Virginia); W. Beall Fowler, PHD (University of Rochester); James D. Gunton, PHD (Stanford University); Albert Peet Hickman, PHD (Rice University); John P. Hueneenkens, PHD (University of Colorado Boulder); George Eadon McCluskey, Jr., PHD (University of Pennsylvania); Shelden H. Radin, PHD (Yale University); Russell A. Shaffer, PHD (Johns Hopkins University); George D. Watkins, PHD (Harvard University)

COLLEGE OF ARTS AND SCIENCES

B.A. with Major in Physics Program Requirements

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<th>Course</th>
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<th>Credits</th>
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<tr>
<td>PHY 010</td>
<td>General Physics I</td>
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<tr>
<td>PHY 031</td>
<td>Introduction to Quantum Mechanics</td>
<td>3</td>
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<td>MATH 021</td>
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<td>MATH 205</td>
<td>Linear Methods</td>
<td>3</td>
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<tr>
<td>CHM 030</td>
<td>Introduction to Chemical Principles</td>
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Select at least 6 of the following: 18

<table>
<thead>
<tr>
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<tr>
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<td>Electricity and Magnetism I</td>
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<td>PHY 213</td>
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<td>ASTR 301</td>
<td>Modern Astrophysics I</td>
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<td>High-Energy Astrophysics</td>
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<td>PHY 340</td>
<td>Thermal Physics</td>
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<tr>
<td>PHY 342</td>
<td>Relativity and Cosmology</td>
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<td>PHY 348</td>
<td>Plasma Physics</td>
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<td>Modern Optics</td>
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<td>PHY 355</td>
<td>Nonlinear Optics</td>
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<td>Physics of Solids</td>
<td>4</td>
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<td>PHY 364</td>
<td>Nuclear and Elementary Particle Physics</td>
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<td>PHY 365</td>
<td>Physics of Fluids</td>
<td>4</td>
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<td>PHY 369</td>
<td>Quantum Mechanics I</td>
<td>4</td>
</tr>
<tr>
<td>PHY 380</td>
<td>Introduction to Computational Physics</td>
<td>4</td>
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Total Credits 51-53

A total of 120 credits are required for the BA in Physics

B.S. in Physics Program Requirements

Mathematics Courses

<table>
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<td>Calculus II</td>
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<td>MATH 205</td>
<td>Linear Methods</td>
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<td>MATH 208</td>
<td>Complex Variables</td>
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or MATH 320 | Ordinary Differential Equations | 3-4 |

or MATH 322 | Methods of Applied Analysis I | 3-4 |

Basic Science Courses

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<tr>
<td>or PHY 010</td>
<td>General Physics I</td>
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<tr>
<td>PHY 021</td>
<td>Introductory Physics II</td>
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<tr>
<td>or PHY 023</td>
<td>Introductory Physics II with Relativity</td>
<td>4</td>
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<td>PHY 012</td>
<td>Introductory Physics Laboratory I</td>
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<td>PHY 022</td>
<td>Introductory Physics Laboratory II</td>
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<tr>
<td>PHY 031</td>
<td>Introduction to Quantum Mechanics</td>
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223
CHM 030  Introduction to Chemical Principles  4

**Laboratory and Computing Courses**

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<tr>
<td>PHY 220</td>
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<td>PHY 221</td>
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*Or an equivalent course in scientific computing.

**Intermediate and Advanced Courses**

<table>
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<td>Classical Mechanics I</td>
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<td>PHY 369</td>
<td>Quantum Mechanics I</td>
<td>3</td>
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**Approved Elective Courses**

Select two courses from among...

<table>
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<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
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<td>PHY 363</td>
<td>Physics of Solids</td>
<td>3</td>
</tr>
<tr>
<td>PHY 352</td>
<td>Modern Optics</td>
<td>3</td>
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<tr>
<td>or PHY 355</td>
<td>Nonlinear Optics</td>
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<tr>
<td>PHY 348</td>
<td>Plasma Physics</td>
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<tr>
<td>or PHY 365</td>
<td>Physics Of Fluids</td>
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<tr>
<td>PHY 380</td>
<td>Introduction to Computational Physics</td>
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</table>

... plus three additional courses in appropriate technical areas in consultation with the adviser. Students planning graduate work in Physics are advised to include PHY 273 (Research) among their electives.

Total Credits 90-92

A total of 123 credits are required for the BS in Physics

**Recommended Sequence of Courses**

The recommended sequence of courses for physics degree programs are indicated below. General electives are not indicated, but they should be selected in consultation with the advisor so that educational goals and total credit hour requirements are satisfied.

**B.A. with a Major in Physics, College of Arts & Sciences**

**First Year**

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
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<td>MATH 022</td>
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<td>Col. Sem.</td>
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15-16 15

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<tr>
<td>PHY 013 or 021</td>
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<td>Dist. Req.</td>
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16-17 16-17

**Total Credits: 62-65**

**B.S. in Physics, College of Arts & Sciences**

**First Year**

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<td>ENGL 002</td>
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<tr>
<td>PHY 011 or 010</td>
<td>4</td>
<td>CHM 030</td>
<td>4</td>
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**Second Year**

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</table>

15-17 14-15

**Total Credits: 58-64**

*Or an equivalent course in scientific computing.

**P.C. ROSSIN COLLEGE OF ENGINEERING & APPLIED SCIENCES**

Both concentrations require 131 credit hours. The tables below indicate both course requirements and recommended enrollment sequences.

**Bachelor of Engineering Physics**

with a concentration in Solid State Electronics

**First Year**

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<th>Credits</th>
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<td>HSS</td>
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14 16

<table>
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<th>Spring</th>
<th>Credits</th>
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<td>4</td>
<td>MATH 205</td>
<td>3</td>
</tr>
<tr>
<td>ECE 081</td>
<td>4</td>
<td>MATH 208</td>
<td>3</td>
</tr>
<tr>
<td>ECE 123</td>
<td>3</td>
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17 15

<table>
<thead>
<tr>
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<th>Spring</th>
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<td>ECE 033</td>
<td>4</td>
<td>PHY 262</td>
<td>2</td>
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<td>ECE 108</td>
<td>4</td>
<td>PHY 215</td>
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<td>3</td>
<td>ECE 126</td>
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<tr>
<td>HSS</td>
<td>4</td>
<td>HSS</td>
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18 18

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</table>

16 17

**Total Credits: 131**
The 11 credit hours of SSE (Solid State Engineering) electives must include ECE 257 or ECE 258 or PHY 273. Other advanced physics or engineering courses may be included among the SSE electives with the approval of the student's advisor.

with a concentration in Optical Sciences

<table>
<thead>
<tr>
<th>First Year</th>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
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<td>HSS</td>
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<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
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<td>PHY 031</td>
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<td>MATH 023</td>
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<td>ECO 001</td>
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<td>MATH 208</td>
<td>HSS/Dist. Req.</td>
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<th>Spring</th>
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<td>PHY 221</td>
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<td>ECE 108</td>
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<td>PHY 364</td>
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<td>MATH 322</td>
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<td>ECE 121</td>
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<td>Jr. Writing</td>
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<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
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<td>PHY 340 or ME 104</td>
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<td>PHY 355</td>
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<td>PHY 352</td>
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<td>OE –Elec</td>
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<td>Electives</td>
<td>6</td>
<td>HSS</td>
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<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
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<tbody>
<tr>
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<td>3</td>
<td>ECE 258</td>
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<tr>
<td>MATH 231</td>
<td>3</td>
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<td>ECE 136</td>
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<td>15</td>
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</tbody>
</table>

Total Credits: 131

(1) The 18 credit hours of OE (Optical Engineering) electives must include ECE 257 or ECE 258 or PHY 273. Must include at least two of ECE 347, ECE 348, ECE 371, ECE 372. Other advanced physics or engineering courses may be included among the OE electives with the approval of the student’s advisor.

COMBINED B.S.(PHYSICS)/B.S.(ELECTRICAL ENGINEERING)

The combined arts/engineering programs resulting in bachelors degrees in both physics and electrical engineering may be arranged so that either of the two degrees is completed within the first four years. The suggested curricula are:

Physics-Elec. Engr (Physics first)

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<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
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<tr>
<td>ENGL 001</td>
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<tr>
<td>PHY 011 &amp; PHY 012</td>
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<td>MATH 021</td>
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<td>ENGR 005</td>
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<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
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<tbody>
<tr>
<td>PHY 021 &amp; PHY 022</td>
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<td>MATH 205</td>
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<td>ECE 081</td>
<td>4</td>
<td>ECE 123</td>
<td>3</td>
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</tbody>
</table>
### RESEARCH OPPORTUNITIES

A majority of physics, astronomy, and engineering physics majors take advantage of opportunities to participate in research under the direction of a faculty member. Research areas available to undergraduates are the same as those available to graduate students; they are described below under the heading For Graduate Students. Undergraduate student research is arranged informally as early as the sophomore (or, occasionally, freshman) year at the initiation of the student or formally as a senior research project. In addition, a number of students receive financial support to do research during the summer between their junior and senior years, either as Physics Department Summer Research Participants or as Sherman Fairchild Scholars.

### DEPARTMENTAL HONORS

Students may earn departmental honors by satisfying the following requirements:

- Grade point average of at least 3.50 in physics courses.
- Complete 6 credits of PHY 273 (research), or summer REU project, submit a written report, and give an oral presentation open to faculty and students.
- Complete three courses from the list:
  - Select one of the following: 3 credits
    - PHY 332 High-Energy Astrophysics
    - PHY 342 Relativity and Cosmology
    - PHY 348 Plasma Physics
    - PHY 363 Physics of Solids
    - PHY 352 Modern Optics
    - or PHY 355 Nonlinear Optics
    - PHY 369 Quantum Mechanics I
    - PHY 380 Introduction to Computational Physics
    - Any 400 level Physics course

For students majoring in astronomy or astrophysics, see the Astronomy and Astrophysics section of this catalog.

### FIVE-YEAR COMBINED BACHELOR/MASTER’S PROGRAMS

Five-Year programs that lead to successive bachelor and master’s degrees are available. These programs satisfy all of the requirements of one of the five bachelor’s degrees in physics (B.A., B.S., B.S.E.P.) and astronomy/astrophysics (B.A., B.S.), plus the requirements of the M.S. in physics in the final year. Depending upon the undergraduate degree received, one summer in residence may be required. Interested students should contact the associate chair of physics no later than the spring semester of their junior year for further detail.

### THE MINOR PROGRAM

The minor in physics requires 15 credits of Physics and Astronomy courses. It must consist of the physics introductory sequence, plus 9 credits of physics courses at or above the 100 level. No more than one course required in a student’s major program can be counted towards the number of credits for the physics minor. To account for this and to ensure a coherent intellectual theme, the program for an individual student is designed in consultation with and approved by the physics department chair. For the purpose of this minor, the physics introductory sequence consists of PHY 10 or PHY 11, PHY 13 or PHY 21, PHY 12, PHY 22, and PHY 31, or equivalent courses. Examples of course sequences for the minor program can be found on the Physics Department WebSite.

### FOR GRADUATE STUDENTS

The department of physics has concentrated its research activities within several fields of physics, with the result that a number of projects are available in each area. Current departmental research activities include the following:

- **Astronomy and Astrophysics.** Current research involves theoretical and observational studies of stars and planets. Particular areas of interest in stellar astrophysics are young open clusters, binary stars, X-ray binaries, the formation of disks in Be stars, and stellar pulsations. Research on planets involves the discovery and characterization of exoplanets orbiting bright stars and the search for extraterrestrial life.
- **Atomic, Molecular, and Optical Physics.** Current research investigates the physics of quantum many-body systems through studies of ultracold atomic gases. Topics include superfluidity, spin and heat transport, and thermodynamics of strongly interacting Fermi
gases. Experiments employ laser cooling and optical trapping to produce quantum degenerate atomic gases, and tailored optical potentials, radiofrequency spectroscopy and other techniques to perform measurements. Research also includes thermalization and condensation of photons in dye media confined within a narrow optical cavity.

**Biophysics.** Researchers in the physics department employ experimental as well as mathematical and computational modeling to study the organization and dynamics of biological systems. They are involved in interdisciplinary collaborations with researchers in biology, bioengineering and related fields. Areas of research involve experimental and theoretical studies of mechanical properties of cells and biomaterials using techniques such as optical tweezers and optical microscopy; modeling studies of cell division, cell motion, polarized growth, and matings; physics of cytoskeletal self-organization; and experimental study of lipid membranes using microfluidics and confocal microscopy.

**Computational Physics.** Many of the fields of physics research at Lehigh involve the use of state-of-the-art computers to address large-scale computational problems. Researchers in the physics department employ computational approaches to model complex many-body systems in condensed matter, biological, and quantum systems; the detection of variable signals in large astronomical surveys; coarse-grained models of biological systems with molecular dynamics, statistical, and continuum methods. The computational research is performed at both high performance computing facilities on campus and in national facilities.

**Condensed Matter Physics.** Areas of interest include the optical and electronic properties of defects in semiconductors and insulators; collective dynamics of disordered solids; structural phase transitions in ferroelectrics and superconducting crystals; organic molecular crystals; exciton dynamics, singlet-triplet conversion, and in general the physics of electronic and optoelectronic devices; the quantum physics of matter, fields, and their interactions at the nanoscale; surfaces, interfaces and heterostructures; emergent physics in low-dimensional materials; strongly correlated electronic systems, topological phases of matter, unconventional superconductivity, and classical and quantum phase transitions.

**High Energy Nuclear Experimental Physics.** Current research involves the study of relativistic heavy-ion collisions at the Solenoidal Tracker at RHIC (STAR) and sPHENIX experiments at Brookhaven National Labs. This field of research focuses on the study of matter under extreme conditions of temperature, density, and pressure, where the quarks and gluons that make up normal nuclear matter are no longer confined into hadrons. This deconfined matter is called the quark gluon plasma (QGP), and experiments use high-energy probes, such as particle jets and heavy flavor quarks, to determine how quarks and gluons lose energy in this medium.

**High Energy Theory.** String theory, quantum field theory and cosmology. Areas of interest include the connection between gravitational theories and quantum field theories, holographic gauge/gravity dualities, the behavior of strongly correlated quantum phases of matter, and the evolution of the early universe.

**Nonlinear Optics and Photonics.** Research topics include nonlinear light-matter interaction that enables the control of light with light, four-wave mixing, phase conjugation, and wavelength conversion. We develop materials for second- and third-order nonlinear optics in particular organic molecular assemblies, and in general study materials and effects for photonics and optoelectronics. Examples include single crystals in glass, photonic crystals, holey and other specialty fibers, waveguides, resonant Brillouin scattering, and ferroelectric domain patterning for quasi phase matching. There is also considerable work on applications of photonics to biological systems, near-field optics, and thermal radiation.

**Plasma Physics.** Laboratory studies of collisional and collisionless phenomena in supercritical laser-produced plasmas. Laboratory simulation of supernova emissions in the mid-infrared by excitation of interstellar nano-crystallites by strong shock waves in a new cryogenic diaphragm-less shock tube facility

**Soft Condensed Matter and Complex Fluids.** Biopolymer networks, biomembranes, and colloidal suspensions are investigated using experimental techniques such as confocal microscopy, laser tweezers, electro-osmotic control, microfluidics, in combination with image analysis and computational modeling. Research areas include phase separation on cell membranes, micro rheology of macromolecules and living cells, generalized sedimentation equilibrium of colloidal suspensions, active colloidal suspensions far from equilibrium, diffusion in complex and/or crowded environments, and formation and evolution of nanoscale complexes in solutions.

**Statistical Physics.** Research includes equilibrium and nonequilibrium fluctuations in gases and liquids; genesis and dynamics of disorder in 2-D solids near percolation threshold; and modeling of transport in disordered metallic solids under thermal forcing.

Candidates for advanced degrees normally will have completed, before beginning their graduate studies, the requirements for a bachelor’s degree with a major in physics, including advanced mathematics beyond differential and integral calculus. Students lacking the equivalent of this preparation will make up deficiencies in addition to taking the specified work for the degree sought.

At least eight semester hours of general college physics using calculus are required for admission to all 200- and 300-level courses. Additional prerequisites for individual courses are noted in the course descriptions. Admission to 400-level courses generally is predicated on satisfactory completion of corresponding courses in the 200- and 300-level groups or their equivalent.

**FACILITIES FOR RESEARCH**

Research facilities are housed in the Sherman Fairchild Center for the Physical Sciences, containing Lewis Laboratory, the Sherman Fairchild Laboratory for Solid State Studies, and a large connecting research wing. Resources include a machine shop, electronics shop, and networked computer facilities.

Lehigh researchers in astrophysics are involved in a number of worldwide astrophysics surveys and collaborations, including the KELT exoplanet survey, the NASA K2 and TESS missions, LSST, and WFIRST. Lehigh researchers in experimental high energy nuclear physics participate in collaborations affiliated with the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Lab. These include the Solenoidal Tracker at RHIC (STAR) and the sPHENIX collaborations.

Instruments used for experimental studies include a wide variety of laser systems, spectrometers, and microscopes. Examples include femtosecond and picosecond pulsed and dye lasers, various spectrometers (Raman and Fourier-transform), a facility for luminescence microscopy, a cell culture facility, and a laser-tweezers system for studies of cells and complex fluids. The Fairchild Laboratory also houses a processing laboratory where advanced Si devices can be fabricated and studied.

Several physics professors are also members of interdisciplinary initiatives that offer a wide range of state-of-the-art facilities including a fiber drawing tower, waveguide and fiber characterization labs, and a new epitaxy facility for the growth of III-V semiconductor structures and devices. World-class electron microscopy facilities are also available. Members of the physics department also participate in Lehigh’s Emulsions Polymer Institute, the Institute for Functional Materials and Devices, and the Institute for Data, Intelligent Systems, and Computation.

Extensive up-to-date computer facilities are available on campus and in the department. High Performance Computing facilities (http://www.lehigh.edu/computing/hpc/), can be accessed directly from graduate student and faculty offices through a high speed backbone. Access to the Extreme Science and Engineering Discovery Environment (XSEDE) is available through computing time allocations to Lehigh faculty.
Courses

PHY 005 Concepts In Physics 4 Credits
Fundamental discoveries and concepts of physics and their relevance to current issues and modern technology. For students not intending to major in science or engineering. Lectures, demonstrations, group activities, and laboratories using modern instrumentation and computers. This is a non-calculus course; no previous background in physics is assumed. Three class meetings and one laboratory period per week.
Attribute/Distribution: NS

PHY 009 Introductory Physics I Completion 1-2 Credits
For students who have Advanced Placement or transfer credit for 2 or 3 credits of PHY 11. The student will be scheduled for the appropriate part of PHY 11 to complete the missing material. The subject matter and credit hours will be determined by the Physics Department for each student. Students with AP Physics C credit for mechanics will take the thermodynamics and kinetic theory part of PHY 11 for one credit. Consent of department required.
Prerequisites: MATH 021 or MATH 031 or MATH 051 or MATH 076 or MATH 075
Can be taken Concurrently: MATH 021, MATH 031, MATH 051, MATH 076, MATH 075
Attribute/Distribution: NS

PHY 010 General Physics I 4 Credits
Statics, dynamics, conservation laws, thermodynamics, kinetic theory of gases, fluids. Primarily for architecture, biological science, earth and environmental science students.
Prerequisites: MATH 021 or MATH 031 or MATH 051 or MATH 076 or MATH 075
Can be taken Concurrently: MATH 021, MATH 031, MATH 051, MATH 076, MATH 075
Attribute/Distribution: NS

PHY 011 Introductory Physics I 4 Credits
Kinematics, frames of reference, laws of motion in Newtonian theory and in special relativity, conservation laws, as applied to the mechanics of mass points; temperature, heat and the laws of thermodynamics; kinetic theory of gases. Two lectures and two recitations per week.
Prerequisites: MATH 021 or MATH 031 or MATH 051 or MATH 076 or MATH 075
Can be taken Concurrently: MATH 021, MATH 031, MATH 051, MATH 076, MATH 075
Attribute/Distribution: NS

PHY 012 Introductory Physics Laboratory I 1 Credit
A laboratory course taken concurrently with PHY 10 or 11. Experiments in mechanics, heat, and DC electrical circuits. One three-hour laboratory period per week.
Prerequisites: PHY 010 or PHY 011
Can be taken Concurrently: PHY 010, PHY 011
Attribute/Distribution: NS

PHY 013 General Physics II 3 Credits
A continuation of PHY 10, primarily for biological science and earth and environmental science students. Electrostatics, electromagnetism, light, sound, atomic physics, nuclear physics, and radioactivity.
Prerequisites: (PHY 010 or PHY 011) and (MATH 021 or MATH 031 or MATH 051)
Can be taken Concurrently: MATH 021, MATH 031, MATH 051
Attribute/Distribution: NS

PHY 019 Introductory Physics II Completion 1-2 Credits
For students who have Advanced Placement or transfer credit for 2 or 3 credits of PHY 21. The student will be scheduled for the appropriate part of PHY 21 to complete the missing material. The subject matter and credit hours will be determined by the Physics Department for each student. Students with AP Physics C credit for electricity and magnetism will take the optics and modern physics part of PHY 21 for one credit. Consent of instructor required.
Prerequisites: (PHY 010 or PHY 011) and (MATH 022 or MATH 032 or MATH 052)
Attribute/Distribution: NS

PHY 021 Introductory Physics II 4 Credits
A continuation of PHY 11. Electrostatics and magnetostatics; DC circuits; Maxwell's equations; waves; physical and geometrical optics; introduction to modern physics. Two lectures and two recitations per week. May not be taken by students who have previously completed PHY 023.
Prerequisites: (PHY 010 or PHY 011) and (MATH 022 or MATH 032 or MATH 052)
Attribute/Distribution: NS

PHY 022 Introductory Physics Laboratory II 1 Credit
A laboratory course to be taken concurrently with PHY 13 or 21. One three-hour laboratory period per week.
Prerequisites: (PHY 012) and (PHY 021 or PHY 013 or PHY 023)
Can be taken Concurrently: PHY 021, PHY 013, PHY 023
Attribute/Distribution: NS

PHY 023 Introductory Physics II with Relativity 4 Credits
A version of PHY 021 for students interested in majoring in physics or astrophysics, or students with a strong interest in related fields. It is well-suited for students with PHY 011 AP credit, or with PHY 021 AP credit who wish to replace that course with a more sophisticated version. The theory of electricity and magnetism is developed from a modern point of view, emphasizing the unity of electric and magnetic fields in the context of special relativity.
Prerequisites: (PHY 010 or PHY 011) and (MATH 022 or MATH 032 or MATH 052)
Attribute/Distribution: NS

PHY 031 Introduction to Quantum Mechanics 3 Credits
Experimental basis and historical development of quantum mechanics; the Schroedinger equation; one-dimensional problems; angular momentum and the hydrogen atom; many-electron systems; spectra; selected applications. Three lectures per week.
Prerequisites: (PHY 013 or PHY 021 or PHY 023)
Attribute/Distribution: NS

PHY 072 Special Topics In Physics 1-4 Credits
Selected topics not sufficiently covered in other courses. Repeat Status: Course may be repeated.
Attribute/Distribution: NS

PHY 120 Physics of Medical Imaging: Ultrasound and Radiography 2 Credits
An introduction and analysis of the physical principles and effects that underlay medical imaging techniques such as those using ultrasound, x-rays or other high-energy radiation. The course will serve as an introduction to intermediate quantum physics and electromagnetism concepts and discuss the effects and data collection techniques that ultimately allow to create an image that a physician can interpret for clinical purposes.
Prerequisites: PHY 021 or PHY 013
Attribute/Distribution: NS

PHY 121 Physics of Medical Imaging: Ultrasound and Radiography, Supplement 1 Credit
A supplementary course taken concurrently with PHY 120 [Physics of Medical Imaging: Ultrasound and Radiography]. Themes pertaining ultrasound and radiography will be covered more in depth, like for example: SPECT- and PET-scans, Beam forming and phased arrays, Dosimetry, Image formation (Radon transform and projection slice theorem).
Prerequisites: PHY 021 or PHY 013
Corequisites: PHY 120
Attribute/Distribution: NS

PHY 122 Physics of Medical Imaging: Magnetic Resonance 2 Credits
An introduction and analysis of the physical principles and effects that underlay medical imaging techniques based on nuclear magnetic resonance, such as MRI (Magnetic Resonance Imaging). The course will serve as an introduction to intermediate/advanced quantum physics and electromagnetism concepts and discuss the effects and data collection techniques that ultimately allow to create an image that a physician can interpret for clinical purposes.
Prerequisites: PHY 021 or PHY 013
Attribute/Distribution: NS
PHY 123 Physics of Medical Imaging: Magnetic Resonance, Supplement 1 Credit
A supplementary course taken concurrently with PHY 122 [Physics of Medical Imaging: Magnetic Resonance]. Themes pertaining magnetic resonance will be covered more in depth, like for example: Fourier analysis in spectroscopy, Advanced techniques in magnetic resonance (fMRI, DTI, mMRI, ...)
Prerequisites: PHY 021 or PHY 013
Corequisites: PHY 122
Attribute/Distribution: NS

PHY 142 Special Relativity 3 Credits
A development of the special theory of relativity at an introductory/intermediate level. Starting from the equivalence between inertial reference frames, the course will introduce the Lorentz transformations, space and time in different reference frames, the new relativistic versions of kinematics and mechanics, and the relationship between relativity and electromagnetism. Topics include momentum and energy, four-vectors, acceleration and forces, the relativistic version of Newton’s second law, zero-mass particles, and the relation between electric and magnetic fields.
Prerequisites: PHY 013 or PHY 021
Attribute/Distribution: NS

PHY 172 Special Topics In Physics 1-4 Credits
Selected topics not sufficiently covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS

PHY 212 Electricity and Magnetism I 3 Credits
Electrostatics, magnetostatics, and electromagnetic induction.
Prerequisites: (PHY 021 or PHY 013 or PHY 023) and MATH 205
Can be taken Concurrently: MATH 205
Attribute/Distribution: NS

PHY 213 Electricity and Magnetism II 3 Credits
Maxwell’s equations, Poynting’s theorem, potentials, the wave equation, waves in vacuum and in materials, transmission and reflection at boundaries, guided waves, dispersion, electromagnetic field of moving charges, radiation, Lorentz invariance and other symmetries of Maxwell’s equations.
Prerequisites: PHY 212
Attribute/Distribution: NS

PHY 215 Classical Mechanics I 4 Credits
Kinematics and dynamics of point masses with various force laws; conservation laws; systems of particles; rotating coordinate systems; rigid body motions; topics from Lagrange’s and Hamilton’s formulations of mechanics; continuum mechanics.
Prerequisites: (PHY 021 or PHY 013 or PHY 023) and MATH 205
Can be taken Concurrently: MATH 205
Attribute/Distribution: NS

PHY 220 Advanced Physics Laboratory I 3 Credits
In a lab/lecture format, students learn basic elements needed for experimental, observational and computational work in physics, astrophysics and other technical areas. This course and its continuation as PHY 221 include topics such as electronics, optics, vacuum systems, data acquisition and analysis, curve fitting, scientific computing, interfacing of computers to experiments, and modern machining. These methods will be utilized in the examination of various physical systems; e.g., atomic and molecular spectroscopy, astronomical observations, condensed-matter phenomena, and others.
Prerequisites: (PHY 021 or PHY 023) and PHY 022 and CSE 002
Attribute/Distribution: NS

PHY 221 Advanced Physics Laboratory II 2 Credits
This is a continuation of PHY 220.
Prerequisites: (PHY 021 or PHY 023) and PHY 022 and PHY 220
Attribute/Distribution: NS

PHY 272 Special Topics In Physics 1-4 Credits
Selected topics not sufficiently covered in other courses.
Repeat Status: Course may be repeated.

PHY 273 Research 2-3 Credits
Participation in current research projects being carried out within the department.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS

PHY 300 Apprentice Teaching 1-4 Credits

PHY 332 (ASTR 332) High-Energy Astrophysics 3 Credits
Observation and theory of X-ray and gamma-ray sources, quasars, pulsars, radio galaxies, neutron stars, black holes. Results from ultraviolet, X-ray and gamma-ray satellites. Generally offered in the spring of odd-numbered years.
Prerequisites: (PHY 021 or PHY 023) and (MATH 023 or MATH 033) and PHY 031 and PHY 215
Can be taken Concurrently: MATH 023, MATH 033
Attribute/Distribution: NS

PHY 340 Thermal Physics 3 Credits
Basic principles of thermodynamics, kinetic theory, and statistical mechanics, with emphasis on applications to classical and quantum mechanical physical systems.
Prerequisites: (PHY 013 or PHY 021 or PHY 023) and (MATH 023 or MATH 032 or MATH 052)
Attribute/Distribution: NS

PHY 342 (ASTR 342) Relativity and Cosmology 3 Credits
Special and general relativity. Schwarzschild and Kerr black holes. Super massive stars. Relativistic theories of the origin and evolution of the universe. Generally offered in the spring of even-numbered years.
Prerequisites: (PHY 021 or PHY 023) and (MATH 023 or MATH 033) and PHY 215
Can be taken Concurrently: MATH 023, MATH 033, PHY 215
Attribute/Distribution: NS

PHY 348 Plasma Physics 3 Credits
Single particle behavior in electric and magnetic fields, plasmas as fluids, waves in plasmas, transport properties, kinetic theory of plasmas, controlled thermonuclear fusion devices. Must have senior standing or consent of the department chair.
Prerequisites: (PHY 021 or PHY 023) and MATH 205
Attribute/Distribution: NS

PHY 352 Modern Optics 3 Credits
Paraxial optics, wave and vectorial theory of light, coherence and interference, diffraction, crystal optics, and lasers.
Prerequisites: MATH 205 and (PHY 213 or ECE 203)
Can be taken Concurrently: PHY 213, ECE 203
Attribute/Distribution: NS

PHY 355 Nonlinear Optics 3 Credits
This course will introduce the fundamental principles of nonlinear optics. Topics include nonlinear interaction of optical radiation with matter, multi-photon interactions, electro-optics, self and cross phase modulation, and the nonlinear optical susceptibilities that describe all these effects in the mainframe of electromagnetic theory.
Prerequisites: PHY 031 and (PHY 213 or ECE 203)
Can be taken Concurrently: PHY 213, ECE 203
Attribute/Distribution: NS

PHY 362 Atomic and Molecular Structure 3 Credits
Review of quantum mechanical treatment of one-electron atoms, electron spin and fine structure, multi-electron atoms, Pauli principle, Zeeman and Stark effects, hyperfine structure, structure and spectra of simple molecules.
Prerequisites: (PHY 031 or CHM 341) and MATH 205
Attribute/Distribution: NS

PHY 363 Physics of Solids 3 Credits
Introduction to the theory of solids with particular reference to the physics of metals and semiconductors.
Prerequisites: (PHY 031 or MAT 316 or CHM 341) and PHY 340
Can be taken Concurrently: PHY 340
Attribute/Distribution: NS
PHY 364 Nuclear and Elementary Particle Physics 3 Credits
Models, properties, and classification of nuclei and elementary particles; nuclear and elementary particle reactions and decays; radiation and particle detectors; accelerators; applications.
Prerequisites: PHY 031 and MATH 205 and PHY 362
Attribute/Distribution: NS
PHY 365 Physics Of Fluids 3 Credits
Concepts of fluid dynamics; continuum and molecular approaches; waves, shocks and nozzle flows; nature of turbulence; experimental methods of study.
Prerequisites: (PHY 212 or ECE 202) and (PHY 340 or ME 104)
Can be taken Concurrently: PHY 212, ECE 202, PHY 340, ME 104
Attribute/Distribution: NS
PHY 366 Introduction to String Theory 3 Credits
Introduction to string theory for upper-level undergraduates and beginning graduate students. Building on Einstein’s theory of general relativity and quantum theory, this course covers the fundamentals of string theory and the latest developments. Advanced topics such as D-branes, non-perturbative dualities and holography will also be covered. The course content is appropriate to students who have a working knowledge of quantum mechanics and special relativity, and have had some exposure to general relativity. Instructor permission required in lieu of Phy 362/369.
Prerequisites: PHY 031 and PHY 215 and (PHY 362 or PHY 369)
Can be taken Concurrently: PHY 369
Attribute/Distribution: NS
PHY 369 Quantum Mechanics I 3 Credits
Prerequisites: PHY 031 and MATH 205 and PHY 215 and PHY 362
Attribute/Distribution: NS
PHY 372 Special Topics In Physics 1-3 Credits
Selected topics not sufficiently covered in other courses.
Repeat Status: Course may be repeated.
Attribute/Distribution: NS
PHY 380 Introduction to Computational Physics 3 Credits
Prerequisites: MATH 205
Can be taken Concurrently: MATH 205
Attribute/Distribution: NS
PHY 382 Physics of Cells 3 Credits
This course focuses on the physical principles underlying the organization of living cells, which spans several orders of magnitude in length and time. It provides an introduction to biological physics and relevant concepts of soft-matter physics. Topics include: self-organization of filaments and motor proteins of the cytoskeleton that determine cell shape and motion; the plasma membrane as a fluid responsive to environmental and biochemical signals; biological waves and pattern formation; mathematical modeling of biological systems; experimental methods and image analysis.
Prerequisites: (PHY 010 or PHY 011) and (PHY 013 or PHY 021)
Attribute/Distribution: NS
PHY 389 Honors Project 1-8 Credits
Repeat Status: Course may be repeated.
PHY 420 Mechanics 3 Credits
Includes the variational methods of classical mechanics, methods of Hamilton and Lagrange, canonical transformations, Hamilton-Jacobi Theory.
PHY 421 Electricity & Magnetism I 3 Credits
Electrostatics, magnetostatics, Maxwell’s equations, dynamics of charged particles, multipole fields.
PHY 422 Electricity & Magnetism II 3 Credits
Electrodynamics, electromagnetic radiation, physical optics, electrodynamics in anisotropic media. Special theory of relativity.
Prerequisites: PHY 421
PHY 424 Quantum Mechanics II 3 Credits
General principles of quantum theory; approximation methods; spectra; symmetry laws; theory of scattering.
Prerequisites: PHY 369
PHY 425 Quantum Mechanics III 3 Credits
Prerequisites: PHY 424
PHY 428 Methods of Mathematical Physics I 3 Credits
Analytical and numerical methods of solving the ordinary and partial differential equations that occur in physics and engineering. Includes treatments of complex variables, special functions, product solutions and integral transforms.
PHY 429 Methods of Mathematical Physics II 3 Credits
Continuation of Physics 428 to include the use of integral equations. Green’s functions, group theory, and more on numerical methods.
Prerequisites: PHY 428
PHY 431 Theory Of Solids 3 Credits
Prerequisites: PHY 363 and PHY 424
PHY 442 Statistical Mechanics 3 Credits
General principles of statistical mechanics with application to thermodynamics and the equilibrium properties of matter.
Prerequisites: PHY 340 and PHY 369
PHY 443 Nonequilibrium Statistical Mechanics 3 Credits
A continuation of PHY 442. Applications of kinetic theory and statistical mechanics to nonequilibrium processes; nonequilibrium thermodynamics.
Prerequisites: PHY 442
PHY 446 Atomic and Molecular Physics 3 Credits
Advanced topics in the experimental and theoretical study of atomic and molecular structure. Topics include fine and hyperfine structure, Zeeman effect, interaction of light with matter, multi-electron atoms, molecular spectroscopy, spectral line broadening atom-atom and electron-atom collisions and modern experimental techniques.
Prerequisites: PHY 424
PHY 455 Physics of Nonlinear Phenomena 3 Credits
Basic concepts, theoretical methods of analysis and experimental development in nonlinear phenomena and chaos. Topics include nonlinear dynamics, including period-multiplying routes to chaos and strange attractors, fractal geometry and devil’s staircase. Examples of both dissipative and conservative systems will be drawn from fluid flows, plasmas, nonlinear optics, mechanics and waves in disordered media. Must have graduate standing in science or engineering, or consent of the chairman of the department.
PHY 462 Theories of Elementary Particle Interactions 3 Credits
Relativistic quantum theory with applications to the strong, electromagnetic and weak interactions of elementary particles.
Prerequisites: PHY 425
PHY 472 Special Topics In Physics 1-3 Credits
Selected topics not sufficiently covered in other courses.
Repeat Status: Course may be repeated.
PHY 474 Seminar In Modern Physics 3 Credits
Discussion of important advances in experimental physics.
Repeat Status: Course may be repeated.
PHY 475 Seminar In Modern Physics 3 Credits
Discussion of important advances in theoretical physics.
Repeat Status: Course may be repeated.
PHY 482 Applied Optics 3 Credits
Review of ray and wave optics with extension to inhomogenous media, polarized optical waves, crystal optics, beam optics in free space (Gaussian and other types of beams) and transmission through various optical elements, guided wave propagation in planar waveguides and fibers (modal analysis), incidence of chromatic and polarization mode dispersion, guided propagation of pulses, nonlinear effects in waveguides (solitons), periodic interactions in waveguides, acousto-optic and electro-optics.
Prerequisites: PHY 352

PHY 490 Thesis 1-6 Credits

PHY 491 Research 3 Credits
Research problems in experimental or theoretical physics.

PHY 492 Research 3 Credits
Continuation of PHY 491.
Repeat Status: Course may be repeated.

PHY 499 Dissertation 1-15 Credits
Repeat Status: Course may be repeated.

**Political Science**

Brian L. Fife, Ph.D, Professor and Department Chair
E:mail: blf218@lehigh.edu / Phone: 610-758-3338 / Fax: 610-758-3348
http://cas.lehigh.edu/pols

The major in political science is designed to promote understanding of political ideas, institutions and processes, and to develop skills in analyzing and evaluating political problems.

A balanced program within the discipline, one that exposes the student to various areas of inquiry in political institutions and political processes as well as in the comparative and philosophical perspectives of political analysis, has been the manner in which the goals of the major program generally have been achieved. While the major program outlined below will prove adequate for most student needs, it may be that some special factors such as late transfer or unusual interests and/or abilities the outlined program does not accommodate some students. In that case students may, in consultation with their advisers, develop a major program that in their judgment will more adequately fulfill those needs.

The faculty adviser to the student majoring in political science is designated by the department. The adviser consults with the student and approves the major program. The adviser attempts to help the student relate courses offered by the department to the student's educational goals. The adviser also may act as a resource for the student, and may suggest courses in other disciplines, language courses, and courses in research techniques that may be of benefit.

A variety of experiential opportunities are available to undergraduates majoring in political science. The department, for example, offers a Community Politics Internship every semester that includes opportunities for internship placements in either local government, private agencies, or law offices. Students are also encouraged to apply for off-campus internship opportunities, e.g., American University's Washington Semester Program and The Philadelphia Center's Internship in Philadelphia.

Completion of the political science major is considered suitable training for the undergraduate who wishes to go to law school, to become a social science teacher, or to work as a governmental official, party or civic leader, public affairs commentator, or staff member of a government research bureau. In addition, the private sector continues to provide opportunities in areas such as banking, insurance, and marketing for bachelor of arts graduates with training in the social sciences. Graduate study is advisable for students contemplating certain careers: college teaching, research, or public administration, for example.

**Professors.** Brian L. Fife, PHD (State University of NY at Binghamton); Jennifer M. Jensen, PHD (University of North Carolina Chapel Hill); Richard K. Matthews, PHD (University of Toronto); Laura K Olson, PHD (University of Colorado Boulder)

**Associate Professors.** Frank L. Davis, PHD (University of North Carolina at Chapel Hill); Nandini Deo, PHD (Yale University); Anthony R DiMaggio, PHD (University of Illinois at Chicago); Vera L. Fennell, PHD (University of Chicago); Breena Holland, PHD (University of Chicago); Janet Laible, PHD (Yale University); Holona L. Ochs, PHD (University of Kansas); Albert H. Wurth, Jr., PHD (University of North Carolina Chapel Hill)

**Professor Of Practice.** Karen Beck Pooley, PHD (University of Pennsylvania)

**Emeriti.** Edward P. Morgan, PHD (Brandeis University); Howard R. Whitcomb, PHD (State University of NY at Albany)

The three core courses are required. Individual exceptions may be made, for good reasons, by the major adviser with the approval of the department chair.

**Major Requirements**

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>POLS 001</td>
<td>American Political System</td>
<td>4</td>
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<tr>
<td>POLS 003</td>
<td>Comparative Politics</td>
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</tbody>
</table>

Select one of the following: 4

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>POLS 100</td>
<td>Introduction to Political Thought</td>
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<tr>
<td>POLS 101</td>
<td>Ancient Political Heritage</td>
</tr>
<tr>
<td>POLS 102</td>
<td>Modern Political Heritage</td>
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</tbody>
</table>

**Electives**

Select seven of the following with at least two courses from each of the two fields listed below: 28

- American Politics, Public Law and Interdisciplinary
  - POLS 103 | Introduction to Public Administration |
  - POLS 104 | Political Sociology |
  - POLS 107 | The Politics of the Environment |
  - POLS 108 | Global Citizenship and its Discontents |
  - POLS 109 | Introduction to Public Policy |
  - POLS 110 | Environmental Planning for Healthy Cities |
  - POLS 115 | Technology As Politics |
  - POLS 179 | Politics of Women |
  - POLS 205 | The Political Development of American Race Relations |
  - POLS 230 | Social Movements and Legacies of the 1960s |
  - POLS 232 | The Vietnam War in Politics, Media, and Memory |
  - POLS 240 | Law and Order. The Politics of Crime and Punishment |
  - POLS 274 | Political Parties and Elections |
  - POLS 282 | First Ladies and the Changing Role of Women |
  - POLS 302 | Comparative State Politics |
  - POLS 304 | Governors and Presidents |
  - POLS 305 | Residential Segregation: Policies and Practices |
  - POLS 306 | Public Policy Process |
  - POLS 307 | The Politics of Mental Health Policy |
  - POLS 309 | Nonprofit Administration |
  - POLS 310 | Social Entrepreneurship: How to Change the World |
  - POLS 312 | Urban Environmental Policy Workshop |
  - POLS 314 | Urban Agriculture Policy, Planning and Practice |
  - POLS 317 | The American Presidency |
  - POLS 318 | Descriptive Statistics and Mapping |
  - POLS 326 | Organizing For Democracy |
  - POLS 328 | U.S. Politics and the Environment |
  - POLS 329 | Propaganda, Media, and American Politics |
  - POLS 331 | Community Politics Internship |
## Political Science

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<td>Social Psychology of Politics</td>
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<td>POLS 348</td>
<td>Land Use, Growth Management, and the Politics of Sprawl</td>
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<td>POLS 351</td>
<td>Constitutional Law and Politics</td>
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<td>POLS 352</td>
<td>Civil Rights and Civil Liberties</td>
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<td>POLS 354</td>
<td>U.S. Health Care Politics</td>
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<td>POLS 358</td>
<td>Interest Groups, Faction, and Coalitions in American Politics</td>
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<td>POLS 359</td>
<td>U.S. Congress</td>
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<td>POLS 360</td>
<td>Public Administration</td>
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<td>POLS 363</td>
<td>Public Opinion Research</td>
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<td>POLS 373</td>
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<td>POLS 375</td>
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<td>Seminar: National Social Policy</td>
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<td>Political Theory and Comparative Politics</td>
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<td>Introduction to Political Thought</td>
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<td>Environmental Values and Ethics</td>
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<td>POLS 125</td>
<td>International Political Economy</td>
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<td>POLS 133</td>
<td>Lehight in Martinique: Globalization and Local Identity</td>
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<td>POLS 201</td>
<td>Democracy and Dictatorship in South Asia</td>
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<td>POLS 301</td>
<td>Current Political Controversies</td>
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<td>POLS 311</td>
<td>Environmental Valuation for Policy Design</td>
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<td>POLS 321</td>
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<td>POLS 323</td>
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<td>POLS 324</td>
<td>Politics of Western Europe</td>
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<td>POLS 325</td>
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<td>POLS 335</td>
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<td>POLS 336</td>
<td>U.S. Foreign Policy and Latin America</td>
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<td>POLS 337</td>
<td>Religion and Politics in Latin America</td>
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<td>POLS 338</td>
<td>Markets, Justice, and Law</td>
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<td>POLS 339</td>
<td>The Rise of the State in Modern East Asia</td>
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<td>POLS 340</td>
<td>Domination</td>
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<td>Gender and Third World Development</td>
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<td>POLS 343</td>
<td>Global Politics of Race: Asia and Africa</td>
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<td>POLS 350</td>
<td>Religion and Politics in Comparative Perspective</td>
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<td>POLS 355</td>
<td>Environmental Justice and the Law</td>
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<tr>
<td>POLS 356</td>
<td>Seminar: Political Philosophy</td>
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<td>POLS 357</td>
<td>Politics of Authenticity</td>
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<td>POLS 364</td>
<td>Issues in Contemporary Political Philosophy</td>
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<td>POLS 367</td>
<td>American Political Thought</td>
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<tr>
<td>POLS 370</td>
<td>Seminar: The Citizen versus the Administrative State</td>
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Total Credits: 40

1. One of the electives may, with the consent of the department, be in a cognate field.

### POLITICAL SCIENCE MINOR

It takes five (5) courses to complete the political science minor. Two core courses are required plus any three other POLS courses (core or elective).
POLS 100 (GS 100, PHIL 100) Introduction to Political Thought 4 Credits
A critical examination of political ideologies: Liberalism, Marxism, Fascism, and Islamism.

POLS 101 Ancient Political Heritage 4 Credits
Important political thinkers from the pre-Socratics to early, modern political theorists like Machiavelli.
Attribute/Distribution: SS

POLS 102 Modern Political Heritage 4 Credits
Beginning where POLS 101 ends: from early, modern theorists (e.g., Hobbes) up to contemporary thinkers (e.g., Marcuse).
Attribute/Distribution: SS

POLS 103 Introduction to Public Administration 4 Credits
This course presents the intellectual history of the study of public administration in a manner that is intended to inform career choices for those who might consider public service and provide a broad introduction to the field of public administration. Students will gain a comprehensive perspective on the public administration discipline by exploring the pervasive puzzles, ethical dilemmas, and the critical issues in governance to date.
Attribute/Distribution: SS

POLS 104 (SOC 104) Political Sociology 4 Credits
An introduction to political sociology through an examination of the major sociological questions concerning power, politics, and the state. Covers questions concerning state formation, nationalism, social movements, globalization, political culture and participation, and civil society.
Attribute/Distribution: SS

POLS 105 (ES 105) US Environmental Policy and Law 4 Credits
Analysis of the framework that has been established to protect the environment and promote sustainable growth. Focus on the roles of the different branches of the U.S. government and the relative responsibilities of state and local governments within this framework. Consideration of the political nature of environmental issues and the social forces influencing environmental protection in different areas of domestic environmental policy, such as climate change, toxic waste disposal, and natural resources conservation.
Attribute/Distribution: SS

POLS 106 (ES 106) Environmental Values and Ethics 4 Credits
An introduction to the ethical perspectives and values that shape human relationships to the natural environment in contemporary society. What are the moral implications of these relationships for justice and human collective action? Given these implications, what policy responses to environmental problems are morally or politically justifiable? In answering these questions, the course explores ethical ideas developed in different schools of environmental thought, such as deep ecology and ecofeminism, in addition to ideas that emerge from social movements, such as environmental justice and bioregionalism.
Attribute/Distribution: SS

POLS 107 The Politics of the Environment 4 Credits
A survey of the major environmental, resource, energy and population problems of modern society, focusing on the United States. The politics of man's relationship with nature, the political problems of ecological scarcity and public goods, and the response of the American political system to environmental issues.
Attribute/Distribution: SS

POLS 108 Global Citizenship and its Discontents 4 Credits
The purpose of the course is to consider the nature-and desirability-of citizenship, both as an ideal and as applied (if possible) in the global context. What exactly does it mean to be a “citizen”\textsuperscript{?} Does citizenship require particular actions, thoughts, or values? What are the legal, political, and moral obligations of this designation? What exactly do you owe to your neighbor, or to someone on the other side of the world? Readings range from Socrates to the Manefesto of the Unabomber.
Attribute/Distribution: SS

POLS 109 Introduction to Public Policy 4 Credits
Introduces students to the basic theories, principles, institutions, and processes of public policy in the U.S. The objectives are to provide students with an understanding of how social problems are defined, how potential solutions to those problems move through the policy process, and gain an empirical perspective on the consequences, as well as insight regarding the normative dimensions of policy making. Students will develop knowledge of the framework for understanding policy and engage in critical thinking regarding the nature of policy.
Attribute/Distribution: SS

POLS 110 (ES 110, HMS 110) Environmental Planning for Healthy Cities 4 Credits
An introduction to the topic of environmental planning, the course will review the roles of citizens, other stakeholders, political interests, and local governments in determining the use of land; unpack the meaning of “sustainability;” and grapple with the challenge of balancing communities’ demand for development with the need to protect valuable natural resources. Students will be introduced to examples of successful and unsuccessful instances of environmental planning both at home and abroad.
Attribute/Distribution: SS

POLS 115 Technology As Politics 4 Credits
Relationship of technology and technological change with politics and public policy. Review of theories of political significance of technology, including technological determinism, technology assessment, technological progress and appropriate technology. Specific issues in technology with emphasis on U.S.
Attribute/Distribution: ND

POLS 126 (REL 126) Religion, Law and Constitution 4 Credits
An examination of the relationship of religion to American law and the United States Constitution. Course will focus on Supreme Court decisions involving the "establishment" and "free exercise" clauses of the First Amendment. Attention will also be given to the intellectual, historical, religious and theological background behind the American experiment in "church-state" separation, including the thought of Roger Williams, the Founders (Washington, Jefferson, Madison), and contemporary analysts (e.g., M. Nussbaum).
Attribute/Distribution: HU

POLS 133 (AAS 133, FREN 133, HIST 133, LAS 133, MLL 133) Lehigh in Martinique: Globalization and Local Identity 3-4 Credits
History, culture, and politics of the French Caribbean island of Martinique, from its position as a key site of the 18th century Atlantic World economy to becoming an official French department and outpost of the European Union. Interdisciplinary perspectives on the complex nature of social identity, historical memory and impact of globalization. No French is required. Offered during winter inter-term through Lehigh Study Abroad.

POLS 179 (WGSS 179) Politics of Women 4 Credits
Selected social and political issues relating to the role of women in American society. Focuses on such questions as economic equality, poverty, and work roles, the older woman, gender gap, political leadership, reproduction technology, and sexual violence.
Attribute/Distribution: SS

POLS 201 (ASIA 201, GS 201) Democracy and Dictatorship in South Asia 4 Credits
Examines the politics of countries in South Asia (India, Pakistan, Bangladesh, Sri Lanka, Nepal, Bhutan, and the Maldives). Some of the key themes are 1) the lasting legacy of colonialism, 2) ways in which ethnic and religious diversity is managed, 3) distinctiveness of political institutions like parliament and constitutions in South Asia, and 4) how politics, economics, and culture relate to one another. The focus of the course changes each year in order to reflect current developments and student interest.
Attribute/Distribution: SS

POLS 205 (AAS 205) The Political Development of American Race Relations 4 Credits
This course examines the distinctive role race has played in shaping the political history of the United States.
Attribute/Distribution: SS
**POL 210 (AAS 210, WGSS 210) Revolution on Campus 4 Credits**
University protests are often sites of political protest. Some of these protests are expressive but ineffective, others can spark revolutions and regime change. Why? What distinguishes universities as sites for resistance? What makes students prone to mobilization? The study of politics can seem like an abstract pursuit, one that is not relevant to our lives. This course takes the scholarly literature on social movements and applies it to the university. Students will engage in social activism as part of this course.

**Attribute/Distribution:** SS

**POL 225 (IR 225) International Political Economy 4 Credits**
Principles governing the interaction between the economic and political components of international phenomena. Political aspects of trade, investment, and global economic order. Political underpinnings of international economic relations. Domestic and international political consequences of economic policy and international economic relations.

**Prerequisites:** IR 010 and ECO 001

**Attribute/Distribution:** SS

**POL 230 (AAS 230) Social Movements From the 1960s to Present 4 Credits**
The lessons of U.S. social and political movements from the 1960s and the post-2000 era. Students examine social movements through the lens of intersectionality, with a focus on civil rights, anti-war activism, women’s rights, global justice, and ecology movements, to assess their connection to democracy and citizens’ lives.

**Attribute/Distribution:** SS

**POL 232 War on Terr in Politics, Media, and Memory 4 Credits**
Examines the meaning of the US war on terrorism as interpreted and disputed in American politics, the mass media, and private and public memory. Reviews the political history and context of the war, personal experiences and critical perspectives on the war, and characterizations of the war in mainstream news media and popular film.

**Attribute/Distribution:** SS

**POL 240 Law and Order. The Politics of Crime and Punishment 4 Credits**
This course explores the legal and political consequences of various theories of crime, punishment and social control in the United States. Topics include policing, racial profiling, trial court proceedings and the administration of justice, growing incarceration rates and the prison industry, capital punishment, the jury system, and the nature of legal obligation.

**Attribute/Distribution:** SS

**POL 274 Political Parties and Elections 4 Credits**
Study of the organization, functions and behavior of political parties in the United States. Includes voting behavior, campaigns and elections, polling, interest groups, public opinion and the role of the media.

**Attribute/Distribution:** SS

**POL 300 Apprentice Teaching 1-4 Credits**
Repeat Status: Course may be repeated.

**POL 301 Current Political Controversies 4 Credits**
Selected topical policy issues and alternative approaches to understanding them. Includes the major domestic questions facing the U.S. Emphasis is on debating the current issues of the day.

**Attribute/Distribution:** SS

**POL 302 Comparative State Politics 4 Credits**
Analysis of major questions relating to the role of the states in the American federal system and their relationship with the national government.

**Attribute/Distribution:** SS

**POL 305 (AAS 305, ES 305) Residential Segregation: Policies and Practices 4 Credits**
This course is an introductory planning course, with an emphasis on housing and community development policy. It will examine historical and contemporary aspects of urban politics; the economic, demographic, and spatial evolution of American cities; and various urban problems, such as the spatial mismatch between people and jobs, housing quality and affordability, and residential segregation. Finally, the course will review how planners have addressed conditions in cities and regions over time.

**Attribute/Distribution:** SS

**POL 306 Public Policy Process 3-4 Credits**
Power relations and their impacts on selected public policy issues, specifically taxation, housing, environment, poverty, energy, the military, and health.

**Attribute/Distribution:** SS

**POL 307 (HMS 307) The Politics of Mental Health Policy 4 Credits**
What is normal behavior, and how do we come to understand mental illness? How do the resulting policies, to address mental health, impact society? This course is designed to facilitate thoughtful discourse on the various ways in which society regulates access to opportunities, facilitates integration or alienation, and constructs the social world.

**POL 309 (ENTP 309) Nonprofit Administration 4 Credits**
This course will address key questions in nonprofit sector research, policy, and management and familiarize students with factors that tend to make the nonprofit sector distinct. Students will gain an understanding of the scope and character of nonprofit activity in the U.S. and abroad. We will explore current debates in nonprofit policy and evaluate critical challenges facing the organization and management of nonprofits.

**Attribute/Distribution:** SS

**POL 310 (ENTP 310) Social Entrepreneurship: How to Change the World 4 Credits**
The marketplace does not always have to be harsh. Social entrepreneurship uses market-based approaches to address needs and solve problems in our society. Students in this seminar-style course will learn how to identify community problems, convince the community that it is a problem worth solving, design the response, and implement it. Hands-on projects. Must have at least junior standing or consent of the minor director.

**Attribute/Distribution:** SS

**POL 311 (ES 311) Environmental Valuation for Policy Design 4 Credits**
Seminar on how to value the environment for the purpose of designing and analyzing environmental policies. Review of the "contingent valuation method" currently used to price environmental resources, and assessment of this method's empirical and normative strengths and weaknesses. Evaluation of "deliberative monetary valuation" as an improved method for environmental assessment. Consideration of non-monetary approaches to environmental valuation as alternatives to understanding the environment's relationship to human well-being in policy contexts.

**Attribute/Distribution:** SS

**POL 312 (ES 312) Urban Environmental Policy Workshop 4 Credits**
An urban environmental planning and policy course in which students explore an issue affecting the local community, evaluate current policy responses and possible alternatives, and present recommendations to public officials, local organizations, and community members. Student research and analysis will draw on primary and secondary data, as well as feedback from conducting individual interviews, focus groups, and community meetings. Prior projects include determining how Bethlehem's new City Revitalization improvement Zone (CRIZ) might best benefit the South Side of Bethlehem, PA.

**Attribute/Distribution:** SS
POLS 314 (ES 314) Urban Agriculture Policy, Planning and Practice 4 Credits
Review of urban agriculture and greening programs in growing social movement to strengthen neighborhoods, promote healthier living, and create localized and sustainable food economies. Students consider these programs in relation to national farm policy and develop urban agriculture projects with community partners. Case studies illustrate how improving food access, beautifying vacant land, and reducing farm-to-table distances, are creatively and successfully combined. Students will receive hands-on gardening and farming experience at a community garden.
Attribute/Distribution: SS

POLS 317 The American Presidency 3-4 Credits
Role of the executive in the American political process. Includes an analysis of the historical development, selection process, and scope of executive power. Emphasizes domestic and foreign policy initiatives of selected presidents from FDR to today.
Prerequisites: (POLS 001)
Attribute/Distribution: SS

POLS 319 (ES 319) Mapping Data for Policymaking 4 Credits
This research methods course teaches students to highlight important conditions and trends — ones that warrant policymakers’ attention — using publicly available data sources (like the Census). Conveying information in a clear and persuasive way, one that motivates decision-makers to act, is a key step in any policymaking process. Students will become familiar with these databases and proficient at generating charts, graphs and maps using Microsoft Excel, Microsoft Access, and ArcMAP (three programs central to most jobs in policy-related fields).

POLS 320 (ES 320, HMS 320) Food Justice in Urban Environments 4 Credits
This course will review how urban agriculture and city greening programs and policies are part of a growing movement working to strengthen neighborhoods, promote healthier living, and create more localized and sustainable food economies. This class will explore research and readings from multiple disciplines on these programs and policies, and will also delve into individual case studies that illustrate how efforts to improve food access, beautify vacant land, and reduce farm-to-table distances get creatively and successfully combined.
Attribute/Distribution: SS

POLS 321 Research In Political Science 4 Credits
Models in the explanation of political phenomena, appropriateness of measurement techniques; construction of research designs; rationale and application of statistical analyses; individual projects involving the construction and testing of models employing a major social science data set. Consent of instructor required.
Attribute/Distribution: SS

POLS 322 The Politics of Data 4 Credits
Rapid advances in methods of data collection and analysis raise new political questions about how public institutions, the private sector, and individuals produce, use, and share data. This course examines how the emergence of data-driven decision-making is reshaping politics, exploring issues of inclusiveness, equality, privacy, and democratic accountability. We pay particular attention to how new methods of data analysis contribute to the exercise of power. If algorithms are not "neutral," then who is privileged in their use, diffusion and management?
Prerequisites: POLS 003
Attribute/Distribution: SS

POLS 323 Politics Of The European Union 4 Credits
The institutions and policy-making processes of the European Union. Topics include the creation of the single market and the euro, environmental and agricultural policy, regional development and the policy challenges of eastward enlargement.
Prerequisites: POLS 003 or IR 010
Attribute/Distribution: SS

POLS 324 Politics Of Western Europe 3,4 Credits
Comparative discussion of systems of government in Western Europe and of major policy questions facing these states in the post-war era. Topics include the evolution of social welfare systems, the impact of economic crises and globalization on Western European political economy, and immigration and identity politics.
Prerequisites/Distribution: SS

POLS 325 (GS 325) Nationalism, Regionalism, and Populism 3,4 Credits
Examination of major theoretical and policy debates in the study of nationalism. Focus on the emergence and endurance of nationalist movements in the modern era, the spread of autonomy movements, and the recent rise of populist politics. Discussion of responses to nationalist claims and efforts to resolve nationalist conflict.
Prerequisites: POLS 003

POLS 326 Organizing For Democracy 3-4 Credits
Seminar on the theory and practice of community and political organizing and their relationship with democracy and power in the United States, complementing semester-long student field placements with community groups and local organizations. Student teams help enhance the political voice of under-resourced community groups through organization-building, outreach, and policy input at the local level. Consent of instructor required.
Attribute/Distribution: SS

POLS 328 (ES 328) U.S. Politics and the Environment 4 Credits
An examination of contemporary American politics and policy dealing with environmental issues. Current controversies in the legislative and regulatory areas will be covered to examine environmental issues and the political process. Significant portions of the course readings will be taken from government publications.
Attribute/Distribution: SS

POLS 329 Propaganda, Media, and American Politics 4 Credits
The role of propaganda and mass media in sustaining hegemony in the United States. Emphasis on television, advertising and mass culture, public relations, news media, and political propaganda pertaining to U.S. foreign and domestic policy. Students compare critical counter-hegemonic theories to political speeches, documents, news reports, and media encounters that shape much of American political life.
Attribute/Distribution: SS

POLS 331 Community Politics Internship 4 Credits
Integrated fieldwork and academic study. Seminar, research paper, and journal; internship with government and social service agencies, political groups, elected officials, and law offices. Consent of instructor required.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

POLS 333 Social Psychology of Politics 4 Credits
Political behavior viewed from a psychological and social psychological perspective.
Prerequisites: (ANTH 001 or SOC 001 or PSYC 001)
Attribute/Distribution: SS

POLS 335 Latin American Political Systems 4 Credits
Democratic, authoritarian and revolutionary paths to contemporary political issues. Political, economic and social implications of contemporary “democratic” regimes and neo-liberal economic policies. Discussion groups and student presentations on prospects for democratic peace and prosperity in the future.
Prerequisites: (POLS 003)
Attribute/Distribution: SS

POLS 336 U.S. Foreign Policy and Latin America 3-4 Credits
U.S. historical relationship with Central America, Caribbean and South America with emphasis on economic and military dominance. Contemporary issues such as U.S. invasions of Panama and Grenada, U.S. Cuban relations, the militarization of the "drug war," counter-insurgency. Written analysis of competing U.S. interests across time and regions.
Prerequisites: (POLS 003)
Attribute/Distribution: SS
POLS 337 Religion and Politics in Latin America 4 Credits  
Indigenous and “imported” religious structures, the prominent role of the Catholic Church in Latin America, and the recent explosion of Protestant/ Pentecostal churches. Emphasis on the intersection of religious belief and power (i.e., gender, local politics, national development, etc.). Short papers integrate material with students’ knowledge of religious/political phenomena. Discussion groups analyze philosophical foundations of belief.  
Prerequisites: (POLS 003 and POLS 336)  
Attribute/Distribution: SS

POLS 338 Markets, Justice, And Law 3,4 Credits  
The exploration of the various ways in which markets shape cultural, social, ethical, and political practices in contemporary society. Normative justification for market as an institutional arrangement that is neutral between different views of “the good”. Ethical critique of this normative justification and implications of the critique for law and policy.  
Attribute/Distribution: SS

POLS 339 (ASIA 339) The Rise of the State in Modern East Asia 4 Credits  
An examination of the role of Asian nationalism in the construction of the modern state form in Asia.  
Attribute/Distribution: SS

POLS 340 Domination 4 Credits  
Is hierarchy in human societies inevitable? How do we make sense of justice and equality if domination is an inescapable aspect of the social world? Our consideration of these questions will draw on a wide range of literatures including primatology, political philosophy, anthropology, and gender studies. We will also use non-academic sources such as films and novels to explore the world of domination and resistance.  
Attribute/Distribution: SS

POLS 342 (GS 342, WGSS 342) Gender and Third World Development 3-4 Credits  
Focus on gender implications of contemporary strategies for Third World economic growth, neo-liberalism. How do economic theories affect ‘real people’? How do economic theories affect men vs. women? What is the role of people who want to ‘help’? Some background in economic theories and/or Third World politics desired, but not required.  
Prerequisites: POLS 001 or WGSS 001  
Attribute/Distribution: SS

POLS 343 (AAS 343, ASIA 343, GS 343) Global Politics of Race: Asia and Africa 4 Credits  
An examination of the concept of “race” and its impact on domestic and international politics.  
Attribute/Distribution: SS

POLS 348 Land Use, Growth Management, and the Politics of Sprawl 3-4 Credits  
An intro to the issues of Land Use Planning, Community, Growth Mgmt, & Sprawl. Will examine the history of urban development in America, from the earliest settlements to the auto suburbs. Also explore such planning & development factors as comprehensive plans, zoning, & the influence of infrastructure on development. Concludes with an assessment of the revival of city centers, alternatives to sprawl, & comparisons to development patterns in other countries.  
Attribute/Distribution: SS

POLS 349 (WGSS 349) American Social Policy: Race, Class, Gender and Sexuality 4 Credits  
This course examines criminal justice, housing, health, education, and welfare policies across US states through the lenses of class, race, gender, and sexuality. Students will learn how social regulations structure opportunities and assess the implications of those opportunity structures.  
Attribute/Distribution: SS

POLS 350 Religion and Politics in Comparative Perspective 4 Credits  
This research seminar attempts to identify the conditions under which religious parties arise and become influential, how religion influences popular understandings of secular politics and the extent to which religion is a necessary feature of modern public discourse. These topics are explored through country specific cases from around the world.  
Attribute/Distribution: SS

POLS 351 Constitutional Law and Politics 4 Credits  
Exploration of the process of legal reasoning, the place of the United States Supreme Court in the American political system, the multiple influences on judicial decision-making, and various interpretive debates over the meaning of the U.S. Constitution. Following this introduction to the interplay of law and politics, the focus turns to particular domains within the canon of constitutional law, including cases pertaining to the Supreme Court’s jurisdiction and capacity; the separation of powers between the three branches of government; federalism.  
Attribute/Distribution: SS

POLS 352 Civil Rights and Civil Liberties 3-4 Credits  
A continuation of themes, issues, and debates of the previous semester (POLS 351). This course addresses the major cases and controversies within several legal domains, including the freedoms of and from religion; freedom of speech; freedom of association; freedom of the press; the right to bear arms; the rights of criminal defendants and suspects; the right to privacy; capital punishment; and, the equal protection of the law.  
Prerequisites: POLS 351  
Attribute/Distribution: SS

POLS 354 (HMS 354) U.S. Health Care Politics 4 Credits  
Health care programs, policies, and their impact on American society. Topics include approaches to health care; public sector plans (Medicare and Medicaid); managed care; the employer-sponsored system; medically uninsured; vested interests and lobbyists; movements for national health care; and options for change.  
Attribute/Distribution: SS

POLS 355 (ES 355) Environmental Justice: From Theory to Practice 4 Credits  
This course explores the various ways in which environmental law and policy can have discriminatory effects. It examines the rise and evolution of environmental justice movement, and the impact of environmental justice claims on administration policies, especially at the federal level. Considering the role of politics in the ongoing struggle for environmental justice, it reviews theories of substantive and procedural justice, and uses them to consider strategies for advancing equity in environmental law and policy.  
Prerequisites: POLS 105 or ES 105  
Attribute/Distribution: SS

POLS 356 Seminar: Political Philosophy 3-4 Credits  
Critical examination of several of the “great books” and/or “great ideas” in political thought. Students will help select the material for critical discussion.  
Attribute/Distribution: SS

POLS 357 Politics Of Authenticity 4 Credits  
Works in political philosophy, psychoanalytic theory, literature, and film that discuss knowing and being one’s self will be critically discussed. If you feel a life of “quiet desperation” is inevitable, this course is for you.  
Attribute/Distribution: SS

POLS 358 Interest Groups, Factions, and Coalitions in American Politics 4 Credits  
The rise of interest group power. Social, economic, and political reasons for groups’ increasing influence. Value of different group resources and influence in particular national policy arenas. Types of more, and less, powerful interests, and the implications of this distribution of power for American politics.  
Attribute/Distribution: SS

POLS 359 U.S. Congress 3-4 Credits  
Elections for the House and Senate and their significance for the way in which Congress functions. The formal structure of party leadership and committees, House and Senate organizational and functional differences, and informal and formal power of legislation and oversight. Congressional relations with the president, bureaucracy, and Supreme Court.  
Prerequisites: POLS 001  
Attribute/Distribution: SS
POLS 360 Public Administration 3-4 Credits
The nature of administration; problems of organization and management; public personnel policies; budgeting and budgetary system; forms of administrative responsibility.
Attribute/Distribution: SS

POLS 363 Public Opinion Research 4 Credits
This course examines fundamental processes and tools employed in public opinion research. This class is designed to provide students with the ability to develop, implement and evaluate various forms of public opinion research including surveys, focus groups and individual interviews. Students will be introduced to numerous aspects of public opinion research including questionnaire design, sampling, interviewing, data analysis, focus group moderation, and varied forms of data collection.
Attribute/Distribution: SS

POLS 364 (PHIL 364) Issues In Contemporary Political Philosophy 3-4 Credits
Selected topics in contemporary political philosophy, such as the Frankfurt school, existentialism, legitimation, authenticity, participatory democracy, and the alleged decline of political philosophy. May be repeated for credit with the consent of instructor.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

POLS 366 Political Economy 3-4 Credits
Relationship of democratic politics to government and market, and significance of economic power in the American polity. Economic rationale for the place of the market and economic institutions in polity. Emphasis on information in comparison of economic approaches to public policy and organization (public goods, market failure, and shared action) with traditional political science approaches (group mobilization and conflict, non-decisions and symbolic action).
Attribute/Distribution: SS

POLS 370 Seminar: The Citizen versus the Administrative State 4 Credits
Administrative power and policy. Constitutional and judicial control of administration. Remedies against improper administrative acts. Major emphasis will be on the United States, with some attention given to analogous issues in other countries.
Attribute/Distribution: SS

POLS 373 Globalization and Social Well-Being 4 Credits
This course examines how the various dimensions of globalization impact people by exploring factors that reflect and affect quality of life. Students will gain an understanding of the complexities resulting from the growing interconnectedness and interdependencies of global relations. The course is intended to get people thinking creatively about opportunities for connections that preserve human dignity.
Attribute/Distribution: SS

POLS 374 The Politics of Inequality 4 Credits
Examines the politics of gender, racial, and economic inequality in the U.S. Explores the effects of growing inequality on political representation, and the impact of government policy on perpetuating inequality. Class consciousness, and its effects on political beliefs and behavior, are examined.

POLS 375 (ES 375) Seminar: Green Polity 4 Credits
Development of guidelines and applications for public policy and political action directed toward environmental sustainability and political feasibility. Focus on problem-solving and policy design, confronting sustainable environmental goals with workable and responsive institutional designs.
Attribute/Distribution: SS

POLS 376 Seminar: National Social Policy 3-4 Credits
A readings/research seminar on current social policy questions. Analyzes from alternative political perspectives, such issues as Social Security, Medicare, health care, welfare reform, income inequality, and taxation. Students research a specific social issue of their choice. Class discussion on individual research and common readings.
Attribute/Distribution: SS

POLS 378 Honors Thesis in Political Science 1-4 Credits
Opportunity for undergraduate majors in Political Science to pursue an extended project for senior honors. Department permission required.
Attribute/Distribution: SS

POLS 379 Honors Thesis in Political Science 4 Credits
Continuation of POLS 378. Consent of department required.
Prerequisites: POLS 378
Attribute/Distribution: SS

POLS 381 Special Topics 1-4 Credits
A seminar on a topic of special interest in a particular political institution, process, or policy. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

POLS 382 Special Topics 1-4 Credits
A seminar on a topic of special interest in a particular political institution, process, or policy. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

POLS 402 Methods Of Policy Analysis 3 Credits
Approaches or models used to analyze public policy. Assumptions underlying each model and critiques of each; may include a number of the following approaches: institutional, process, rational, group, incremental, and/or elite.

POLS 403 Creativity, Ideas, and Methods in Political Science 3 Credits
Explores the challenges and creative possibilities of turning ‘research interests’ into doable research projects – such as research papers, MA theses, or doctoral dissertations. Discusses the domains of qualitative methodology and how social scientists seek to understand, represent, and analyze the social world. Topics: the politics of interpretation, observation, and quantification in social research, and critiques of assumptions about power and causality.

POLS 404 Environmental Valuation: Policy Design/Legal Analysis 3 Credits

POLS 405 (ES 405) Residential Segregation: Policies and Practices 3 Credits
This course is an introductory planning course, with an emphasis on housing and community development policy. It will examine historical and contemporary aspects of urban politics; the economic, demographic, and spatial evolution of American cities; and various urban problems, such as the spatial mismatch between people and jobs, housing quality and affordability, and residential segregation. Finally, the course will review how planners have addressed conditions in cities and regions over time.

POLS 407 The Politics of Mental Health Policy 3 Credits
What is normal behavior, and how do we come to understand mental illness? How do the resulting policies, to address mental health, impact society? This course is designed to facilitate thoughtful discourse on the various ways in which society regulates access to opportunities, facilitates integration or alienation, and constructs the social world.

POLS 408 American Politics Core 3 Credits
A survey of American politics utilizing readings reflecting a variety of methodological approaches and theoretical perspectives. Readings include but are not limited to works widely regarded as “classics” in American political science.
POLS 409 Nonprofit Administration 3 Credits
This course will address key questions in nonprofit sector research, policy, and management and familiarize students with factors that tend to make the nonprofit sector distinct. Students will gain an understanding of the scope and character of nonprofit activity in the U.S. and abroad. We will explore current debates in nonprofit policy and evaluate critical challenges facing the organization and management of nonprofits.

POLS 411 (ES 411) Environmental Valuation for Policy Design 3 Credits
Seminar on how to value the environment for the purpose of designing and analyzing environmental policies. Review of the "contingent valuation method" currently used to price environmental resources, and assessment of this method's empirical and normative strengths and weaknesses. Evaluation of "deliberative monetary valuation" as an improved method for environmental assessment. Consideration of non-monetary approaches to environmental valuation as alternatives to understanding the environment's relationship to human well-being in policy contexts.

POLS 412 (ES 412) Urban Environmental Policy Workshop 3 Credits
An urban environmental planning and policy course in which students explore an issue affecting the local community, evaluate current policy responses and possible alternatives, and present recommendations to public officials, local organizations, and community members. Student research and analysis will draw on primary and secondary data, as well as feedback from conducting individual interviews, focus groups, and community meetings. Prior projects include determining how Bethlehem's new City Revitalization improvement Zone (CRIZ) might best benefit the South Side of Bethlehem, PA.

POLS 413 Modern Political Philosophy 3 Credits
A study of selected modern political philosophers and their continuing effect on politics and political philosophy.

POLS 414 (ES 414) Urban Agriculture Policy, Planning and Practice 3 Credits
Review of urban agriculture and greening programs in growing social movement to strengthen neighborhoods, promote healthier living, and create localized and sustainable food economies. Students consider these programs in relation to national farm policy and develop urban agriculture projects with community partners. Case studies illustrate how improving food access, beautifying vacant land, and reducing farm-to-table distances, are creatively and successfully combined. Students will receive hands-on gardening and farming experience at a community garden.

POLS 415 State and Local Government 3 Credits
Comparative state government, urban politics, intergovernmental relations, regional and local government.

POLS 416 American Environmental Policy 3 Credits
Formation, implementation and impact of environmental policies in the U.S. An examination of the scope of environmental problems, the development of environment as an issue, the role of interest groups and public opinion, the policy-making process, and the various approaches to implementing environmental policy. Special attention to current issues and administrative approaches and to the distinctive character of environmental protection as a political issue.

POLS 419 (ES 419) Mapping Data for Policymaking 3 Credits
This research methods course teaches students to highlight important conditions and trends – ones that warrant policymakers’ attention – using publicly available data sources (like the Census). Conveying information in a clear and persuasive way, one that motivates decision-makers to act, is a key step in any policymaking process. Students will become familiar with these databases and proficient at generating charts, graphs and maps using Microsoft Excel, Microsoft Access, and ArcMAP (three programs central to most jobs in policy-related fields).

POLS 420 (ES 420) Food Justice in Urban Environments 3 Credits
This course will review how urban agriculture and city greening programs and policies are part of a growing movement working to strengthen neighborhoods, promote healthier living, and create more localized and sustainable food economies. This class will explore research and readings from multiple disciplines on these programs and policies, and will also delve into individual case studies that illustrate how efforts to improve food access, beautify vacant land, and reduce farm-to-table distances get creatively and successfully combined.

POLS 421 Research Methods 3 Credits
Models in the explanation of political phenomena, appropriateness of measurement techniques; construction of research designs; rationale and application of statistical analyses; individual projects involving the construction and testing of models employing a major social science data set.

POLS 422 The Politics of Data 3 Credits
Rapid advances in methods of data collection and analysis raise new political questions about how public institutions, the private sector, and individuals produce, use, and share data. This course examines how the emergence of data-driven decision-making is reshaping politics, exploring issues of inclusiveness, equality, privacy, and democratic accountability. We pay particular attention to how new methods of data analysis contribute to the exercise of power. If algorithms are not "neutral," then who is privileged in their use, diffusion and management?

POLS 423 Politics Of The European Union 3 Credits
The institutions and policy-making processes of the EU. Topics include the creation of the single market and the euro, environmental and agricultural policy, regional development and the policy challenges of eastward enlargement.

POLS 425 Nationalism, Regionalism, and Populism 3 Credits
Examination of major theoretical and policy debates in the study of nationalism. Focus on the emergence and endurance of nationalist movements in the modern era, the spread of autonomy movements, and the recent rise of populist politics. Discussion of responses to nationalist claims and efforts to resolve nationalist conflict.

POLS 426 Organizing For Democracy 3 Credits
Seminar on the theory and practice of community and political organizing and their relationship with democracy and power in the United States, complementing semester-long student field placements with community groups and local organizations. Student teams help enhance the political voice of under-resourced community groups through organization-building, outreach, and policy input at the local level. Consent of instructor required.

POLS 427 American Democracy: Decline or Revival? 3 Credits
Theories of democracy, analysis of its decline, and possible scenarios for a revived democratic culture. Research projects on topics of personal interest; class participation in hands-on project in local democracy-building.

POLS 428 Media & Democracy 3 Credits
General & theoretical considerations about democracy, the political economy of the mass media, and analysis of ways in which the media influence political discourse in the United States and globalized media culture. Hands-on analysis of media samples: news coverage, political advertising, public relations advertising, and interactive learning on how group might utilize the media to express its voice effectively.

POLS 429 Propaganda, Media & American Politics 3 Credits
The role of propaganda and mass media in sustaining hegemony in the United States. Emphasis on television, advertising and mass culture, public relations, news media, and political propaganda pertaining to U.S. foreign and domestic policy. Students compare critical, counter-hegemonic theories to political speeches, documents, news reports, and media encounters that shape much of American political life.

POLS 430 Social Movements From the 1960s to Present 3 Credits
The lessons of U.S. social and political movements from the 1960s and the post 2000 era. Students examine social movements through the lens of intersectionality with a focus on civil rights, anti-war activism, women’s rights, global justice, and ecology movements, to assess their connection to democracy, citizens’ lives.
POLS 431 (ES 431) Public Management 3 Credits
The study of bureaucracy and problems of public and nonprofit organization and management; executive leadership; personnel management systems and regulatory administration.

POLS 433 The Politics Of Health Care 3 Credits
Examines the politics of American health care and its impact on society. Issues ranging from the role of the private sector to government-supported programs; focus on ways to restructure the system, based on alternatives in selected nations.

POLS 435 Power, Persuasion and the American Presidency 3 Credits
Examination of selected modern presidents, from FDR to the current occupant of the White House, and their effectiveness as communicators and policy makers.

POLS 438 Markets, Justice, And Law 3 Credits
The exploration of the various ways in which markets shape cultural, social, ethical, and political practices in contemporary society. Normative justification for market as an institutional arrangement that is neutral between different views of “the good”. Ethical critique of this normative justification and implications of the critique for law and policy.

POLS 439 The Rise of the State in Modern East Asia 3 Credits
An examination of the role of Asian nationalism in the construction of the modern state form in Asia.

POLS 440 Domination 3 Credits
Is hierarchy in human societies inevitable? How do we make sense of justice and equality if domination is an inescapable aspect of the social world? Our consideration of these questions will draw on a wide range of literatures including primatology, political philosophy, anthropology, and gender studies. We will also use non-academic sources such as films and novels to explore the world of domination and resistance.

POLS 443 Global Politics of Race: Asia and Africa 3 Credits
An examination of the concept of “race” and its impact on domestic and international politics.

POLS 447 Constitutional Law and Politics 3 Credits
Exploration of the process of legal reasoning, the place of the United States Supreme Court in the American political System, the multiple influences on judicial decision-making, and various interpretive debates over the meaning of the U.S. Constitution. Following this introduction to the interplay of law and politics, the focus turns to particular domains within the canon of constitutional law, including cases pertaining to the Supreme Court’s jurisdiction and capacity; the separation of powers between the three branches of government; federalism.

POLS 448 (HIST 448) Land Use, Growth Management, and the Politics of Sprawl 3 Credits
An intro to the issues of Land Use Planning, Community, Growth Mgmt, & Sprawl. Will examine the history of urban development in America, from the earliest settlements to the auto suburbs. Also explore such planning & development factors as comprehensive plans, zoning, & the influence of infrastructure on development. Concludes with an assessment of the revival of city centers, alternatives to sprawl, & comparisons to development patterns in other countries.

POLS 449 (WGSS 449) American Social Policy: Race, Class, Gender and Sexuality 3 Credits
This course examines criminal justice, housing, health, education, and welfare policies across US states through the lenses of class, race, gender, and sexuality. Students will learn how social regulations structure opportunities and assess the implications of those opportunity structures.

POLS 450 Religion and Politics in Comparative Perspective 3 Credits
This research seminar attempts to identify the conditions under which religious parties arise and become influential, how religion influences popular understandings of secular politics and the extent to which religion is a necessary feature of modern public discourse. These topics are explored through country specific cases from around the world.

POLS 451 Comparative Politics Core 3 Credits
Discussion of major recent works in comparative politics that exemplify on-going substantive debates and methodological problems in the field. Topics: state-building and the construction of social order, institutions, political economy, democracy, development, and political mobilization.

POLS 452 Civil Rights and Civil Liberties 3 Credits
A continuation of themes, issues, and debates of the previous semester (POLS 447). This course addresses the major cases and controversies within several legal domains, including the freedoms of and from religion; freedom of speech; freedom of association; freedom of the press; the right to bear arms; the rights of criminal defendants and suspects; the right to privacy; capital punishment; and, the equal protection of the law.

Prerequisites: POLS 447

POLS 453 Seminar: Media, Propaganda and Democracy 3 Credits
Research seminar on theoretical and applied issues related to democracy vs. political hegemony, as affected by propaganda, the mass media, popular culture, and the capitalist economy. Students will pursue individual research topics linked to common class readings. Weekly paper presentations and critical responses.

POLS 454 The State in Asia 3 Credits
Examination of state-directed political, economic and social development in and among Asian states, with an addition focus on the relationships between the domestic policies of various Asian states and relations with non-Asian states.

POLS 455 (ES 455) Environmental Justice: From Theory to Practice 3 Credits
This course explores the various ways in which environmental law and policy can have discriminatory effects. It examines the rise and evolution of environmental justice movement, and the impact of environmental justice claims on administrative rule making at state and federal level. Reviewing the history of case law concerning environmental justice suits filed under the 1964 Civil Rights Act, it also examines the future of environmental justice in environmental law and policy.

POLS 456 Seminar: Political Philosophy 3 Credits
Critical examination of several of the “great books” and/or “great ideas” in political thought.

POLS 457 Politics Of Authenticity 3 Credits
Works in political philosophy, psychoanalytic theory, literature, and film that discuss knowing and being one’s self will be critically discussed. If you feel a life of “quiet desperation” is inevitable, this course is for you.

POLS 458 Interest Groups, Power, and Democracy in American Politics 3 Credits
Examines the competition for power in American politics between business groups, professional organizations, citizens groups, and social movements. Evaluates claims about the rise of upper-class dominance in politics, and what implications this trend may have for American democracy in an era of rising economic inequality.

POLS 462 Seminar: American Political Thought 3 Credits
Focus on a narrow topic or theorist in the field, e.g., the work of Jefferson, Madison, Hamilton, or Tocqueville. Students will be required to write a major paper and present it to the class.

POLS 463 Public Opinion Research 3 Credits
This course examines fundamental processes and tools employed in public opinion research. This class is designed to provide students with the ability to develop, implement and evaluate various forms of public opinion research including surveys, focus groups and individual interviews. Students will be introduced to numerous aspects of public opinion research including questionnaire design, sampling, interviewing, data analysis, focus group moderation, and varied forms of data collection.

POLS 464 Community Fellowship 1 3 Credits
15 hours/week in regional agency on specific project relating to regional redevelopment with regularly scheduled contact hours with the faculty advisor.
**POLSC 465 Community Fellowship II 3 Credits**
15 hours/week in regional agency on specific project relating to regional redevelopment with regularly scheduled contact hours with the faculty advisor.

**POLSC 467 Legal Problems 3 Credits**
This course involves an examination of the role of legal rules, agents, institutions, and values in our society. Primary emphasis will be given to the American legal system, though we will evaluate U.S. principles and politics through a comparative lens as well.

**POLSC 468 Political Economy 3 Credits**
Relationship of democratic politics to government and market, and significance of economic power in the American polity. Economic rationale for the place of the market and economic institutions in polity. Emphasis on information in comparison of economic approaches to public policy and organization (public goods, market failure and collective action) with traditional political science approaches (group mobilization and conflict, non-decisions and symbolic actions).

**POLSC 473 Globalization and Social Well-Being 3 Credits**
This course examines how the various dimensions of globalization impact people by exploring factors that reflect and affect quality of life. Students will gain an understanding of the complexities resulting from the growing interconnectedness and interdependencies of global relations. The course is intended to get people thinking creatively about opportunities for connections that preserve human dignity.

**POLSC 474 The Politics of Inequality 3 Credits**
Examines the politics of gender, race, and economic inequality in the U.S. Explores the effects of growing inequality on political representation, and the impact of government policy on perpetuating inequality. Class consciousness, and its effects on political beliefs and behavior, are examined.

**POLSC 475 (ES 475) Seminar: Green Polity 3-4 Credits**
Development of guidelines and applications for public policy and political action directed toward environmental sustainability and political feasibility. Focus on problem-solving and policy design, connecting sustainable environmental goals with workable and responsive institutional designs.

**POLSC 477 Advanced Computer Applications 3 Credits**
Uses of computers in social sciences, including data collection, management, analysis, presentation, and decision-making; includes weekly lab.

**POLSC 481 Special Topics 1-3 Credits**
Individual inquiry into some problem of government. Reading, field work, and other appropriate techniques of investigation. Conferences and reports. 
Repeat Status: Course may be repeated.

**POLSC 482 Special Topics 1-3 Credits**
Continuation of POLS 481. 
Repeat Status: Course may be repeated.

**POLSC 490 Thesis 1-6 Credits**

**Psychology**

The Psychology Department offers B.A. and B.S. undergraduate degrees, an undergraduate minor in general psychology, and M.Sc. and Ph.D. graduate degrees.

Psychology is the science of mind, brain, and behavior. Undergraduate study in psychology provides:
- A knowledge base about how people think, feel, and act as individuals and in groups, from infancy to old age
- An understanding of how psychological principles can be applied in everyday life, including to address societal needs
- Training in scientific reasoning, critical thinking, and problem solving, including effective research methods to address psychological phenomena
- An appreciation of individual, sociocultural, and international diversity
- Opportunities to build skills in writing and oral communication

Psychology majors pursue careers in many areas such as: business (marketing, human resources, industrial/organizational psychology); education; medicine/health; mental and behavioral health professions (clinical, counseling, and sports psychology); law; human services; and basic and applied research positions. The knowledge and skills provided by a degree in Psychology are valuable to all such careers.

For more information, please visit our website: [http://psychology.cas2.lehigh.edu/](http://psychology.cas2.lehigh.edu/)

**Professors.**  Mark H. Bickhard, PHD (University of Chicago); Michael J. Gill, PHD (University of Texas at Austin); Diane T. Hyland, PHD (Syracuse University); Deborah Laible, PHD (University of Nebraska-Lincoln); Barbara C. Malt, PHD (Stanford University); Gordon B. Moskowitz, PHD (New York University); Ageliki Nicolopoulou, PHD (University of California, Berkeley); P.ádraig G OÓSzághda, PHD (University of Toronto); Dominic J. Packer, PHD (University of Toronto)

**Associate Professors.**  Catherine M. Arrington, PHD (Michigan State University); Susan E Barrett, PHD (Brown University); Amanda C. Brandone, PHD (University of Michigan); Christopher T. Burke, PHD (New York University); Almit Hupbach, PHD (Universitat Trier); Jesseca Marsh, PHD (Yale University)

**Assistant Professors.**  Nancy B. Carlisle, PHD (Vanderbilt University, Peabody College); Lucy Napper, PHD (University of Sheffield); Valerie Jones Taylor, PHD (Stanford University)

**Emeriti.**  William Newman, PHD (Stanford University); Martin L. Richter, PHD (Indiana State University); George K. Shortess, PHD (Brown University)

**B.A. MAJOR PROGRAM IN PSYCHOLOGY**

The Bachelor of Arts in psychology is a social science major requiring 13 courses (approximately 49 credit hours) in psychology as described below. The B.A. requires four core courses, four 100-level breadth courses, a 100-level recitation section accompanying one of the breadth courses, and four 300-level seminars. Students are required to complete a portfolio of written work that provides a record of their learning and accomplishments throughout the major. Students must also fulfill college and university degree requirements. This flexible program permits development of one or more minors in other fields or the undertaking of a double major. Transfer credits and study abroad course work may be applied toward the major; however, students must take a minimum of two 100-level breadth courses, three 300-level seminars, and the PSYC 201, 202, and 203 sequence at Lehigh to complete a psychology major from Lehigh.

**Required Core Courses**

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>PSYC 001</td>
<td>Introduction to Psychology</td>
</tr>
<tr>
<td>PSYC 201</td>
<td>Research Methods and Data Analysis I</td>
</tr>
<tr>
<td>PSYC 202</td>
<td>Research Methods and Data Analysis II</td>
</tr>
<tr>
<td>PSYC 203</td>
<td>Research Methods and Data Analysis III</td>
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</table>

**Breadth Courses**

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<tbody>
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<td>Child Development</td>
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<td>PSYC 109</td>
<td>Adulthood and Aging</td>
</tr>
<tr>
<td>PSYC 121</td>
<td>Social Psychology</td>
</tr>
<tr>
<td>PSYC 153</td>
<td>Personality</td>
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</table>

**100-level Recitation**

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<td>PSYC 182</td>
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<td>Cognitive Psychology Recitation</td>
</tr>
<tr>
<td>PSYC 184</td>
<td>Cognitive Neuroscience Recitation</td>
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</tbody>
</table>
engagement in supervised research and participation in the honors program.

Students in the B.S. program must complete a concentration in Cognition and Cognitive Neuroscience; Developmental; Social and Personality; or Clinical and Behavioral Health. Progression through the program is best served through early commitment. Students who do not declare their majors early may find it difficult to complete the B.S. major program. Transfer credits and study abroad course work may be applied toward the major; however, students must take a minimum of two 100-level breadth courses, three 300-level seminars, and the PSYC 201, 202, and 203 sequence at Lehigh to earn a psychology major from Lehigh.

Requirements for the B.S. in Psychology

Collateral Requirements
For students in the B.S. program, collateral courses can be used to fulfill the college distribution requirements in mathematics, natural science, and social science. To fulfill natural science college distribution requirements, at least one course must include the associated lab.

Please consult the course listings for information on prerequisites.

Mathematics and Computer Science 7-8
Select two from the following:

- MATH 012 Basic Statistics
- MATH 043 Survey of Linear Algebra
- Any MATH course 21 or above
- CSE 001 Breadth of Computing
- CSE 002 and Fundamentals of Programming
- Any CSE course 12 or above

Natural Science 14-16
Select at least one from the following:

- BIOS 010 Bioscience in the 21st Century
- BIOS 041 Biology Core I: Cellular and Molecular
- EES 025 The Environment and Living Systems
- EES 028 Conservation and Biodiversity
- PSYC 012 Introduction to Human Neuroscience
- Any ASTR course 007 or above
- Any BIOS course 010 or above
- Any CHM course 030 or above
- Any EES course 002 or above
- Any PHY course 010 or above

Social and Cognitive Science 7-8
Select any two SS courses that are not cross-listed with psychology.

Possible departments include: Africana Studies (AAS), Asian Studies (ASIA), Cognitive Science (COGS), Global Studies (GS), Health, Medicine, & Society (HMS), History (HIST), International Relations (IR), Communication (COMM), Latin American & Latino Studies (LAS), Philosophy (PHIL), Political Science (POL), Religion Studies (REL), Science, Technology, & Society (STS), Sociology and Anthropology (ANTH, SQAN, SOC), Women, Gender, & Sexuality Studies (WGSS).

Additional Coursework 3-4
Select any one additional course from the above lists.

Total Credits 31-36

1 Courses may not be cross-listed with Psychology.
2 Courses must have a SS designation.
3 Students are strongly encouraged to discuss their interests and career goals with their advisor before selecting courses.

Psychology Requirements

Required Core Courses 16

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>PSYC 001</td>
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</tr>
</tbody>
</table>
**Cognition and Cognitive Neuroscience Concentration**

Level seminars within the concentration area.

Involves selecting two specific 100-level breadth courses and three 300-level seminars, choose three:

Specified 100-level breadth courses, take both:

<table>
<thead>
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<tbody>
<tr>
<td>PSYC 107</td>
<td>Child Development</td>
</tr>
<tr>
<td>PSYC 109</td>
<td>Adulthood and Aging</td>
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</table>

300-level seminars, choose three:

<table>
<thead>
<tr>
<th>Course Code</th>
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</tr>
</thead>
<tbody>
<tr>
<td>PSYC 304</td>
<td>Memory Development from Infancy to Old Age</td>
</tr>
<tr>
<td>PSYC/WGSS 318</td>
<td>Seminar in Gender and Psychology</td>
</tr>
<tr>
<td>PSYC 328</td>
<td>Educational Psychology</td>
</tr>
<tr>
<td>PSYC 346</td>
<td>Child Development and Social Policy</td>
</tr>
<tr>
<td>PSYC 351</td>
<td>Children’s Thinking</td>
</tr>
<tr>
<td>PSYC 352</td>
<td>Adolescence and Emerging Adulthood</td>
</tr>
<tr>
<td>PSYC 358</td>
<td>Inside the Infant Mind</td>
</tr>
<tr>
<td>PSYC 363</td>
<td>Personality and Social Development in Childhood</td>
</tr>
<tr>
<td>PSYC 364</td>
<td>The Meaning and Power of Narratives through the Lifespan</td>
</tr>
<tr>
<td>PSYC/GS 365</td>
<td>Human Development in Cross-Cultural Perspective</td>
</tr>
<tr>
<td>PSYC 368</td>
<td>Children, Psychology, and the Law</td>
</tr>
<tr>
<td>PSYC 372</td>
<td>Special Topics in Developmental Psychology</td>
</tr>
<tr>
<td>PSYC 375</td>
<td>Development of Good and Evil</td>
</tr>
<tr>
<td>PSYC 376</td>
<td>Child Language and Social Inequality</td>
</tr>
<tr>
<td>PSYC 378</td>
<td>Emotional Development</td>
</tr>
<tr>
<td>PSYC 383</td>
<td>Attachment Theory &amp; Research: The Study of Close Relationships Across the Lifespan</td>
</tr>
<tr>
<td>PSYC/HMS 386</td>
<td>Pediatric Psychology</td>
</tr>
</tbody>
</table>

**Social and Personality Concentration**

Specified 100-level breadth courses, take both:

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<tbody>
<tr>
<td>PSYC 121</td>
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<td>PSYC 153</td>
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<tr>
<td>PSYC/HMS 302</td>
<td>Stress and Coping</td>
</tr>
<tr>
<td>PSYC 311</td>
<td>The Psychology of Stereotyping, Prejudice, and Discrimination</td>
</tr>
<tr>
<td>PSYC 313</td>
<td>Person Perception</td>
</tr>
<tr>
<td>PSYC 314</td>
<td>Social Cognition</td>
</tr>
<tr>
<td>PSYC/WGSS 318</td>
<td>Seminar in Gender and Psychology</td>
</tr>
<tr>
<td>PSYC/AAS 326</td>
<td>The Doing and Undoing of Racism</td>
</tr>
<tr>
<td>PSYC 332</td>
<td>The Psychology of Morality</td>
</tr>
<tr>
<td>PSYC 341</td>
<td>Social Psychology and Social Issues</td>
</tr>
<tr>
<td>PSYC/HMS 349</td>
<td>Participatory and Action Research in Psychology</td>
</tr>
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</tr>
</tbody>
</table>

**Breadth Courses**

Four 100-level courses, with a minimum of one from each of the following three areas, are required of all majors. The fourth 100-level breadth course is determined by the concentration being pursued and may be selected from any of the courses below, or PSYC 130, or PSYC 138.

**Cognition and Cognitive Neuroscience**

<table>
<thead>
<tr>
<th>Course Code</th>
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</thead>
<tbody>
<tr>
<td>PSYC/COGS 117</td>
<td>Cognitive Psychology</td>
</tr>
<tr>
<td>PSYC/COGS 176</td>
<td>Cognitive Neuroscience</td>
</tr>
</tbody>
</table>

**Developmental**

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**Social and Personality**

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**100-level Recitation**

One 100-level recitation section accompanying one of the above breadth courses.

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<tr>
<td>PSYC 186</td>
<td>Social Psychology Recitation</td>
</tr>
</tbody>
</table>

**Seminars**

Five 300-level seminars are required of all B.S. students. Seminars need to span at least two areas. (See list of seminars per area in Psychology Concentrations section below.)

**Student Portfolio**

Students are also required to complete a portfolio of written work that provides a record of their learning and accomplishments throughout the major.

**Total Credits**

49-53

1 Students can not use PSYC 300, PSYC 310, PSYC 391, PSYC 392, PSYC 393, PSYC 394 or to fulfill this requirement. All other 300-level psychology courses can be used to fulfill this requirement.

**PSYCHOLOGY CONCENTRATIONS**

Concentrations are available in four areas: Cognition and Cognitive Neuroscience; Developmental; Social and Personality; and Clinical and Behavioral Health. Students in the B.A. major program may choose to complete a concentration. Students in the B.S. major program are required to complete a concentration. Completion of a concentration involves selecting two specific 100-level breadth courses and three 300-level seminars within the concentration area.

**Cognition and Cognitive Neuroscience Concentration**

Specified 100-level breadth courses, take both:

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300-level seminars, choose three:

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<tr>
<td>PSYC 304</td>
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</tr>
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<td>PSYC/HMS 344</td>
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</tr>
<tr>
<td>PSYC 351</td>
<td>Children’s Thinking</td>
</tr>
<tr>
<td>PSYC 355</td>
<td>Seminar in Cognitive Neuroscience</td>
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</tbody>
</table>

**Developmental Concentration**

Specified 100-level breadth courses, take both:

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>PSYC 107</td>
<td>Child Development</td>
</tr>
<tr>
<td>PSYC 109</td>
<td>Adulthood and Aging</td>
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</tbody>
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300-level seminars, choose three:

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<td>PSYC 304</td>
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<tr>
<td>PSYC/WGSS 318</td>
<td>Seminar in Gender and Psychology</td>
</tr>
<tr>
<td>PSYC 328</td>
<td>Educational Psychology</td>
</tr>
<tr>
<td>PSYC 346</td>
<td>Child Development and Social Policy</td>
</tr>
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<td>Children’s Thinking</td>
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<td>PSYC 352</td>
<td>Adolescence and Emerging Adulthood</td>
</tr>
<tr>
<td>PSYC 358</td>
<td>Inside the Infant Mind</td>
</tr>
<tr>
<td>PSYC 363</td>
<td>Personality and Social Development in Childhood</td>
</tr>
<tr>
<td>PSYC 364</td>
<td>The Meaning and Power of Narratives through the Lifespan</td>
</tr>
<tr>
<td>PSYC/GS 365</td>
<td>Human Development in Cross-Cultural Perspective</td>
</tr>
<tr>
<td>PSYC 368</td>
<td>Children, Psychology, and the Law</td>
</tr>
<tr>
<td>PSYC 372</td>
<td>Special Topics in Developmental Psychology</td>
</tr>
<tr>
<td>PSYC 375</td>
<td>Development of Good and Evil</td>
</tr>
<tr>
<td>PSYC 376</td>
<td>Child Language and Social Inequality</td>
</tr>
<tr>
<td>PSYC 378</td>
<td>Emotional Development</td>
</tr>
<tr>
<td>PSYC 383</td>
<td>Attachment Theory &amp; Research: The Study of Close Relationships Across the Lifespan</td>
</tr>
<tr>
<td>PSYC/HMS 386</td>
<td>Pediatric Psychology</td>
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</table>

**Social and Personality Concentration**

Specified 100-level breadth courses, take both:

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<tbody>
<tr>
<td>PSYC 121</td>
<td>Social Psychology</td>
</tr>
<tr>
<td>PSYC 153</td>
<td>Personality</td>
</tr>
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<tr>
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<td>Stress and Coping</td>
</tr>
<tr>
<td>PSYC 311</td>
<td>The Psychology of Stereotyping, Prejudice, and Discrimination</td>
</tr>
<tr>
<td>PSYC 313</td>
<td>Person Perception</td>
</tr>
<tr>
<td>PSYC 314</td>
<td>Social Cognition</td>
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<td>Seminar in Gender and Psychology</td>
</tr>
<tr>
<td>PSYC/AAS 326</td>
<td>The Doing and Undoing of Racism</td>
</tr>
<tr>
<td>PSYC 332</td>
<td>The Psychology of Morality</td>
</tr>
<tr>
<td>PSYC 341</td>
<td>Social Psychology and Social Issues</td>
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<td>PSYC/HMS 349</td>
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<td>PSYC 353</td>
<td>Social Justice and Social Change</td>
</tr>
<tr>
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**FOR GRADUATE STUDENTS**

The Department of Psychology offers a distinctive, research-intensive graduate program with specializations in cognitive, developmental and social psychology. The department accepts mainly Ph.D. students, who obtain a master’s degree in the process of working for the doctorate. However, well-qualified students may also be accepted for a Master of Science degree. Students are trained primarily for positions at universities, and in basic or applied research settings. For more information visit: http://psychology.cas2.lehigh.edu/content/welcome-graduate-program-psychology.

In addition we offer two non-degree Certificate Programs in collaboration with other departments and programs.

The Graduate Certificate in Stereotypes, Prejudice, Discrimination, and Intergroup Relations is administered by the Psychology Department. Information is available via: http://psychology.cas2.lehigh.edu/content/stereotypes-prejudice-discrimination-and-intergroup-relations-graduate-certificate.

The Graduate Certificate in Cognitive Science is administered by the Cognitive Science Program. Information is available at: http://psychology.cas2.lehigh.edu/content/cognitive-science-graduate-certificate.

**Requirements for a Ph.D. in the Department of Psychology**

**Research**

All graduate students are expected to be involved in research throughout their graduate careers. There are also several formal research requirements of the program.

**First-Year Apprenticeship**

First-year students are expected to choose an advisor and begin to work on research projects as early as possible. An oral report of the student’s research activities is made to the department. Students will submit a draft Master’s Thesis Proposal by June 1 of the first year of the Ph.D. program.

**Master’s Thesis**

A master’s thesis (usually empirical or data-based) is required. An oral presentation of the thesis is made to the department. Students entering with a master’s degree may instead conduct an equivalent non-degree Pre-dissertation Project.

**Third-Year independent scholarly activity**

Third year students will work toward formulation of their dissertation proposal by completing a literature review or writing a small grant proposal. By the end of the third year of the Ph.D. program, students will choose a dissertation committee, and meet to report on their research activities.

**Doctoral Dissertation**

This is an original piece of scholarly work usually involving empirical research, although original theoretical or historical research is possible with faculty approval.

**Course work**

For the Ph.D., the minimum course requirements include:

- Three core courses covering cognitive psychology (PSYC 403), developmental psychology (PSYC 402), and social cognition (PSYC406);
- Two courses in statistics and research methodology (PSYC 421 and PSYC 422);
- At least three graduate seminars (PSYC 430 and above);
- Two elective courses, approved by the advisor;
- A professional development seminar (PSYC 409)

**Teaching**

Students are encouraged to participate in teaching as appropriate for their training throughout their graduate years. Normally, students begin as teaching assistants and progress to teaching independently.

**General Examination**

A general examination is required for all doctoral candidates and will be completed at the end of the second year of the Ph.D. program. Readings and questions for the exam will be compiled by faculty in the student’s specialization area.

**Requirements for a Master of Science in the Department of Psychology**

Master of Science students will complete the First-Year Apprenticeship and Master’s Thesis requirements as described in the Ph.D. section above.

**Coursework**

For the M.Sc., the minimum course requirements include:
• Two core courses covering cognitive psychology (PSYC 403), developmental psychology (PSYC 402), or social cognition (PSYC 406);
• Two courses on statistics and research methodology (PSYC 421, and PSYC 422 or approved equivalent);
• Two elective courses, approved by the advisor;
• A professional development seminar (PSYC 409)

Evaluation
Graduate students are evaluated on their performance in coursework, research and scholarship, teaching assistantships assignments, and the general examination. The faculty provides each student with an annual written evaluation of their progress in the graduate program.

Financial Support
Support for Ph.D. students is available in the form of teaching and research assistantships, fellowships and scholarships.

How To Apply
Information about admission and financial aid can be obtained from the Department of Psychology or found at: https://psychology.cas2.lehigh.edu/node/67. While a strong undergraduate background in psychology is desirable, promising students with majors other than psychology are encouraged to apply. Completed application forms, plus transcripts, letters of recommendation, and a report of scores on the Graduate Record Exam and advanced tests in psychology should be submitted no later than January 1 of the year of admission. New students are normally accepted for entrance into the program only for the fall semester.

Courses

PSYC 001 Introduction to Psychology 4 Credits
Psychology as a science of behavior. Natural science aspects such as learning, sensation-perception, and physiological bases; and social science aspects such as human development, intelligence, and personality. Methodologies appropriate to these areas, and related societal problems.

Attribute/Distribution: SS

PSYC 012 Introduction to Human Neuroscience 4 Credits
In this introductory course, we will uncover how our brains are able to give rise to the complexities of human thought and behavior. We will examine the neural bases of seeing, hearing, sleep, dreaming, sexual behavior, emotion, aggression, behavioral disorders, learning, and memory.

Attribute/Distribution: NS

PSYC 107 Child Development 4 Credits
Survey of theories and research concerning perceptual, cognitive, social, and personality development through infancy and childhood. May not be taken pass/fail. Open to Freshmen with departmental permission.

Prerequisites: PSYC 001 or SOC 001

Attribute/Distribution: SS

PSYC 109 Adulthood and Aging 4 Credits
Social science approaches to the latter two-thirds of life. Cognitive and personality development; attitudes toward aging; social behavior of older adults; widowhood; retirement. May not be taken pass/fail. Open to Freshmen with departmental permission.

Prerequisites: PSYC 001 or SOC 001

Attribute/Distribution: SS

PSYC 110 Statistical Analysis of Behavioral Data 4 Credits
Principles of experimental design and statistical analysis: characteristics of data and data collection; descriptive statistics; hypothesis testing theory and practice; correlation, chi-square, t-test, analysis of variance. Three hours lecture and one hour computer lab. Department permission required. Open to Freshmen with departmental permission.

Attribute/Distribution: ND

PSYC 115 REL 115 Religion And Psychology 4 Credits
A study of the origins, development and consequences of religion from a psychological perspective. Attention will be given to classic and contemporary sources, with a focus on major psychoanalytic theorists of religion (Freud, Jung, Erikson); psychological analyses of religious experience (e.g., Wm. James, Victor Frankl); and the diverse cultural and religious forms that structure the connection between religion and psychology (e.g., Buddhist psychology, Japanese Morita therapy).

Attribute/Distribution: HU

PSYC 117 COGS 117 Cognitive Psychology 4 Credits
The architecture and dynamics of the human mind: How we acquire knowledge through perception, represent and activate it in memory, and use it to communicate, make decisions, solve problems, and reason creatively. May not be taken pass/fail.

Prerequisites: PSYC 001 or COGS 007

Attribute/Distribution: SS

PSYC 121 Social Psychology 4 Credits
Theories, methods of investigation, and results of research on the way social and psychological processes interact in human behavioral settings. Topics include analysis of self and relationships, dynamics of small groups, attitudes and persuasion, prejudice, prosocial and antisocial behavior. May not be taken pass/fail. Open to Freshmen with departmental permission.

Prerequisites: SOC 001 or PSYC 001

Attribute/Distribution: SS

PSYC 130 HMS 130 Introduction to Health Psychology 4 Credits
This course explores the psychological processes that influence how people stay healthy, why people get sick, and how people respond to illness. The course also examines what the study of health psychology has to teach us about illness prevention and the provision of health care services.

Prerequisites: PSYC 001

Attribute/Distribution: SS

PSYC 138 HMS 138 Abnormal Psychology 4 Credits
Examines research and theory on the patterns, causes, and treatment of various forms of abnormal behavior.

Prerequisites: PSYC 001

Attribute/Distribution: SS

PSYC 153 Personality 4 Credits
Examination of the major theoretical frameworks psychologists use to understand human thought, feeling, and behavior. Whereas these frameworks each emphasize very different concepts (e.g., the unconscious mind vs. culture vs. neurotransmitters), they are united in their effort to answer the question: Why does a given individual think, feel, or behave as she does? May not be taken pass/fail.

Prerequisites: PSYC 001 or SOC 001

Attribute/Distribution: SS

PSYC 160 Independent Study 1-3 Credits
Readings on topics selected in consultation with a staff member. Consent of faculty sponsor required.

Repeat Status: Course may be repeated.

Prerequisites: PSYC 001

Attribute/Distribution: SS

PSYC 161 Supervised Research 1-3 Credits
Apprenticeship in ongoing faculty research program. Literature review, experimental design, data collection and analysis, and professional writing under faculty supervision. Consent of faculty sponsor required.

Repeat Status: Course may be repeated.

Prerequisites: PSYC 001 or COGS 007

Attribute/Distribution: SS

PSYC 162 Psychological Field Work 1-3 Credits
Work-study practice including supervised experience in one of several local agencies. Development of familiarity with the operations of the agency and working with individual patients or students. Must have completed two additional psychology courses. Consent of instructor required.

Repeat Status: Course may be repeated.

Prerequisites: PSYC 001

Attribute/Distribution: SS
PSYC 176 (COGS 176) Cognitive Neuroscience 4 Credits
Perception and cognitive neuroscience as the link between mental processes and their biological bases. Visual and auditory perception; the control of action; neuropsychological syndromes of perception, language, memory and thought; neural network (connectionist) models of mental processes. May not be taken pass/fail.
Prerequisites: PSYC 001 or COGS 007
Attribute/Distribution: NS
PSYC 182 Child Development Recitation 1 Credit
Research, discussion, and analysis of topics in child development.
Prerequisites: PSYC 107
Can be taken Concurrently: PSYC 107
Attribute/Distribution: ND
PSYC 183 (COGS 183) Cognitive Psychology Recitation 1 Credit
Research, discussion, and analysis of topics in cognitive psychology.
Prerequisites: PSYC 117 or COGS 117
Can be taken Concurrently: PSYC 117, COGS 117
PSYC 184 (COGS 184) Cognitive Neuroscience Recitation 1 Credit
Research, discussion, and analysis of topics in cognitive neuroscience.
Prerequisites: PSYC 176 or COGS 176
Can be taken Concurrently: PSYC 176, COGS 176
Attribute/Distribution: ND
PSYC 185 Personality Recitation 1 Credit
Research, discussion, and analysis of topics in personality.
Prerequisites: PSYC 153
Can be taken Concurrently: PSYC 153
PSYC 186 Social Psychology Recitation 1 Credit
Research, discussion, and analysis of topics in social psychology.
Prerequisites: PSYC 121
Can be taken Concurrently: PSYC 121
PSYC 201 Research Methods and Data Analysis I 4 Credits
Part 1 of a course sequence on how to design and analyze psychological research. This course sequence focuses on developing research questions and answering them using appropriate research designs and complementary data analysis techniques: descriptive statistics, hypothesis testing, correlation, regression, chi-square, t-test, analysis of variance. Three hours of lecture and one hour of computer lab. Department permission required.
Prerequisites: PSYC 001
PSYC 202 Research Methods and Data Analysis II 4 Credits
Part 2 of a course sequence on how to design and analyze psychological research. This course sequence focuses on developing research questions and answering them using appropriate research designs and complementary data analysis techniques: descriptive statistics, hypothesis testing, correlation, regression, chi-square, t-test, analysis of variance. Three hours of lecture and one hour of computer lab. Department permission required.
Prerequisites: PSYC 201
PSYC 203 Research Methods and Data Analysis III 4 Credits
Part 3 of a course sequence on how to design and analyze psychological research. Students will design, conduct, and analyze behavioral research studies and develop skills in scientific writing. Department permission required.
Prerequisites: PSYC 201 and PSYC 202
PSYC 210 Experimental Research Methods and Laboratory 4 Credits
Designing, conducting, and reporting psychological experiments. Laboratory exercises, report writing, and a group research project. Consent of department required.
Prerequisites: PSYC 001 and PSYC 110
PSYC 300 Apprentice Teaching 1-4 Credits
PSYC 302 (HMS 302) Stress and Coping 4 Credits
How does stress affect the psychological system, and what psychological mechanisms are in place to help people overcome environmental stressors? This seminar examines classic and contemporary theories and research on stress, coping, and social support.
Prerequisites: PSYC 121 or PSYC 153 or HMS 160 or HMS 180
Attribute/Distribution: SS
PSYC 304 Memory Development from Infancy to Old Age 4 Credits
Memory development throughout the lifespan. We will discuss methods invented to study memory in preverbal infants, and the amazing memory capacities they have revealed. We will explore memory components that develop during early and middle childhood, look at memory in adults, and consider the normal and pathological decline of memory in older age, and possible ways of slowing aging processes down.
Prerequisites: PSYC 117 or COGS 117 or PSYC 176 or COGS 176 or COGS 007
Attribute/Distribution: SS
PSYC 307 Higher Order Cognition 4 Credits
In depth exploration of selected areas of higher level cognition such as thinking and reasoning, metacognition, expertise, executive processes, language and thought.
Prerequisites: PSYC 117 or COGS 117
Attribute/Distribution: SS
PSYC 310 Advanced Research Methods in Psychology 4 Credits
Experimental and nonexperimental research design; Sampling and selection from populations; Data exploration; Quantitative and qualitative measurement and analysis; Computer-based data collection; and other specialized topics.
Prerequisites: PSYC 210
PSYC 311 The Psychology of Stereotyping, Prejudice, and Discrimination 4 Credits
We first examine the basic cognitive processes that make stereotyping a functional aspect of everyday cognition, and then turn toward examining emotional, motivational, and personality differences that affect one’s level of prejudice. Finally, we will study the role of social forces in transmitting prejudice (parents, schools, religion, media) and the impact of societal prejudice (discrimination) on those who are the targets of prejudice. How stereotypes, prejudice, and discrimination are understood, measured, expressed, and altered is the focus of the course.
Prerequisites: PSYC 153 or PSYC 121
Attribute/Distribution: SS
PSYC 312 Person Perception 4 Credits
Psychological processes involved in forming impressions of others. Survey of the factors that influence the way in which we think about the people who make up our social environment and of the laboratory methods with which experimental social psychology investigates person perception. The emphasis is on demonstrating the joint impact of the behaviors performed by others and the biases/expectancies that we bring into the social setting.
Prerequisites: PSYC 153 or PSYC 121
Attribute/Distribution: SS
PSYC 313 Social Cognition 4 Credits
Examines the cognitive processes through which people make sense of social groups, individual others, themselves, and the world. Topics include judgment and decision making, attitudes and persuasion, ordinary personology, stereotyping and prejudice, and the self.
Prerequisites: PSYC 121
Attribute/Distribution: SS
PSYC 316 The Talking World: Psychology and Neuroscience of Speaking 4 Credits
Intricate processes underlie the everyday activity of speaking. We will examine the components of speaking, from thinking to articulation, within and across individual speakers and languages, using behavioral and neuroscientific evidence.
Prerequisites: PSYC 117 or COGS 117 or PSYC 176 or COGS 176
Attribute/Distribution: NS
PSYC 317 Psychology of Emotion 4 Credits
A selective overview of the scientific study of emotion. Topics will include: historical and modern theories of emotion, physiological and neuropsychological aspects of emotions, evidence that facial expressions of emotion may be universal among humans, and the role of emotion in cognition.
Prerequisites: PSYC 110
Attribute/Distribution: SS

PSYC 318 (WGSS 318) Seminar in Gender and Psychology 4 Credits
Gender as shaped by psychological and social psychological processes. Socialization, communication and power, gender stereotypes, methodological issues in sex differences research. Consent of department required.
Prerequisites: PSYC 210
Can be taken Concurrently: PSYC 210
Attribute/Distribution: SS

PSYC 319 (HMS 319) The Psychology of Trauma 4 Credits
This course explores the nature of psychological trauma, including the physiological, emotional, cognitive, behavioral, interpersonal, and developmental impact of exposure to extreme stress and traumatic events. Historical and current perspectives on the individual and cultural effects of trauma will be examined, including consequences of relational trauma, traumatic loss, injury/illness, crime, combat exposure, terrorism, natural disasters, and vicarious traumatization. Posttraumatic Stress Disorder and related conditions will be explored, as will the nature of effective intervention techniques, recovery, adaptive coping, and resilience.
Prerequisites: PSYC 138 or HMS 138
Attribute/Distribution: SS

PSYC 320 Psychology of Language 4 Credits
Psychological processes involved in language comprehension, production, and use. Topics include the relation of language to thought; word meaning; speech perception; language acquisition; sign language; language in society.
Prerequisites: PSYC 117 or PSYC 176 or COGS 007 or COGS 117 or COGS 176
Attribute/Distribution: SS

PSYC 321 Language Development 4 Credits
Descriptive and theoretical accounts of the development of language. Primary focus is on the development of spoken language in infancy and early childhood. Involves observation of children at various stages of language development.
Prerequisites: PSYC 107 or PSYC 117 or COGS 117
Attribute/Distribution: SS

PSYC 326 (AAS 326) The Doing and Undoing of Racism 4 Credits
This course will provide students with a critical understanding of historical, legal, and social psychological factors that lead to prejudice, discrimination, and racism within our society. It will survey the US constitution, policy, and social psychological theories that explain the causes and maintenance of prejudice, discrimination, and racism in their many forms. Students will learn how laws and various theoretical perspectives apply to people’s psychological functioning and group behavior, and examine theoretically derived interventions to reduce prejudice, discrimination, and racism.
Prerequisites: PSYC 121 or AAS 003
Attribute/Distribution: SS

PSYC 327 (HMS 327) Advanced Topics in Health Psychology 4 Credits
This course provides an overview of the psychological study of health. The course explores psychological theories that aim to explain health behavior (e.g., why do people smoke?) and the role of psychology in understanding the experience of illness. This course also examines how psychological research and theory can be applied to promote health behavior (e.g., how can we design interventions to promote physical activity).
Prerequisites: PSYC 130
Attribute/Distribution: SS

PSYC 328 Educational Psychology 4 Credits
Overview of historical, contemporary, and emerging issues in the field of educational psychology. Implications of various social, cognitive and behavioral educational-psychological theories for teaching and learning in the classroom.
Prerequisites: PSYC 107
Attribute/Distribution: SS

PSYC 332 The Psychology of Morality 4 Credits
We begin with the Big Questions: Are human beings intrinsically good? How potent is our intrinsic capacity for goodness? What does it mean to be “good” or “moral”? How can we answer these questions? Next, we examine a variety of motives, capacities, and emotions that can promote our “good” behavior. Some examples include empathy, compassion (and other moral emotions), the justice motive, the norm enforcement motive, moral intuitions, social bonds, and perhaps even our general capacity for reason.
Prerequisites: PSYC 121
Attribute/Distribution: SS

PSYC 334 (HMS 334, WGSS 334) The Psychology of Body Image and Eating Disorders 4 Credits
The course addresses the psychosocial aspects of the development of healthy and unhealthy body image and eating disorders. The roles of personality traits/individual factors, family and interpersonal functioning, and cultural factors will be examined, as will the impact of representations of body image in mass media. Public health and psychological interventions for prevention and treatment will be explored. Personal accounts/memoirs, clinical case presentations, and documentary and dramatic films will be incorporated in the presentation of topics.
Attribute/Distribution: SS

PSYC 335 (BIOS 335) Animal Behavior 3 Credits
Discussion of the behavior of invertebrates and vertebrates and analysis of the physiological mechanisms responsible for behavioral actions, and adaptive value of specific behavior patterns.
Prerequisites: BIOS 121 and BIOS 122
Attribute/Distribution: NS

PSYC 338 Phenomenology and Theory of Childhood Disorders 4 Credits
The nature, classification, and treatment of childhood disorders.
Prerequisites: PSYC 107
Attribute/Distribution: SS

PSYC 341 Social Psychology and Social Issues 4 Credits
This course examines the methods, concepts, and research findings associated with the effort to apply social psychology to the understanding and amelioration of social problems. Special attention will be paid to the topic of human conflict.
Attribute/Distribution: SS

PSYC 344 (HMS 344) Health Care Reasoning and Decision Making 4 Credits
Health care professionals diagnose physical and mental illnesses and create treatment plans to improve their patients’ health. How do these professionals make decisions related to these important issues? We will explore the literature on how medical and mental health professionals reason and make decisions about health care issues. Topics to be covered include diagnosis, treatment decisions, access to care, and how these reasoning processes are swayed. Consideration will be given to patient decision-making as well.
Prerequisites: PSYC 117 or COGS 117 or COGS 007 or HMS 160 or HMS 180
Attribute/Distribution: SS

PSYC 346 Child Development and Social Policy 4 Credits
This course explores the intersection of child development research and social policy. We will examine what we know about healthy child development from current research and how it can help inform and improve existing programs, policies, and recommendations for children and families. Topics include critical social policy issues such as child care, early childhood education, child abuse, divorce and child custody, adolescent pregnancy, poverty, bullying, and technology and media.
Prerequisites: PSYC 107
Attribute/Distribution: SS
PSYC 347 Cognitive Neuroscience of Memory 4 Credits
This seminar explores the brain systems and neural mechanisms involved in the formation and retrieval of memories. Topics include mechanisms of storage, retrieval and forgetting in normal and clinical populations, emotional memory systems, superior autobiographical memory, role of sleep, and effects of stress on memory.
Prerequisites: PSYC 117 or COGS 117 or PSYC 176 or COGS 176
Attribute/Distribution: NS

PSYC 348 (HMS 348) Drugs and Behavior 4 Credits
Why are some people more vulnerable to substance use problems than others? How can we effectively address substance abuse in our society? This course explores theories and research on the complex psychological, social, and biological factors that contribute to substance use and disorders. Topics include theories of addiction, characteristics of illegal and legal drugs, risk and protective factors, and research on substance abuse prevention.
Prerequisites: PSYC 001 or HMS 160 or HMS 180
Attribute/Distribution: SS

PSYC 349 (HMS 349) Participatory and Action Research in Psychology 4 Credits
Action research is used to understand important real-world social problems and promote social action. Participatory research engages community members as equals to help identify areas of focus and to design studies and interventions. This course provides an overview of the rich history of these approaches in psychology, an in-depth look at how they can be used effectively, and an opportunity to gain hands-on experience.
Prerequisites: PSYC 121 or PSYC 153 or HMS 160 or HMS 180
Attribute/Distribution: SS

PSYC 350 The Psychology of Evil 4 Credits
It has been said that no animal could ever be as cruel as a human being. Indeed, human beings have a notable propensity for inflicting harm on other human beings: Physical assault, homicide, torture, and even genocide. What is the psychology behind such actions? What are the root causes? In exploring these questions, we will consider the issue of what, if anything, can be done to reduce evil in the world.
Prerequisites: PSYC 121 or PSYC 153
Attribute/Distribution: SS

PSYC 351 Children's Thinking 4 Credits
This course examines the development of children's thinking from infancy through adolescence. We will discuss current research and theories on the content of children's knowledge and how mental abilities develop. We will also consider the implications of research on children's thinking for real-world questions about parenting, education, and policy-making. Topics include memory, concepts, social cognition, language, reading, mathematics, and individual and cultural differences.
Prerequisites: PSYC 107 or PSYC 117 or COGS 007 or COGS 117
Attribute/Distribution: SS

PSYC 352 Adolescence and Emerging Adulthood 4 Credits
Adolescence is a dynamic development period encompassing multiple interrelated changes in the biological, cognitive, psychological, and social domains. This course will cover theories and research in adolescence and explore connections between research and policy. We will also consider whether emerging adulthood is a separate stage of development.
Prerequisites: PSYC 107
Attribute/Distribution: SS

PSYC 353 Social Justice and Social Change 4 Credits
How do people decide to engage in collective action to challenge social injustice? We will examine motivators and tactics of resistance, as well as barriers to change, against the historical backdrop of the civil rights movement and in the context of current societal and global disparities.
Prerequisites: PSYC 121
Attribute/Distribution: SS

PSYC 354 Psychological Assessment 4 Credits
Basic concepts in the construction, selection, administration, scoring, and interpretation of assessment procedures commonly used in psychology. Selection and evaluation of assessment procedures. Supervised experience administering, scoring, and interpreting assessment procedures.
Prerequisites: PSYC 110
Attribute/Distribution: SS

PSYC 355 Seminar in Cognitive Neuroscience 4 Credits
How have measures of brain activity contributed to our understanding of human information processing? Discoveries from 'peering into the brain' have led to conclusions that would have been impossible using behavioral measures alone. In this course we will examine topics that highlight the unique benefit of cognitive neuroscience techniques to the understanding of human cognition.
Prerequisites: PSYC 176 or COGS 176
Attribute/Distribution: NS

PSYC 357 (ES 357) Psychology of Environmental Issues 4 Credits
Environmental problems and solutions begin with the thoughts, feelings, and behaviors of individual people. We will examine Western ways of relating to nature and the beliefs people hold about it, how they reason about environmental issues, and how they perceive environmental risk and make decisions. We will also consider environmental communication and attitude and behavior change, exploring arenas ranging from patterns of consumption and recycling to climate change. Research methods for investigating these issues will be introduced.
Prerequisites: PSYC 001
Attribute/Distribution: SS

PSYC 358 Inside the Infant Mind 4 Credits
How do babies understand and learn about the world? This course explores the origin and development of human knowledge by venturing inside the infant mind. Topics include current research and theory on infants' understanding of objects, number, language, and people. Research examining thinking in non-human primates is also considered to shed light on what aspects of knowledge are and are not uniquely human.
Prerequisites: PSYC 107 or PSYC 117 or COGS 007 or COGS 117
Attribute/Distribution: SS

PSYC 362 Cognition in Practice & Policy 3-4 Credits
Taking the study of cognition from principle to practice, this course examines how basic research and theory informs understanding of human performance in real-world settings. Topics will be chosen from domains such as automobile safety, environmental and medical decision-making, human-technology interaction, spatial navigation, and breakdown of cognition under fatigue and alcohol. Public policy implications will be considered.
Prerequisites: PSYC 117 or COGS 007 or COGS 117
Attribute/Distribution: SS

PSYC 363 Personality and Social Development in Childhood 4 Credits
Issues related to social development (e.g., attachment, social competence), social contexts (e.g., family, day care), and personality development (e.g., sex roles, aggression, temperament) from infancy through adolescence.
Prerequisites: PSYC 107
Attribute/Distribution: SS

PSYC 364 The Meaning and Power of Narratives through the Lifespan 4 Credits
Examines the complex role of narratives-told to and by children, and enacted by children in play-in children's experience and development. Compares and seeks to integrate different approaches in psychology and other disciplines. In the process, we will also be addressing three basic questions: what is narrative, how is it significant, and how should we study it?
Prerequisites: PSYC 107
Attribute/Distribution: SS
PSYC 365 (GS 365) Human Development in Cross-Cultural Perspective 4 Credits
The formation of mind and personality is shaped in profound ways by the sociocultural contexts within which individuals develop. This course introduces students to basic theoretical and methodological issues and explores important examples of cross-cultural variation and diversity, using comparisons between different societies and between different subcultures within American society. Topics include cognition, language, personality, moral development, socio-emotional development, identity, attachment, and socialization. Materials drawn from anthropology, sociology and education in addition to psychology.
Prerequisites: PSYC 109 or PSYC 107 or PSYC 121
Attribute/Distribution: SS

PSYC 366 Seminar In Cognitive Aging 4 Credits
Information processing by older adults: perception, attention, memory, speech and text processing and comprehension. The course will also examine the effects on cognitive processing of such diseases as Alzheimer’s and Parkinson’s.
Prerequisites: PSYC 109
Attribute/Distribution: SS

PSYC 367 Clinical Psychology 4 Credits
The science and profession of helping people overcome psychological problems. Theories of human personality and abnormality in relation to techniques for assessing and treating psychosocial problems and in the light of empirical evidence of validity and effectiveness. Professional issues are also covered.
Prerequisites: PSYC 153 and PSYC 138
Attribute/Distribution: SS

PSYC 368 Children, Psychology, and the Law 4 Credits
Covers psychological research on child witnesses, child victims, juvenile crime, children’s rights and decision-making capabilities, divorce and custody. Implications of psychological research for social policy and legal reform will be discussed.
Prerequisites: PSYC 107
Attribute/Distribution: SS

PSYC 369 Memory Under Construction 4 Credits
Investigation of the constructive nature of human memory through hands-on exercises, reading and discussion. Includes exploration of personal memories, a memory expanding project, and a final project. Coverage includes autobiographical memory, expert memory, and memory disorders.
Prerequisites: PSYC 117 or PSYC 176 or COGS 007 or COGS 117 or COGS 176
Attribute/Distribution: SS

PSYC 371 Special Topics in Cognition & Cognitive Neuroscience 4 Credits
Topics within cognition and cognitive neuroscience vary from semester to semester. Topics are presented at an advanced level.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

PSYC 372 Special Topics in Developmental Psychology 4 Credits
Topics within developmental psychology vary from semester to semester. Topics are presented at an advanced level.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

PSYC 373 Special Topics in Social & Personality Psychology 4 Credits
Topics within social and personality psychology vary from semester to semester. Topics are presented at an advanced level.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

PSYC 374 Special Topics in Clinical & Behavioral Health 4 Credits
Topics within clinical and behavioral health vary from semester to semester. Topics are presented at an advanced level.
Repeat Status: Course may be repeated.

PSYC 375 Development of Good and Evil 4 Credits
The goal of the course is to trace the origins of children’s good (i.e., prosocial and moral) and evil (i.e., aggressive and bullying) behavior. We will examine the biological (e.g., genetic), cognitive (e.g., social information processing), and contextual factors (e.g., media, parenting, neighborhoods, and peers) that contribute to the development of children’s good and evil behavior.
Prerequisites: PSYC 107
Attribute/Distribution: SS

PSYC 376 Child Language and Social Inequality 4 Credits
What factors influence language development, both positively and negatively, for children growing up in socially and economically disadvantaged situations? Differences in children’s mastery of language can have a major impact on their acquisition of literacy, long-term school success, and ability to achieve their full potential. Topics include parent-child interactions in different socio-economic and cultural contexts; effects of maternal education and SES; the significance of differences between the languages of home and school; and interventions to address language and knowledge gaps.
Prerequisites: PSYC 107 or PSYC 109 or PSYC 117
Attribute/Distribution: SS

PSYC 377 Attention and Attentional Failures 4 Credits
Attention allows us to function in complex environments where there is more information than we could possibly process all at once and failures of attention can have drastic consequences. Experimental and neuropsychological evidence will be surveyed for topics including basic attentional phenomena, the role of attention in everyday tasks, and the impact of attentional failures from mind wandering to neuropsychological deficits like ADHD.
Prerequisites: PSYC 117 or PSYC 176 or COGS 007 or COGS 117 or COGS 176
Attribute/Distribution: SS

PSYC 378 Emotional Development 4 Credits
The course will cover selected topics in emotional development from infancy through adulthood. Topics will include: infant attachment (learning to love), romantic attachment (being in love), emotion regulation, sympathy/empathy, anger/aggression, temperament, etc. We will also discuss the ways in which significant relationships with peers and parents shape children’s emotional development.
Prerequisites: PSYC 107
Attribute/Distribution: SS

PSYC 380 Sports Psychology 4 Credits
Theory, research and application comprise this focal area of psychology. The course will allow students to explore the theory and research giving rise to individual, team, and peak performance assessment and interventions. Topics will include assessment, affect modulation, imagery, cognitive formulation, and psychodynamic development.
Prerequisites: PSYC 110 or PSYC 153

PSYC 381 Special Topics In Psychology 4 Credits
Topics vary from semester to semester. Topics are presented at an advanced level. Previous course work in psychology and consent of faculty sponsor is required.
Repeat Status: Course may be repeated.

PSYC 382 (BIOS 382) Endocrinology of Behavior 3 Credits
Hormonal effects upon animal and human behavior. Emphasis on neuroendocrinology of steroid hormone involvement in reproductive behaviors.
Prerequisites: BIOS 121
Attribute/Distribution: NS

PSYC 383 Attachment Theory & Research: The Study of Close Relationships Across the Lifespan 4 Credits
This course will examine the influence of close relationships across the lifespan on personality development. We will examine the influence of parents, peers, siblings, and romantic relationships using traditional attachment theory. In addition, we will also explore how attachment quality is measured and the clinical applications of attachment theory.
Prerequisites: PSYC 107
Attribute/Distribution: SS
PSYC 384 Self and Identity 4 Credits
We will examine different types of identity (e.g., personal, relational, collective) and the cognitive processes that allow for a multifaceted yet unified sense of self. We will study how self-related motives (e.g., enhancement, consistency, distinctiveness) influence self-knowledge, self-regulation, and mental health. Finally, we will explore the origins of self from evolutionary, neuroscientific, and cultural perspectives.
Prerequisites: PSYC 121 or PSYC 153
Attribute/Distribution: SS

PSYC 386 (HMS 386) Pediatric Psychology 4 Credits
Focuses on developmental research and theory related to health and wellness issues in children and adolescents. Topics include children's understanding of biology and disease, disease management, medical consent, education and policy efforts to promote children's health.
Prerequisites: PSYC 107
Attribute/Distribution: SS

PSYC 389 Honors Project 1-8 Credits
Repeat Status: Course may be repeated.

PSYC 391 Thesis 4 Credits
Written report: Literature review and design of project in selected area of psychology. Only open to students in the honors program. Consent of Honors Program Coordinator required.
Prerequisites: PSYC 210
Attribute/Distribution: ND

PSYC 392 Honors Thesis 3 Credits
Execution of project designed in PSYC 391. Final report and oral presentation. Only open to students in the honors program. Consent of Honors Program Coordinator required.
Prerequisites: PSYC 391

PSYC 393 Independent Research 1-3 Credits
Individual research projects designed and executed in collaboration with faculty sponsor. Regular meetings with sponsor to give progress reports and receive feedback. Student reads relevant literature and writes report in APA format. Consent of faculty sponsor required.
Repeat Status: Course may be repeated.
Prerequisites: PSYC 210 or PSYC 161

PSYC 394 Senior Research Project 3 Credits
Literature review, design and execution of project in selected area of psychology. Intended for senior majors in psychology. Consent of faculty sponsor required.
Repeat Status: Course may be repeated.

PSYC 402 Developmental Psychology 3 Credits
Survey of theories and research concerning perceptual, cognitive, social, and personality development through infancy and childhood. Must have graduate standing or consent of instructor.

PSYC 403 Cognitive Psychology 3 Credits
Survey of theories and research in cognitive psychology. Must have graduate standing or consent of instructor.

PSYC 404 (BIOS 404) Behavioral Neuroscience 3 Credits
Theoretical and empirical issues in biopsychology. Must have graduate standing or consent of instructor.

PSYC 406 Social Cognition 3 Credits
Theory and research on cognitive processes in personality and social functioning. The self, personality consistency and change, causal attributions, social judgment, goals and self-regulation, and mood and emotion. Topics may vary. Must have graduate standing or consent of instructor.

PSYC 409 Professional Seminar I 1 Credit
For students entering the Ph.D. program: Acculturation to graduate school and the Psychology Ph.D. program in particular; professional issues of relevance to individuals at the outset of a research career in psychology. Department permission required.

PSYC 410 Professional Seminar II 1 Credit
For students nearing graduation: Professional issues of special relevance to Psychology Ph.D. students preparing for academic or nonacademic postdoctoral employment. Department permission required.

PSYC 412 First Year Research Project 1-3 Credits
Research project or paper to be completed by June of the first year of the Ph.D. program under the direction of a faculty advisor. May be repeated in second semester of program.
Repeat Status: Course may be repeated.

PSYC 421 Statistical Analysis of Psychological Data I 3 Credits
First of a two-semester sequence covering essential issues in statistical analysis as practiced by psychologists. Topics include data description, probability, z and t-tests, general linear model, simple correlation/ regression, univariate analysis of variance, chi-square. Emphasis on connecting research designs to appropriate statistical tests, data interpretation, and implementation in statistical packages. Department permission required.

PSYC 422 Statistical Analysis of Psychological Data II 3 Credits
Second course of the two-semester statistics sequence. Topics include advanced analysis of variance designs, analysis of covariance, multivariate analysis, multiple regression, and analysis of categorical data. Emphasis on connecting research designs to appropriate statistical tests, data interpretation, and implementation in statistical packages. Consent of department required.
Prerequisites: PSYC 421

PSYC 423 (COGS 423) Foundations of Cognitive Science 3 Credits
Survey of fundamental theory and methodologies from artificial intelligence, linguistics, cognitive psychology, philosophy, and neuroscience, as well as salient research problems such as knowledge acquisition and representation, natural language processing, skill acquisition, perception and action, and the philosophical question of intentionality.

PSYC 433 Cognitive Neuroscience Techniques 3 Credits
This glimpse into the toolkit of modern cognitive neuroscience provides an overview of a range of techniques from psychopharmacology and single cell recording, to human neuroimaging and neuropsychology. The course introduces different techniques with a focus on issues of temporal and spatial resolution, costs and benefits, and appropriateness for different research questions. Students will develop the skills to be knowledgeable consumers of the modern literatures in psychology and related fields that are increasingly incorporating a range of neuroscience methods.
Prerequisites: PSYC 403

PSYC 434 Seminar In Language Acquisition 3 Credits
Special topics in language acquisition. Content will vary each time the seminar is offered.
Prerequisites: PSYC 402 or PSYC 403

PSYC 445 Prosocial and Moral Development 3 Credits
This course will explore children's prosocial and moral development (including the development of moral emotions, cognition, behavior, and values) in infancy through adolescence. In addition to exploring normative prosocial and moral development, we will also focus on the biological, social, and cultural factors that predict individual differences in prosocial and moral development.

PSYC 446 Developmental Theories and Special Populations 3 Credits
Traditional developmental theories focus on normative development. Children with disabilities have a unique set of experiences that pose special challenges for these theories. In the developmental literature, children with disabilities have sometimes been the focus of studies because they provide a "tests case" for specific theoretical predictions. In this course, we will consider some of these theoretical issues and the insights that have been gained by focusing on special populations.
Prerequisites: PSYC 402

PSYC 447 Understanding Evil, Understanding Morality 3 Credits
Cruey, aggression, and mass killing are encountered all-too-frequently in human affairs. At the same time, most people feel allegiance to a "moral code," a code which invariably emphasizes kindness, compassion, non-violence, and even loving one's enemies. In this course, we will examine the psychological literature to see what insights it offers regarding these two perennial forces—Evil and Morality—that underlie human action.
PSYC 448 Seminar in Psychology of Language 3 Credits
Topics in language comprehension and production. Content will vary from year to year.
Prerequisites: PSYC 403
Repeat Status: Course may be repeated.

PSYC 450 Special Topics in Mathematical Models and Statistics 3 Credits
Selected topics in the application of mathematics to psychological research.
Repeat Status: Course may be repeated.

PSYC 460 Special Study 1-9 Credits
Study of some special topic not covered in the regular course offerings.
Repeat Status: Course may be repeated.

PSYC 461 Research Seminar 1-9 Credits
Original research designed and executed in collaboration with the faculty.
Repeat Status: Course may be repeated.

PSYC 462 Stereotypes, Prejudice, Discrimination 3 Credits
An in-depth survey of the social psychological literature on stereotypes, prejudice, and discrimination. Topics will include: Origin of stereotypes, mental representation of stereotypes, cognitive and behavioral consequences of stereotypes, inevitability of stereotyping, nature of prejudice in contemporary American society, context-specificity of discriminatory behavior, and theories of intergroup conflict reduction.
Prerequisites: PSYC 406
Repeat Status: Course may be repeated.

PSYC 464 Naive Realism in Social Judgement 3 Credits
This seminar examines the variety of unconscious influences that impact on social judgment, with a focus on the cognitive processing mechanisms through which influence is exerted. These influences include contributions to judgment from attitudes, goals, accessible constructs, mindsets, stereotypes, expectancies, heuristics, and theories about social objects.
Prerequisites: PSYC 402
Repeat Status: Course may be repeated.

PSYC 466 Prosocial Cognition, Emotion, and Behavior 3 Credits
In this course we will examine such phenomena as compassion, caregiving, sympathy, justice motivation, and helping. We will begin with an examination of human nature: Is prosociality fundamental to human nature? Subsequently, we will examine how prosociality can be nurtured by particular developmental experiences. Finally, we will examine the literature on the nature of prosociality in adulthood: What cognitive capacities support prosociality? What situational factors promote prosociality? What emotional qualities promote prosociality? What belief systems are linked to prosociality?
Prerequisites: PSYC 406
Repeat Status: Course may be repeated.

PSYC 476 Seminar In Cognition 3 Credits
Selected topics in human information processing, including such areas as attention, memory, language and comprehension, and decision-making. Area of emphasis will vary from year to year.
Prerequisites: PSYC 403
Repeat Status: Course may be repeated.

PSYC 478 (COGS 478) Ontological Psychology 3 Credits
Principles and constraints for the modeling of psychological phenomena: Representation, perception, memory, knowing, emotions, consciousness, language, and rationality.
Repeat Status: Course may be repeated.

PSYC 480 Seminar in Cognitive Development 3 Credits
Selected topics in cognitive development in infancy and childhood, including such areas as conceptual development, memory development, the development of reasoning abilities, and language acquisition. Emphasis will vary from year to year.
Prerequisites: PSYC 402
Repeat Status: Course may be repeated.

PSYC 481 Selected Topics in Social and Personality Development 3 Credits
Topics include emotional and sex-role development, peer relations, and social competence. Emphasis will vary from year to year.
Prerequisites: PSYC 402
Repeat Status: Course may be repeated.

PSYC 482 Seminar In Adult Development 3 Credits
Application of lifespan developmental theory and methodology to personality, social, and cognitive development in adulthood.
Prerequisites: PSYC 402
Repeat Status: Course may be repeated.

PSYC 483 Seminar In Cultural Psychology 3 Credits
Major theoretical approaches and empirical debates in cultural psychology, with a focus on the interplay of individual and sociocultural elements in the formation of mind, the emergence of the self, and the definition and reproduction of culture.
Prerequisites: PSYC 402
Repeat Status: Course may be repeated.

PSYC 484 (WGSS 484) Psychology of Gender 3 Credits
Major theoretical approaches and empirical debates in the psychology of gender, with a focus on the interplay of nature and nurture in producing gender similarities, gender differences and gender variation in personality, social behaviors, cognitive abilities, achievement, sexuality, and mental health. Methodological issues in gender research. Consent of instructor required.
Repeat Status: Course may be repeated.

PSYC 490 Thesis Research 1-6 Credits
Master's Thesis or Pre-dissertation Project research directed by committee.
Repeat Status: Course may be repeated.

PSYC 495 Narrative & Psychology 3 Credits
This course explores the increasing significance of narrative analysis in psychology by delineating the conceptual foundations of a narrative perspective and considering arguments for narrative as an integrative paradigm in psychological research. Particular emphasis will be on the constitutive role of narrative in cognitive and socio-emotional development, the formation of identity, moral understanding, and other domains. Some specific topics will be narrative development, autobiographical memory, self-narrative, identity development, narratives of conflict, and the role of narrative in socialization and education.
Repeat Status: Course may be repeated.

PSYC 499 Dissertation Research 1-15 Credits
Ph.D. dissertation research directed by dissertation committee.
Repeat Status: Course may be repeated.

Religion Studies

Department Home Page

The religion studies department is committed to the academic investigation of religion as an intrinsic and vital dimension of human culture. The scholarly study of religion is an integral facet of a liberal arts education. The student of religion is engaged in the critical and interpretive task of understanding patterns of religious thought and behavior as aspects of the human cultural experience. Religion studies is interdisciplinary in that it draws upon humanistic and social scientific modes of inquiry. These include historical, philosophical, sociological, anthropological, and psychological perspectives. Religion studies is a cross-cultural, comparative discipline concerned with the character and significance of the major religious traditions of the world. The student of religion confronts ethical problems and basic issues of value and meaning raised by modern multicultural and technological society.

Professors. Dena S Davis, JD (University of Virginia); Michael L. Raposa, PhD (University of Pennsylvania); Robert Thomas Rozehnal, PhD (Duke University); Lloyd H Steffen, PhD (Brown University); Benjamin G. Wright, III, PhD (University of Pennsylvania)

Associate Professors. Jodi Eichler-Levine, PhD (Columbia University); Khurram Hussain, PhD (Yale University); Hartley Lachter, PhD (New York University); Monica R. Miller, PhD (Chicago Theological Seminary)

Assistant Professors. Christopher Mark Driscoll, PhD (Rice University); Annabella Pitkin, PhD (Columbia University)

Emeriti. Alice L. Eckardt, MA (Lehigh University); Norman J. Girardot, PhD (University of Chicago); Laurence J. Silberstein, PhD (Brandeis University); Lenore E. Chava Weissler, PhD (University of Pennsylvania)

MAJOR IN RELIGION STUDIES

The major in religion studies consists of 32 credit hours of coursework (eight courses). Requirements include:

- In consultation with a major advisor from the departmental faculty, students will devise a balanced plan of study responsive to individual needs and interests. The curriculum for each major will demonstrate exposure to a diversity of approaches to the interdisciplinary, transcultural field of religion studies.
• At least four courses at the 100 level or above.

• REL 374 Seminar for Majors

The department recommends that in consultation with a major advisor, students concentrate in one of the major religious traditions, or in a comparative or thematic approach to the study of religion. The concentration should include at least four courses. Language study appropriate to the concentration is also desirable.

Students are particularly encouraged to consider a joint or double major with another major field from any of the three colleges at the university.

DEPARTMENTAL HONORS

Religion studies majors are admitted to honors by invitation of the departmental faculty toward the end of the student's junior year. To be eligible, a student must have attained at least a 3.25 average in his or her major program by the end of the junior year. Upon admittance to honors, the student will work out a special program of studies for the senior year with the major advisor, culminating in the writing of a senior essay.

MINOR IN RELIGION STUDIES

The minor in religion studies consists of a total of 16 credits. The specific courses to be taken by each student are to be decided upon jointly by the student and the departmental advisor. Ordinarily, the student will be expected to take one introductory course unless specifically exempted by the department chair.

Courses

REL 001 Sacred Scriptures in Religious Traditions 4 Credits

An encounter with the different sacred books of the world’s major religions. Both the books and differing attitudes in these traditions towards sacred books are examined. Books investigated include the Bhagavad Gita, the Analects of Confucius, the Qur'an and the Jewish and Christian Bibles.

Attribute/Distribution: HU

REL 002 (ETH 002, HMS 002) Death and Dying: Religious and Ethical Perspectives 4 Credits

Introduces students to the study of religion, world religious traditions and ethics through an exploration of death and dying. Rituals, practices and texts focused on death provide the basis for comparative study of Asian and Western religious approaches to the meaning and mystery of death as it confronts individuals and communities. Attention will also be given to moral justification for deaths brought about by human actions (i.e., killings). Specific issues include suicide, war deaths, abortion, euthanasia and state-sponsored execution.

Attribute/Distribution: HU

REL 003 (ETH 003, PHIL 003) Global Religion, Global Ethics 4 Credits

Introduction to philosophical and religious modes of moral thinking, with attention given to ethical issues as they arise cross-culturally in and through religious traditions. The course will reference the United Nations Millennium Goals to consider family life and the role of women, social justice, the environment, and ethical ideals. Particular focus varies but may include one or more of the following: abortion and reproductive health, the death penalty, religiously motivated violence, and problems of personal disorder (heavy drinking, anorexia, vengeance).

Attribute/Distribution: HU

REL 005 Spiritual Exercises in Religious Traditions 4 Credits

Explores a variety of religious disciplines developed in various traditions, ranging from the practice of yoga and the martial arts to various forms of prayer, meditation, and asceticism.

Attribute/Distribution: HU

REL 006 Religion and Ecological Crisis 4 Credits

Past and present responses to nature in world religions. Contemporary topics include the animal rights debate, ecofeminism, and the development of environmental ethics. Is "the end of nature" at hand? Why is the environment a religious issue?

Attribute/Distribution: HU

REL 007 What Is Religion? 4 Credits

The word "religion" is fairly recent in origin, its linguistic roots unclear, and the phenomena that it has been used to designate both vast and amorphous. This course explores some of the most prominent attempts to define "religion," definitions produced both by religious thinkers and by critics of religion. We will examine some of the methods used by scholars to study religion. Finally, we will ask how the meaning of the word may be shifting in a modern, secular age.

Attribute/Distribution: HU

REL 009 Spiritual Journeys 4 Credits

A comparative survey of spiritual traveling-from overland pilgrimages to inward journeys in search of truth. Through autobiographies, diaries, poetry and films, students encounter the experiences of seekers from diverse religious traditions, including Hinduism, Buddhism, Christianity and Islam.

Attribute/Distribution: HU

REL 010 (ASIA 010, PHIL 010) Intro to Buddhism: Love Death and Freedom 4 Credits

This course will introduce students to Buddhist practices, philosophical systems, and cultural forms, from Buddhism’s Indian origins to its spread in East Asia and Tibet. Students will explore how Buddhists have approached the problem of death, the possibility of freedom, and the forms of social and individual love and concern. Course materials include poetry, biographies, philosophical writings, art and film.

Attribute/Distribution: HU

REL 011 (GS 011) Introduction to World Religions 4 Credits

Living and working in a globalizing 21st century requires an understanding of diverse religious and cultural identities. In this course, students will be introduced to the history, ideas, and practices from a wide variety of the world’s religious traditions.

Attribute/Distribution: HU

REL 012 (ASIA 012) Mountains, Buddhas, Ancestors: Introduction to East Asian Religions 4 Credits

This course explores the principal religions of East Asia, including Buddhism, Daoism, Confucianism, Shinto, and Shamanic Traditions. What is each tradition’s view of human potential? How is ultimate reality depicted and experienced? What do home altars, boisterous festivals, and silent meditation halls have in common? Several primary texts are read in translation.

Attribute/Distribution: HU

REL 013 (GS 013) Religion and Food 4 Credits

This course explores the complex connections between religion and food. We will examine food-related rituals, including Jewish Passover seders, Christian communion, and Hindu puja; the role of gastronomy in forming religious and ethnic identity; and the global ethics of food and sustainability. We will also probe the notion of food itself as sacred. Are “foodies” engaging in their own sort of sacred actions? How does food connect with the sublime? The class will include tastings and outings as scheduling permits.

Attribute/Distribution: HU

REL 014 "Virtual" Religion 4 Credits

The contemporary world is replete with social phenomena that resemble religious thought and practice – sports fandom, trekkies, nationalistic rituals, online gaming, military camaraderie and codes, environmental activism, etc. In this course we will explore and discuss many of these “virtually” religious phenomena through the lens of the study of religion.

Attribute/Distribution: HU

REL 025 (AAS 025) Introduction to Black Religions and Hip-Hop 4 Credits

Rapper KRS ONE once stated that, “Rap is something you do and Hip-Hop is something you live.” This course thinks through the global evolution of Hip-Hop culture and the public and academic study of Black Religions as responses to structural and historical inequality and the search for meaning in culture by considering themes of resistance, constraint, power, the body, deviance, and morality over and against race, class, gender, and sexuality from a range of academic and cultural sources.

Attribute/Distribution: HU
REL 044 (GS 044) Religious Fundamentalism in Global Perspective 4 Credits
This course will explore the rise of fundamentalist religious movements and their involvement in violent conflicts. Topics to be considered will include the relationship between fundamentalist religious ideologies and terrorism, and the kinds of responses that fundamentalist religious movements present to the development of a global marketplace and the spread of secular nationalism.

Attribute/Distribution: HU

REL 060 (ASIA 060) Religions of South Asia 4 Credits
A thematic introduction to the foundational religious traditions of South Asia: Hinduism, Jainism, Buddhism, Sikhism and Islam. Students explore the social and spiritual dimensions of these religious worlds through scripture, ritual practices, narrative and teaching traditions, music and art.

Attribute/Distribution: HU

REL 062 (GS 062) Explorations in Dialogue 4 Credits
Course critically investigates inter-religious dialogue, an important issue in the contemporary academic study of religion. Focus will be on the problem of inter-religious encounter; religion and globalization; different models of dialogue; and the questions of power and identity. At least two traditions will be put into conversation for any proposed offering (e.g., Christian-Buddhist, Jewish-Muslim, Jewish-Christian).

Attribute/Distribution: HU

REL 073 (JST 073) The Jewish Tradition 4 Credits
Judaism is both a textual tradition and a lived religion. Students read basic Jewish texts—Bible, Talmud, Midrash—and study the ways Jews sanctify the life cycle through rites of passage, and the round of the year through the festival cycle.

Attribute/Distribution: HU

REL 075 The Christian Tradition 4 Credits
Introduction to the Christian tradition from its early variety and subsequent classical definition in the church councils up to the enlightenment. Special emphasis will be placed on the multiform interpretations of the Christian message.

Attribute/Distribution: HU

REL 077 (ASIA 077, GS 077) The Islamic Tradition 4 Credits
A thematic introduction to Islamic history, doctrine and practice. Topics include: Qur'an; prophecy and sacred history; ritual practices; community life; legal interpretation; art and aesthetics; mysticism; politics and polemics.

Attribute/Distribution: HU

REL 079 Religion and Fantasy Literature 4 Credits
A survey of the religious themes that entered fantasy literature in the 1950s in the works of C. S. Lewis and J. R. R. Tolkien, and the humanist resistance to those themes in works by J. K. Rowling, Philip Pullman, or others.

Attribute/Distribution: HU

REL 081 (JST 081) Jewish Mysticism 4 Credits
This course will examine both the history and the central texts and ideas of the Jewish mystical tradition. We will read a broad range of texts, including the ancient Sefer Yetzirah or Book of Creation, the Zohar, the works of Isaac Luria and his disciples, and the writings of some of the 18th and 19th century Hasidic rabbis. We will also explore the contemporary emergence of Kabbalah and the activities of the Kabbalah Center in contemporary America.

Attribute/Distribution: HU

REL 099 Special Topics 1-4 Credits
Repeat Status: Course may be repeated.

Attribute/Distribution: HU

REL 102 (AAS 102, ENGL 102, JST 102) Promised Lands: Jewish and African American Children's Literature 4 Credits
In the Hebrew Bible, Psalm 137 asks, "How can we sing the Lord's song in a strange land?" For Jews, blacks, and black Jews, this was and is a poignant question. This course examines how these two rich, often overlapping and interacting groups tell their stories in literature for children and young adults, with a particular focus on the mediation of traumatic pasts. What does it mean to imagine promised lands beyond such pasts—and can they be reached?

Attribute/Distribution: HU

REL 110 (ASIA 110, MLL 110) Drinking and Immortality 4 Credits
This class explores modes of transcendence and their expression in literature and art, but most especially poetry. The primary focus is the role of drinking alcoholic beverages in traditional Chinese society and religion, but also on other modes and what is meant by the search for immortality - and the use of inner versus outer alchemy - will be examined.

Attribute/Distribution: HU

REL 111 (JST 111) Jewish Scriptures/Old Testament 4 Credits
The religious expression of the Hebrews, Israelites, and Jews as found in the Jewish Scriptures (TANAK/Christian Old Testament). Near Eastern context of Hebrew religion, the Patriarchs, the Exodus, the monarchy, prophecy, Exile and Return. Emphasis on historical, literary, critical problems, and newer socio-historical methods.

Attribute/Distribution: HU

REL 112 (JST 112) The Beginnings of Judaism and Jewish Origins: Jewish Diversity in the Greco-Roman World 4 Credits
The variety of approaches to Judaism in the period following the Babylonian exile through the second century C.E. The literature studied will include Apocrypha, Pseudepigrapha, and the Dead Sea Scrolls.

Attribute/Distribution: HU

Early Christianity from its beginnings until the end of the second century. Coverage includes the Jewish and Hellenistic matrices of Christianity, traditions about the life of Jesus and his significance, and the variety of belief and practice of early Christians. Emphasis on encountering primary texts.

Attribute/Distribution: HU

REL 115 (PSYC 115) Religion And Psychology 4 Credits
A study of the origins, development and consequences of religion from a psychological perspective. Attention will be given to classic and contemporary sources, with a focus on major psychoanalytic theorists of religion (Freud, Jung, Erikson); psychological analyses of religious experience (e.g., Wm. James, Victor Frankl); and the diverse cultural and religious forms that structure the connection between religion and psychology (e.g., Buddhist psychology, Japanese Morita therapy).

Attribute/Distribution: HU

REL 116 (ETH 116, HMS 116, PHIL 116) Bioethics 4 Credits
Moral issues that arise in the context of health care and related biomedical fields in the United States today, examined in the light of the nature and foundation of moral rights and obligations. Topics include: confidentiality, informed consent, euthanasia, medical research and experimentation, genetics, and the distribution of health care.

Attribute/Distribution: HU

REL 119 (ASIA 119, GS 119) The Podcast and the Lotus 4 Credits
Buddhism is increasingly a global phenomenon. Contemporary Buddhist teachers stay in touch with students via podcasts, WeChat, Twitter and Facebook. Buddhists from Singapore, Tibet, Japan, Mexico, Taiwan or Pennsylvania now meet via new technology. This class asks, how is Buddhism now a global religion? what effect has this had? How is Buddhism a "modern" religion? Students explore issues of conversion, modernity, globalization, new technology, migration and travel. Sources include autobiography, film, travel writing, political essays, interviews, social media, ethnography.

Attribute/Distribution: HU

REL 121 (JST 121) Sources for the Life of Jesus: the Jewish and Christian Context 4 Credits
Ancient sources that claim to provide information about Jesus of Nazareth. Approaches taken to Jesus’ life and career; early Christian interpretations of the significance of Jesus; methodology in assessing evidence for the historical Jesus and his message.

Attribute/Distribution: HU
REL 122 (JST 122) Archaeology and the Bible 4 Credits
In this course we will examine the way that archaeological work can inform the study of the Bible. One important consideration is how archaeological data have been used either to confirm or falsify the biblical texts. We will look at how archaeologists work and how archaeological data and the Bible intersect. We will examine in detail several archaeological sites in order to understand better the difficulties in interpreting the material remains that archaeologists dig up.
Attribute/Distribution: HU

REL 123 (JST 123) Armageddon: Endtime Thinking in Judaism and Christianity 4 Credits
Thinking about how the world will end was an important feature of certain types of ancient Judaism. Early Christianity took over many of these ideas, and they became fundamental to later Christian theologies, including many that continue to be advocated today. This course will look at ancient Jewish and Christian texts that speak about the end of the world and will trace some of them through more contemporary developments in these two religious traditions.
Attribute/Distribution: HU

REL 124 (PHIL 124) Philosophy Of Religion 4 Credits
A critical look, from a philosophical perspective, at some fundamental problems of religion: The nature of religious experience and belief, reason and revelation, the existence and nature of God, the problem of evil, and religious truth.
Attribute/Distribution: HU

REL 125 Comparative Religious Ethics 4 Credits
How have thinkers within the three major Abrahamic traditions handled ethical questions and dilemmas throughout history? This course will focus on many issues including but not limited to violence and pacifism, debates concerning revelation versus reason, the different accounts of justice and peace, the nature of scripture and the divine. We will look comparatively both within and across these traditions.
Attribute/Distribution: HU

REL 126 (POLS 126) Religion, Law and Constitution 4 Credits
An examination of the relationship of religion to American law and the United States Constitution. Course will focus on Supreme Court decisions involving the "establishment" and "free exercise" clauses of the First Amendment. Attention will also be given to the intellectual, historical, religious and theological background behind the American experiment in "church-state" separation, including the thought of Roger Williams, the Founders (Washington, Jefferson, Madison), and contemporary analysts (e.g., M. Nussbaum).
Attribute/Distribution: HU

REL 129 (JST 129, PHIL 129) Jewish Philosophy 4 Credits
Consideration of how major Jewish thinkers from the first to 21st centuries confronted questions at the intersection of religion and philosophy: the existence and nature of God, free will, evil, divine providence, miracles, creation, revelation, and religious obligation.
Attribute/Distribution: HU

REL 130 (ASIA 130, MLL 130) Monkey Business 4 Credits
Read and discuss in English the premodern Chinese enlightenment experiment, the Journey To The West, featuring the famous mischievous and magical martial arts master, the Monkey King. Familiarize yourself with a cultural icon that has entertained and inspired since the 16th century and continues to inspire spin-off dramas, comics, acrobatic and TV shows, movies, and video games.
Attribute/Distribution: HU

REL 138 (JST 138, WGSS 138) Sex, Gender, Jews 4 Credits
How do Jews of all genders tell their stories? What are the varied Jewish approaches to sexuality? How have feminist movements affected Jewish rituals? In this course, we will consider how religion, gender, sexuality, race, and class intersect in the lives of Jews, with a particular focus on North America. Topics will include: Jewish women’s memoirs; the voices of LGBTQ Jews; recent innovations in Jewish ritual and leadership; Jewish masculinities; and the gendering of Jewish children’s literature, among others.
Attribute/Distribution: HU

REL 140 (GS 140) Globalization and Religion 4 Credits
This course examines the complexity of globalization and its multi-layered impact on religious identity and piety. Though comparative in methodology and historical framework, the class will give special attention to Islam and Hinduism in South Asia. Topics include: European colonialism; Orientalism and its legacy; religious nationalism; Islamophobia and the Internet and mass media.
Attribute/Distribution: HU

REL 141 (PHIL 141) Medieval Islamic Philosophy 4 Credits
The medieval era was the golden age of Islamic civilization. Science, mathematics, theology, philosophy, logic, jurisprudence, and many other disciplines flourished during that time. Islamic scientific and philosophical thoughts were greatly influenced by the Greek intellectual tradition, and in turn the Islamic intellectual tradition influenced European thoughts during the Middle Ages and beyond. The course is an introduction to medieval Islamic philosophy. There is no indigenous Islamic philosophy other than medieval Islamic philosophy. Reading selections include works by al-Kindi, al-Farabi, Ibn Sina (Avicenna), al-Ghazali, Ibn #ufayl, and Ibn Rushd (Averroes). The goal is to attain a thorough understanding of the reading selections instead of covering a large number of treatises.
Attribute/Distribution: HU

REL 143 (GS 143) Religious Nationalism in a Global Perspective 4 Credits
Religion has become a renewed political force on the world stage in recent years. This course will focus on how religion has often provided both the ideological language and the organizing principles for modern nationalisms. Our exploration of this topic will take the form of case studies from various parts of the world, including but not limited to Pakistan, Israel, No. Ireland, India, Iran and USA.
Attribute/Distribution: HU

REL 145 (ASIA 145, GS 145) Islam and the Modern World 4 Credits
Examines how numerous Muslim thinkers-religious scholars, modernists, and Islamists-have responded to the changes and challenges of the colonial and post-colonial eras. Special emphasis is placed on the public debates over Islamic authority and authenticity in contemporary South Asia.
Attribute/Distribution: HU

REL 147 (ASIA 147, GS 147) Pilgrims, Bandits, Traders, Nuns: Traveling Religious Identities in Asia 4 Credits
This course examines religious networks linking Chinese, Tibetan, Himalayan, and Inner Asian people, places, and institutions to Asia and the world. We explore examples of 19th, 20th century and present day transnational religious identities, emerging from trade, religious travel and pilgrimage, refugee migrations, labor migrations, and modern day leisure travel. We consider religious identity, nationalism, transnationalism, and globalization, using literary, historical, and ethnographic sources, and film, video, and popular media.
Attribute/Distribution: HU

REL 148 (GS 148) Islam Across Cultures 4 Credits
Explores the Muslim world's diversity and dynamism in multiple cultural contexts from the Middle East and North Africa, to Asia and America through literature, ethnography, and films. Topics include: travel and trade networks; education; women and gender; Islam and cultural pluralism; colonialism; and identity politics.
Attribute/Distribution: HU

REL 149 (ETH 149) Modern Islamic Ethics 4 Credits
This course will focus on developments in Islamic thinking and ethics that emerge from the modern encounter between Muslim societies and the West. We will discuss Islamic modernism and fundamentalism through short primary texts from a variety of modern Muslim thinkers.
Attribute/Distribution: HU

REL 152 (JST 152) American Judaism 4 Credits
Diverse cultural and social forms through which American Jews express their distinct identity. Is American Jewry an example of assimilation and decline or creative transformation? What, if anything, do American Jews share in common? Compatibility of Judaism with individualism, pluralism, and voluntarism. How have the Holocaust and the State of Israel shaped the self-understanding of American Jewry?
Attribute/Distribution: HU
REL 154 (HIST 154, JST 154) The Holocaust: History and Meaning 4 Credits
The Nazi Holocaust in its historical, political and religious setting. Emphasis upon the moral, cultural and theological issues raised by the Holocaust.
Attribute/Distribution: HU

REL 156 (JST 156) Judaism and Comic Books 4 Credits
Is The Thing Jewish? What does Superman have to do with the bible? Do Orthodox Jewish girls fight trolls? In this course, we will closely examine comic books and graphic novels in order to expand our understanding of what Jewishness might mean. With a POW! and a BAM!, we will consider many topics “from Krakow to Krypton,” including American Jewish history, how representations of Jews are gendered, global Jewish traditions, monsters and mutations, biblical adaptations, and more!
Attribute/Distribution: HU

REL 159 Roman Catholicism in the Modern World 4 Credits
A survey of the various intellectual, cultural, political and ecclesiastical developments that have shaped contemporary Roman Catholic life and thought.
Attribute/Distribution: HU

REL 161 (GS 161, JST 161) Globalization in the Ancient Mediterranean 4 Credits
We often think of globalization as a modern phenomenon. Yet as early as the twelfth century BCE, transportation, trade, political and religious networks tied the Mediterranean basin together. This course will examine in three periods-the Late Bronze Age, the Hellenistic period, and the Roman period-how these networks were organized and how they affected a range of Mediterranean and Near Eastern peoples. We will use some modern approaches to globalization as analytical tools for understanding the ancient world.
Attribute/Distribution: HU

REL 162 (ASIA 162) Zen Buddhism 4 Credits
Attribute/Distribution: HU

REL 166 (ASIA 166, GS 166) Religious Nationalism in South Asia 4 Credits
This course explores the conflation and conflict of religion and politics in one of the most complex, dynamic and volatile regions on the planet (South Asia). Through literature, film and scholarly writings, students will examine the history of cooperation and conflict between the Muslim and Hindu communities in South Asia-from the movements for national independence to twenty-first century identity politics.
Attribute/Distribution: HU

REL 167 (ASIA 167) Engaged Buddhism 4 Credits
Examines a contemporary international movement that applies Buddhist teachings and practices to social, political, and environmental issues. Topics include: important thinkers, forms of engagement, and areas of controversy.
Attribute/Distribution: HU

REL 168 (ASIA 168) Buddhism in the Modern World 4 Credits
Explores contemporary Buddhism in Asia, America, and Europe. Topics include the plight of Tibet, Buddhist environmentalism, and the emergence of a socially engaged Buddhism. How are Westerners adapting this ancient tradition to address present-day concerns?
Attribute/Distribution: HU

REL 170 (SOC 171) Religion And Society 4 Credits
An introduction to the sociology of religion. Covers classical and contemporary approaches to defining and studying the role of religion in society. Emphasis on understanding religious beliefs and practices in the United States, the sources and contours of religious change, and the effects of religion on individuals and society. Specific topics include religious fundamentalism, religious conversion, religious practices and authority, secularization, religion in public life, religion in social change, religious terrorism, and the ways in which religion impacts our personal health, educational attainment, and family life.
Attribute/Distribution: SS

REL 172 (ASIA 172) Tibetan Buddhism and Society 4 Credits
This course examines the history, rituals, practices and art of the Tibetan Buddhist world, and the interaction of Tibetan Buddhism with the Tibetan Bon religion and Tibetan Islam. Students will explore film, autobiography, visual arts, and religious writings, asking, How has Tibetan Buddhism shaped Tibetan societies, as well as neighboring cultures in East Asia and Inner Asia? In what ways is Tibetan Buddhism now a global religion?
Attribute/Distribution: HU

REL 173 (ASIA 173, WGS 173) Sex, Celibacy and Sainthood: Gender and Religion in East Asia 4 Credits
This course explores themes of sexuality, celibacy, gender, and sainthood in East Asian religions. We will pay special attention to the experiences of religious women from many walks of life and time periods, from traditions including Buddhism, Daoism, and shamanism. Through film, poetry, autobiography, philosophical writing, visual art, and descriptions of visionary experience, students will encounter Buddhist and Daoist nuns, lay women, mothers, shamanic healers, oracles, activists, and royalty, from Tibet, Korea, Japan, China, and the U.S.
Attribute/Distribution: HU

REL 174 (JST 174) Modern Theology 4 Credits
Major 20th century movements within Christian and Jewish theology understood as responses to the problems of modern times. May be repeated for credit as the subject matter varies.
Repeat Status: Course may be repeated.

REL 177 (JST 177, THTR 177) Jews and the Broadway Musical 4 Credits
The history of American musical theater is deeply interwoven with the history of American Jews. This course examines how Jews have taken part in musical theater on multiple levels-as composers, lyricists, producers, and performers, among other roles. It also examines how Jews are depicted in Broadway musicals, with particular attention to gender and ethnicity.
Attribute/Distribution: HU

REL 180 (HIST 180) Religion and the American Experience 4 Credits
The historical development of major religious groups in this country from colonial times to the present. Their place in social and political life, and the impact of the national experience upon them. Emphasis on religious freedom and pluralism, and the church/state relationship.
Attribute/Distribution: HU

REL 182 (WGS 182) Sex and Gender in the Bible 4 Credits
The Bible is often invoked—and often simplistically—as an authoritative source in contemporary discussions about the role of women and what kinds of human sexual expression is acceptable. This course will examine how sex and gender are constructed in different biblical periods and biblical books. We will see that things are not nearly as simple as they are often made out to be.
Attribute/Distribution: HU

REL 184 (WGS 184) Religion, Gender and Power 4 Credits
Gender differences as one of the basic legitimations for the unequal distribution of power in Western society. Feminist critiques of the basic social structures, cultural forms, and hierarchies of power within religious communities, and the ways in which religious groups have responded.
Attribute/Distribution: HU

REL 187 Science, Technology, and the Religious Imagination 4 Credits
Impact of the scientific and technological culture on the Western religious imagination. Roots of science and technology in religious ideas and images. Ways of knowing and concepts of experience in religion and science.
Attribute/Distribution: HU

REL 188 Religion and Literature 4 Credits
Religious themes in the modern novel or the spiritual autobiography, Melville, Tolstoy, Camus, Updike, Walker, and Morrison; or Woolman, Tolstoy, Malcolm X, Wiesel, Frederick Douglass, Sojourner Truth, Kukai.
REL 192 (ASIA 192, PHIL 192) Lehigh in Japan: Kyoto I 3 Credits
This is one of 2 courses that will be part of an intensive international summer school course to take start Summer 2016 in Kyoto University. Students will study aspects of Western and Japanese philosophical thought in a small group led by local and international speakers. Participants in the class will also be local and international. Students will be expected to attend all classes for a number of hours over a period of two weeks.
Attribute/Distribution: HU

REL 193 (ASIA 193, PHIL 193) Lehigh in Japan: Kyoto II 3 Credits
A second component of the Philosophy summer school in Kyoto will involve a series of excursions to galleries, museums, temples, shrines, stores, and restaurants. Students can expect to develop their understanding of both Japanese aesthetics and the way in which the philosophical systems present in Japan have influenced the Japanese aesthetic sensibility. Students will be required to submit a series of shorter pieces of writing and a final project.
Attribute/Distribution: HU

REL 220 (ASIA 220) Poet, Meditator, King: Classics of East Asian Religion 4 Credits
Classic texts of East Asia and an introduction to the traditions they represent. What do these texts teach about reality, humanity, divinity, virtue and society? How is the path of personal and social transformation presented?
Attribute/Distribution: HU

REL 221 (ASIA 221) Topics in Asian Religions 4 Credits
Selected thematic and comparative issues in different Asian religious traditions. May include Buddhism and Christianity, religion and martial arts, Asian religions in America, Taoist meditation, Zen and Japanese business, Buddhist ethics. (H/S). Repeat Status: Course may be repeated.

REL 222 Topics in Western Religions 4 Credits
Selected historical, thematic, and comparative issues in Judaism, Christianity, and Islam.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

REL 224 (PHIL 224) Topics in the Philosophy of Religion 4 Credits
Selected problems and issues in the philosophy of religion.
Attribute/Distribution: HU

REL 225 Topics in Religion and Ethics 4 Credits
Analysis of various moral problems and social value questions. Possible topics include: environmental and non-human animal ethics; medical ethics; drug and alcohol abuse; spiritual meaning of anorexia.
Attribute/Distribution: HU

REL 226 (ETH 226, HMS 226) From Black Death to AIDS: Plague, Pandemic, Ethics and Religion 4 Credits
An investigation into the way religion and morality shape interpretations of plague and pandemics. Three specific pandemics are examined: the bubonic plague of the 14th century, the 1918 influenza pandemic, and the current global AIDS crisis. Moral issues provoked by institutional, political and social responses to pandemic disease are also considered.
Attribute/Distribution: HU

REL 228 Theories Of Religion 4 Credits
What is religion? Does it have a universal, cross-cultural and transcultural essence? Drawing on numerous academic disciplines, the course engages the major issues and most influential authors in the academic study of comparative religions.
Attribute/Distribution: HU

REL 230 (JST 230) Kabbalah: Jewish Mystical Tradition 4 Credits
Explores the history of the quest to know God, through mystical experience or theosophical speculation, as found in Jewish tradition. Examines such issues as the tensions between institutional religion and personal religious experience, between views of God as immanent in the world or transcending it, and between imagery for God and religious experience of God.
Attribute/Distribution: HU

REL 231 (JST 231) Classic Jewish Texts 4 Credits
Many people know that the Hebrew Bible (“Old Testament”) is a foundational scripture for Judaism. Fewer are familiar with the postbiblical Jewish classics. Yet these works shaped the understanding of God, the identity of the Jewish people, and the vision of history and of the ethical life that inform Judaism today. As students read the Talmud, Midrash, and traditional prayer-book, they will become familiar with the wisdom of the rabbinic sages, and the central concepts of Judaism.
Attribute/Distribution: HU

REL 247 (ASIA 247, GS 247) Islamic Mysticism 4 Credits
Sufism, the inner or ‘mystical’ dimension of Islam, has deep historical roots and diverse expressions throughout the Muslim world. Students examine Sufi doctrine and ritual, the master-disciple relationship, and the tradition’s impact on art and music, poetry and prose.
Attribute/Distribution: HU

REL 254 (ASIA 254, ES 254, ETH 254) Buddhism and Ecology 4 Credits
Buddhism’s intellectual, ethical, and spiritual resources are reexamined in light of contemporary environmental problems. Is Buddhism the most green of the major world religions? What are the moral implications of actions that affect the environment?
Attribute/Distribution: HU

REL 262 Critics of Modernity 4 Credits
Many modern thinkers find modernity and its forms of social organization and politics to be deeply troubling. Including both religious and nonreligious critiques, this course will explore the varying meanings of modernity and how these thinkers challenge such meanings. Critics including but not limited to Gandhi, Hannah Arendt, Reinhold Niebuhr, Sayyid Qutb, Alasdair MacIntyre and Ruhollah Khomeini.
Attribute/Distribution: HU

REL 300 Apprentice Teaching 1-4 Credits

REL 317 (ENGL 317) Topics in Jewish Literature 4 Credits
Selected topics in Jewish literature, which may include: Contemporary Jewish Literature, Philip Roth’s Complaint, and Jewish Women Writers.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

REL 335 (ANTH 335) Religion, Witchcraft And Magic 4 Credits
Addresses broad questions about supernatural beliefs as systems of meaning and as practical and moral guides, with a focus on theoretical explanations for supernatural beliefs and the function of religious specialists in the social organization of cultures.
Attribute/Distribution: SS

REL 337 (ANTH 337, ASIA 337) Buddhism and Society 4 Credits
In this course we approach Buddhism as a lived tradition rather than as a textual tradition. We examine how Buddhist practices are integrated into local traditions and how religious practices become part of the larger social, political, and value systems. Societies examined may include Thailand, Nepal, Japan, China, and the United States. Students will develop a comparative framework that includes Theravada, Tibetan, and Zen Buddhism.
Attribute/Distribution: SS

REL 347 (AMST 347, PHIL 347) American Religious Thinkers 3-4 Credits
An examination of the writings of key figures in the history of American religious thought (such as Edwards, Emerson, Bushnell, Peirce, James, Royce, Dewey and the Niebuhrs). Attention will be directed both to the historical reception of these writings and to their contemporary significance.

REL 350 Religion and Politics in Comparative Perspective 4 Credits
This research seminar attempts to identify the conditions under which religious parties arise and become influential, how religion influences popular understandings of secular politics and the extent to which religion is a necessary feature of modern public discourse. These topics are explored through country specific cases from around the world.
Attribute/Distribution: SS

REL 361 Fieldwork 1-4 Credits
Opportunity for students to work, or observe under supervision, religious organizations or institutions. Consent of chair required.
Attribute/Distribution: ND
REL 371 Directed Readings 1-4 Credits
Intensive study in areas appropriate to the interests and needs of students and staff.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

REL 374 Seminar for Majors 4 Credits
A capstone seminar for departmental majors. Considers the methodologies of religious studies and assesses current issues in the field. Offers opportunities for in-depth work on a particular tradition under the guidance of a faculty member. Offered in spring semester.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

REL 375 (SOC 375) The Christian Right In America 4 Credits
What do we know about the Christian Right? Who are they? What do they believe? Where do they come from? Seminar explores answers to such questions through a focus on the history of the Christian Right as well as its ideologies and beliefs, the people who are a part of it, and its evolving relationship to the American political system.
Attribute/Distribution: SS

REL 389 Honors Project for Eckardt Scholars 1-8 Credits
Opportunity for Eckardt Scholars to pursue an extended project for senior honors. May be repeated for credit up to a maximum 12 credit hours. Transcript will identify department in which project was completed. Consent of department required.
Repeat Status: Course may be repeated.

REL 391 Senior Thesis in Religion 4 Credits
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

Science, Technology and Society

Program Director: William Best, Professor of Practice (http://www.ece.lehigh.edu/index.php?page=best)
Email: wab205@lehigh.edu | Phone: 610-758-3551
Website: http://sts.cas2.lehigh.edu

Supported by the Office of Interdisciplinary Programs, 610-758-3996; incasip@lehigh.edu
Williams Hall, 31 Williams Drive

** THIS PROGRAM IS CURRENTLY ON HIATUS. NO NEW MAJORS OR MINORS ARE BEING ADMITTED INTO THE SCIENCE, TECHNOLOGY AND SOCIETY PROGRAM. **

The Science, Technology and Society (STS) program is the product of a continuing cross-college effort to create a common ground from which to explore the relations between science, technology and society: between ideas, machines and values.

The STS program serves as a focal point for a wide range of courses that study the natures of science and of technology, and analyze their social and personal implications. It lends coherence and visibility to offerings otherwise dispersed throughout the catalog.

SCIENCE, TECHNOLOGY AND SOCIETY (STS) MAJOR

The major in science, technology and society studies prepares students for graduate study or for a wide variety of career opportunities including policy analysis, planning, or community relations with public or private sector agencies concerned with the social relations of scientific research and technological innovation. The intrinsically cross-disciplinary character of science-technology-society interactions is reflected in the B.A. requirements.

 Majors must complete a minimum of 30 credit hours in STS courses, listed below, together with at least 15 credit hours in any traditional academic discipline: engineering, physical or life science, the humanities, or the social sciences. This collateral set of courses should be chosen in consultation with the program director to provide the foundation needed to engage STS studies issues in which that discipline is implicated. The senior seminar provides an opportunity for students to integrate the knowledge they have gained and the skills they have acquired in their coursework.

Opportunities for student research are available, especially through STS 181: Independent Study and STS 391: Honors Thesis.

STS studies is a social science major in the College of Arts and Science, and majors must fulfill the college’s B.A. distribution requirements. A detailed description of the STS studies major requirements follows.

Detailed Description of STS Major Requirements Course List

Core Courses

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<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tr>
<td>STS 011</td>
<td>Technology and Human Values</td>
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<tr>
<td>IDEA 011</td>
<td>IDEAS Seminar I</td>
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<td>&amp; IDEA 012 IDEAS Seminar II</td>
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<tr>
<td>HIST 007</td>
<td>Technology in America's Industrial Age</td>
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<td></td>
<td>or HIST 008 Technology in Modern America</td>
<td>4</td>
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<tr>
<td>STS/JOUR 124</td>
<td>Politics of Science</td>
<td>4</td>
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<td></td>
<td>or POLS 115 Technology As Politics</td>
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<tr>
<td>PHIL 128</td>
<td>Philosophy Of Science</td>
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<td>or PHIL 228 Topics in the Philosophy of Science</td>
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<td>STS 381</td>
<td>Senior Seminar</td>
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Electives

10-12
Select three additional advanced courses (at least two of which must be at the 100 level or higher) from the list of approved STS studies courses

Concentration Requirement
15
One of the following:

- Concentration in a Complementary Discipline
- Approved Departmental or Interdisciplinary Program Minor
- Double Major

Total Credits
44-47

1 IDEA 011 IDEAS Seminar I and IDEA 012 IDEAS Seminar II together may substitute for STS 011 Technology and Human Values
2 Minimum of 15 hours to be chosen in conjunction with STS studies advisor.

HONORS IN STS

In order to receive Honors in STS, the student must attain a 3.5 grade-point average in courses presented for the major and a 3.2 grade-point average overall, and must complete the 4 credit Honors Thesis sequence (STS 391 and STS 392) beyond the required minimum of 30 Core credits required of all STS majors.

STS STUDIES MINOR

The program also offers a minor in science, technology & society studies which is open to all undergraduates.

Students electing the minor must take a set of courses totaling a minimum of 15 hours that includes STS 011 Technology and Human Values or IDEA 011 IDEAS Seminar I and IDEA 012 IDEAS Seminar II and electives chosen from the list of all courses eligible for STS studies.

Core Course

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<td>&amp; IDEA 012 IDEAS Seminar II</td>
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Electives

Three electives from approved STS courses (minimum 11 credits)

Total Credits
15-16

STS COURSES

Students should consult with the program director when selecting courses for either the major or the minor.

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<tr>
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<tr>
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<td>STS 112</td>
<td>Engineering and Society</td>
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<tr>
<td>STS/HIST/WGSS 117</td>
<td>Pioneering Women: Women in Science, Medicine and Engineering</td>
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<tr>
<td>STS/HIST/HMS 118</td>
<td>History of Modern Medicine</td>
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<tr>
<td>STS/JOUR 124</td>
<td>Politics of Science</td>
<td>4</td>
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</tbody>
</table>
OTHER STS COURSES

These courses, appropriate to STS studies, are offered by various departments. Course descriptions may be found under the catalog entry for the individual department. New courses are frequently added to this list and announced in bulletins published by the STS program. For further information, please contact the program director.

ARCH 107 History of American Architecture 4
ARCH 210 20th Century Architecture 4
DES 066 Design History 4
ECON 311 Environmental Economics 3
ECON 314 Energy Economics 3
EES/ES 002 Introduction to Environmental Science 3
EES/ES 004 The Science of Environmental Issues 1
ES 001 Introduction to Environmental Studies 4
ES 331 Environmental Law I: Pollution & Risk Abatement 4
ES/PHIL 333 International Environmental Law & Philosphical-Policy Design 4
ES/PHIL 343 Comparative Environmental Law & Philosphical-Policy Design 4
ES 338 Environmental Risk 4
HIST 007 Technology in America's Industrial Age 4
HIST 008 Technology in Modern America 4
HIST 107 Technology and World History 4
HIST 308 Industrial America since 1945 4
HIST/ES 315 American Environmental History 4
HIST/ASIA 340 Japanese Industrialization 4
IR 034 Society, Technology and War 4
IDEA 011 IDEAS Seminar I 2
IDEA 012 IDEAS Seminar II 2
IR 344 International Politics of Oil 4
JOUR/ES 125 Environment, the Public and the Mass Media 4
PHIL/REL/HMS 116 Bioethics 4
PHIL 128 Philosophy Of Science 4
PHIL 228 Topics in the Philosophy of Science 4
PHIL/COGS 250 Philosophy of Mind 4
POLS/ES 105 US Environmental Policy and Law 4
POLS/ES 106 Environmental Values and Ethics 4
POLS/ES 107 The Politics of the Environment 4
POLS 115 Technology As Politics 4
POLS/ES 328 U.S. Politics and the Environment 4
POLS/ES 355 Environmental Justice: From Theory to Practice 4
POLS/ES 375 Seminar: Green Polity 4
REL 006 Religion and Ecological Crisis 4
REL 187 Science, Technology, and the Religious Imagination 4
SOC/HMS 160 Medicine and Society 4
SOC 302 The Sociology Of Cyberspace 4
SOC/JOUR 327 Mass Communication and Society 4

Courses

STS 011 Technology and Human Values 4 Credits
Impact of technology on society in relation to ethical problems raised by the exploitation of technological innovations. Illustrations from history, social studies, philosophy, literature, and film.

Attribute/Distribution: SS

STS 112 Engineering and Society 4 Credits
An examination of the social, political, commercial, and cultural factors that determine the problems engineers are asked to solve as well as the terms of acceptable solutions to those problems. This is a discussion-based course using a mix of books, articles, and videos.

Attribute/Distribution: SS

STS 117 (HIST 117, WGSS 117) Pioneering Women: Women in Science, Medicine and Engineering 4 Credits
This course analyses the careers of professional women in science, medicine and engineering, principally in the United States. It examines historical barriers to training and entry into these professions; cultural stereotypes that shape women’s options; women’s participation in innovation in their fields; their concern for work/life balance; and their contribution to clients and patients, both male and female. It focuses on three locations of professional work: the laboratory, the clinic, and the job site.

Attribute/Distribution: SS

STS 118 (HIST 118, HMS 118) History of Modern Medicine 4 Credits
Introduction to Western medical history from the 18th century to the present day. Students will explore patient/practitioner relationships, examine changing ideas concerning health, sickness, and disease, chart changes in hospital care and medical education, and tackle topics such as eugenics, medical experimentation, and health insurance.

Attribute/Distribution: HU

STS 124 (JOUR 124) Politics of Science 4 Credits
Analysis of the multidimensional interaction between the federal government and the scientific community. Explores historical growth of the science-government connection, the scientific establishment both past and present, and the role of scientific advice to the White House and Congress. Also examines scientific ethics, public attitudes toward science, science-society interactions, and case studies of scientific controversies.

Attribute/Distribution: SS

STS 145 (HIST 145) Introduction to the History of Science 4 Credits
The history of modern science, primarily physical and biological, with emphasis on the development of major theoretical models since the seventeenth century.

Attribute/Distribution: SS

STS 181 Independent Study 1-4 Credits
Consent of program director required. Designation of the course as HU or SS will depend on the instructor and the content of the course.

Repeat Status: Course may be repeated.

Attribute/Distribution: HU, SS

STS 252 (CSE 252, EMC 252) Computers, the Internet, and Society 3 Credits
An interactive exploration of the current and future role of computers, the Internet, and related technologies in changing the standard of living, work environments, society and its ethical values. Privacy, security, depersonalization, responsibility, and professional ethics; the role of computer and Internet technologies in changing education, business modalities, collaboration mechanisms, and everyday life.

Attribute/Distribution: SS

STS 323 (ES 323, HMS 323, JOUR 323) Health and Environmental Controversies 4 Credits
Exploration of health, and environmental controversies from the perspectives of scientific uncertainty and mass media coverage. Examines genetic engineering, biotechnology, environmental health risks, and nanotechnology. Includes discussion of ethical and social responsibilities and interactions with the public.

Attribute/Distribution: SS

1 Open to undergraduates by petition only.
STS 341 Issues in American Competitiveness: At Home and Abroad
4 Credits
Issues affecting American commercial competitiveness focusing on topics associated with the recent emergence of a new commercial environment in all First World societies. Team taught in a highly interactive setting with industry, public sector, and government experts, in addition to academics from various disciplines and institutions. Students read topical articles and books, participate in team projects and debates, and conduct team research on competitiveness issues. For open to others. Consent of program director.

Prerequisites: STS 011
Attribute/Distribution: SS

STS 381 Senior Seminar 4 Credits
In-depth study of selected topics in science, technology, and society with special attention to methodological issues. Subject matter may vary from semester to semester. Intended for STS majors and minors, but open to others. Consent of program director.

Prerequisites: STS 011
Attribute/Distribution: SS

STS 391 Honors Thesis 1 Credit

Attribute/Distribution: ND

STS 392 Honors Thesis 3 Credits
Directed undergraduate research thesis required of students who apply and qualify for graduation with program honors.

Prerequisites: (STS 391)
Can be taken Concurrently: STS 391

Attribute/Distribution: ND

STS 481 Readings in Science, Technology and Society 3 Credits
Readings seminar on selected themes and topics in science, technology, and society. May be repeated for credit with permission of the program director.

Repeat Status: Course may be repeated.

Sociology and Anthropology

Web site: http://socanthro.cas2.lehigh.edu/. The department is home to sociology and anthropology. Sociology is the study of human beings in relationships with others. Anthropology is the holistic study of humans today and in the past, in a global, comparative, and multicultural perspective. Together, these disciplines encompass the broadest range of human activities, from comparative examination of diverse past and present cultures and societies, to the influence of society on individual behavior, to examination of the most pressing social issues of our time and what it means to be human.

The curricula within the department provide students with skills necessary to understand and conduct social research in a variety of employment settings through training in research design, methods, and data analysis. Students acquire a theoretical background that promotes self and societal awareness that are valued by a wide range of prospective employers.

The department offers three bachelor of arts majors: Anthropology, Sociology, and Sociology and Anthropology. The three programs are parallel in structure and requirements and each consists of 40 credit hours of course work. The Sociology and Anthropology major is an interdisciplinary program for students desiring a broader social science perspective, whereas the Anthropology and Sociology majors are for students desiring more focused, disciplinary programs of study.

Research Opportunities
The department supports students in research of their own design, as well as engaging students in ongoing research activities of faculty members. Second semester sophomore, junior and senior students interested in a supervised research experience are encouraged to consult with the chair or appropriate faculty member. Course credit can be received for research experience.

Internship Opportunities
The department maintains close working relationships with a variety of social agencies and institutions in the area. Majors can earn course credit by carrying out supervised work in field settings—see http://socanthro.cas2.lehigh.edu/ for more details. This experience allows a student to apply the concepts learned in the classroom to potential employment settings and to evaluate professional options.

Senior Thesis
Majors are encouraged to do independent research culminating in a senior thesis; this is especially recommended for students intending to go on to graduate or professional school. The junior year is the time to begin discussing possible projects with faculty. The department chairperson should be consulted for further details. Our web site has additional information.

Departmental Honors
To be eligible for departmental honors, students must have at least a 3.5 GPA in the major. In addition, students pursuing honors must register for ANTH or SOC 399 and write a thesis during their senior year. Awarding of departmental honors is contingent on both the quality of the thesis, as judged by a departmental committee, and the candidate's GPA at time of graduation.

Professors. David Casagrande, PHD (University of Georgia); David B. Small, PHD (University of Cambridge); Cameron Braxton Wesson, PHD (University of Illinois at Urbana-Champaign)

Associate Professors. Kelly F Austin, PHD (North Carolina State University); Heather Beth Johnson, PHD (Northeastern University); Jacqueline Krasas, PHD (University of Southern California); Danielle J. Lindemann, PHD (Columbia University); Ziad Munson, PHD (Harvard University); Bruce Whitehouse, PHD (Brown University); Yuping Zhang, PHD (University of Pennsylvania)

Assistant Professors. Sirry M. Alang, PHD (University of Minnesota Minneapolis); Hugo Ceron-Anaya, PHD (University of Essex); Allison J. Mickel, PHD (Stanford University)

Professor Of Practice. Sarah Eliza Stanlick, PHD (Lehigh University)

Emeriti. John B. Gatewood, PHD (University of Illinois at Urbana-Champaign); Roy C. Herrenkohl, Jr., PHD (New York University); Judith N. Lasker, PHD (Harvard University); James R. McIntosh, PHD (Syracuse University); Robert E. Rosenwein, PHD (University of Michigan); Nicola Tannenbaum, PHD (Iowa State University)

B.A. Major Programs

ANTHROPOLOGY

Collateral Requirement
Select one of the following general courses in statistics: 3-4

| MATH 012 | Basic Statistics |
| ECO 045 | Statistical Methods |
| PSYC 110 | Statistical Analysis of Behavioral Data |

Or equivalent

Introductory

| ANTH 011 | Cultural Diversity and Human Nature |
| ANTH 012 | Human Evolution and Prehistory |

Methodology

| SOAN 111 | Research Methods and Data Analysis |

Major Electives
Select five anthropology courses 2  20

Research, Internship, or Thesis
Select one of the following: 3  4

| ANTH 300 | Apprentice Teaching |
| ANTH 393 | Supervised Research |
| ANTH 394 | Field School |
| ANTH 395 | Internship |
| ANTH 399 | Senior Thesis |

Total Credits 39-40

1 Note: MATH 012 fulfills the College of Arts and Sciences requirement.
2 At least two of which must be at the 300-level. Individualized study courses ANTH 300, ANTH 393, ANTH 394, ANTH 395, and ANTH 399 cannot be used to fulfill this requirement; however, one SOC course can be substituted as an anthropology elective.
3 Preferably during the senior year, majors must complete at least four credits of experiential learning on a subject or in a context relevant to their major. Students may fulfill this requirement in a variety of ways - research, field school, internship, or thesis.

4 Students who intend going on to graduate or professional school are strongly encouraged to do the senior thesis option, and a senior thesis is required for departmental honors.

Concentrations within the Anthropology Major

Anthropology majors may choose to concentrate in cultural or archaeological anthropology. These optional concentrations in one or the other subfield entail additional constraints on course selection within the major electives category, as described below.

Concentration in Cultural Anthropology

Anthropology majors electing to concentrate in cultural anthropology must complete at least four courses in cultural anthropology at the 100-level or above. Regular course offerings that would satisfy this concentration include the following:

Select at least four of the following:

ANTH 106 Cultural Studies and Globalization
ANTH 111 Comparative Cultures
ANTH 121 Environment and Culture
ANTH 123 Anthropology of Gender
ANTH 140 Introduction to Linguistics
ANTH 182 North American Indians
ANTH 187 Peoples and Cultures of Southeast Asia
ANTH 305 Anthropology Of Fishing
ANTH 320 Global Capitalism
ANTH 325 Economic Anthropology
ANTH 330 Food For Thought
ANTH 335 Religion, Witchcraft And Magic
ANTH 376 Culture and the Individual

Total Credits: 16

Students choosing this concentration are strongly encouraged to use their general education electives to complete at least three courses in cultural anthropology; pursue courses in museum studies, mathematics, computer science, history, and the social sciences as interests dictate; and take a wide range of natural science courses of special relevance to archaeologists.

SOCIOLGY AND ANTHROPOLOGY

Collateral Requirement

Select the following general courses in statistics:

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<thead>
<tr>
<th>Course Code</th>
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<th>Credits</th>
</tr>
</thead>
<tbody>
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<tbody>
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</tr>
<tr>
<td>ANTH 011</td>
<td>Cultural Diversity and Human Nature</td>
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Theory and Methodology

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</tr>
</thead>
<tbody>
<tr>
<td>SOAN 111</td>
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<tr>
<td></td>
<td>(fall)</td>
</tr>
<tr>
<td>SOC 112</td>
<td>Development of Social Theory</td>
</tr>
</tbody>
</table>

Major Electives

Select three courses in sociology

Select three courses in anthropology

Total Credits: 43-44

1 Note: MATH 012 fulfills the College of Arts and Sciences’ mathematics requirement.
2 One of which must be at the 300-level.
3 Individualized study courses SOC 300, SOC 393, SOC 395, and SOC 399 can be taken as major electives but cannot be used to fulfill the 300 level course requirement.
4 Individualized study courses ANTH 300, ANTH 393, ANTH 394, ANTH 395, ANTH 395, and ANTH 399 can be taken as major electives but cannot be used to fulfill the 300 level course requirement.

SOCIOLGY

Collateral Requirement

Select the following general courses in statistics:

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<td>(fall)</td>
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<td>Development Of Social Theory</td>
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</tbody>
</table>

Major Electives

Select five courses in sociology

Total Credits: 39-40

1 Note: MATH 012 fulfills the College of Arts and Sciences’ mathematics requirement.
2 At least two of which must be at the 300-level. Individualized study courses SOC 300, SOC 393, SOC 395 and SOC 399 cannot be used to fulfill this requirement; however, one ANTH course can be substituted as a “sociology” elective.
3 Preferably during the senior year, majors must complete at least four credits of experiential learning on a subject or in a context relevant to their major. Students may fulfill this requirement in a variety of ways: supervised research, field school, internship, or thesis.
Students who go on to graduate or professional school are strongly encouraged to do the senior thesis option, and a senior thesis is required for departmental honors.

**Minor Programs**

**ANTHROPOLOGY**

ANTH 011 Cultural Diversity and Human Nature 4
or ANTH 012 Human Evolution and Prehistory

Select any four courses in Anthropology 16

Total Credits 20

**SOCIOLOGY AND ANTHROPOLOGY**

One of the following introductory courses:

SOC 001 Introduction to Sociology 4

ANTH 011 Cultural Diversity and Human Nature

ANTH 012 Human Evolution and Prehistory

Select two additional courses in Sociology at the 100 level or above 8

Select two additional courses in Anthropology at the 100 level or above 8

Total Credits 20

**SOCIOLOGY**

SOC 001 Introduction to Sociology 4

Select any four courses in Sociology 16

Total Credits 20

**GRADUATE COURSES IN SOCIOLOGY**

The Master’s Program in Sociology prepares students to apply sociological perspectives and methods to the analysis of social realities. Grounded in a strong theoretical and substantive understanding of social institutions, social relations, and social policy, as well as in advanced research and data analytic skills, students are prepared to be effective and experienced practitioners in the field of applied social research or to continue into doctoral studies in the field.

Sociology MA program

The Sociology MA program requires 30 hours of course work. Required courses are:

Quantitative Research 3
Statistics for Sociological Inquiry 3
Qualitative Research 3
Social Theory 3
Select six electives 18

Total Credits 30

Quantitative Research 3
Statistics for Sociological Inquiry 3
Qualitative Research 3
Social Theory 3
Select six electives 18

Total Credits 30

All students must take and pass a comprehensive exam. Students choose whether to write a thesis.

**COMMUNITY FELLOWS PROGRAM**

Applicants for the Sociology MA program may also choose to apply to the Community Fellows Program, a one year Master’s Program in which students work for 15 hours a week in a non-profit organization as part of their academic experience. Please see the program website at www.lehigh.edu/communityfellows.

**Anthropology Courses**

**ANTH 011 Cultural Diversity and Human Nature 4 Credits**
A cross-cultural investigation of variation in human societies. Examines forms of social organization, kinship, religion, symbolism, and language through the consideration of specific cultural case studies in local and global contexts. Students will learn how anthropological research methods enhance understanding of contemporary social issues, help solve real-world problems, and foster an informed perspective on what it means to be human.

Attribute/Distribution: SS

**ANTH 012 Human Evolution and Prehistory 4 Credits**

Attribute/Distribution: NS

**ANTH 100 Seminar in Anthropology 1-4 Credits**
Topics in anthropology.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

**ANTH 106 (GS 106) Cultural Studies and Globalization 4 Credits**
This course closely examines the complex relationship between culture and globalization. The impact of globalization on local culture is an essential topic. But the interaction of globalization and culture is not a one-way process. People around the world adapt globalization to their own uses, merging global cultural flows with local practices in transformative ways. The course will study the interaction of local culture with globalizing forces; immigration and culture; the localizing of mass culture; cultures of diasporic and migratory groups, and globalization, gender and identity.

Attribute/Distribution: SS

**ANTH 108 (GS 108) Not-so-Lonely Planet: The Anthropology of Tourism 4 Credits**
Love to travel? This course explores tourist attractions around the world to understand why people leave home, why they visit resorts, monuments, historical sites, memorials, parks, museums, and more. By reading anthropological scholarship and by visiting nearby attractions ourselves, we examine the politics and economics of the global tourism industry, the impact of tourism on local communities, and tourists’ search for an ‘authentic’ experience. And we see how Disneyland, of all places, provides insight into each of these topics.

Attribute/Distribution: SS

**ANTH 111 Comparative Cultures 4 Credits**
Anthropology is a comparative discipline; through comparisons we learn what is unique to a particular culture, what is shared among a number of cultures, and how traits, ideas, practice or belief are related to each other. Students will learn how anthropologists do comparisons and do their own comparative research utilizing both qualitative and quantitative techniques.

Attribute/Distribution: SS

**ANTH 112 (CLSS 112) Doing Archaeology 4 Credits**
Principles of archaeological method and theory. Excavation and survey methods, artifact analysis, dating techniques, and cultural reconstruction. Includes field project.

Attribute/Distribution: SS

**ANTH 113 Culture Theory 4 Credits**
This course immerses students in Anthropological theories that seek to explain global cultural diversity, patterns of similarities, and evolution of societies through time. Students will learn how anthropological theory helps us to understand contemporary cultural issues, solve real-world problems, and foster an informed perspective on what it means to be human.

Attribute/Distribution: SS

**ANTH 121 (ES 121) Environment and Culture 4 Credits**
Impact of environment upon cultural variability and change. Comparative study of modern and past cultures and their environments as well as current theories of human/ environmental interaction.

Attribute/Distribution: SS
ANTH 123 (WGSS 123) Anthropology of Gender 4 Credits
Comparative study of the meanings and social roles associated with gender. Psychological, symbolic, and cultural approaches.
Attribute/Distribution: SS

ANTH 140 (COGS 140, MLL 140) Introduction to Linguistics 4 Credits
Relationship between language and mind; formal properties of language; language and society; how languages change over time. May not be taken pass/fail.
Attribute/Distribution: SS

ANTH 145 Human Evolution 4 Credits
Principles of biological anthropology focusing on the evolution of the human species. Topics include evolutionary theory, nonhuman primate diversity and behavior, the relationship between biology and behavior in evolutionary terms, the hominid fossil record, and genetic variability among contemporary human populations.
Attribute/Distribution: NS

ANTH 155 (GS 155, HMS 155) Medical Anthropology 4 Credits
Medical Anthropology is the study of how conceptions of health, illness, and healing methods vary over time and across cultures. Students will learn how social and cultural factors shape health outcomes in a variety of human contexts, and will study culturally specific approaches to healing, including Western bio-medicine. The course offers a broad understanding of the relationship between culture, health, and healing.
Attribute/Distribution: NS

ANTH 172 North American Archaeology 4 Credits
Development of prehistoric North American indigenous population north of Mexico, beginning with earliest evidence of people in the New World continuing up through European contact.
Attribute/Distribution: SS

ANTH 173 Archaeology of the Middle East 4 Credits
Covers major archaeological findings from Iraq, Iran, Israel, Palestine, Jordan, Egypt, and Turkey, as well as historical context surrounding those findings. Learn about palaces, temples, fortresses, pyramids, toms, and ancient cities that archaeologists have excavated—but also about who excavated these sites and why. Answer questions like: Who built the pyramids? How did writing begin? And: Why is the Rosetta Stone now in England? How has our knowledge of the past been shaped by the relationship between archaeology and colonialism?
Attribute/Distribution: SS

ANTH 174 (ARCH 174, ART 174, CLSS 174) Greek Archaeology 3-4 Credits
Ancient Greek culture from the Neolithic to Hellenistic periods. Reconstructions of Greek social dynamics from study of artifacts.
Attribute/Distribution: SS

ANTH 175 Britain After the Romans 4 Credits
Exploration of the archaeological record of the British Isles from the Roman Invasion until the Middle Ages. Focuses on the long-term impacts of incorporation into the Roman Empire on the indigenous cultures of Britain, the culture instability that accompanied the collapse of Roman rule, and the subsequent waves of invasion and immigration from Western Europe that followed. Regional variations within and between various island cultures are addressed.
Attribute/Distribution: SS

ANTH 176 (ARCH 176, ART 176, CLSS 176) Roman Archaeology 4 Credits
Cultures of the Roman Empire. Reconstructions of social, political, and economic dynamics of the imperial system from study of artifacts.
Attribute/Distribution: SS

ANTH 177 Britain Before the Romans 4 Credits
Exploration of the archaeological record of the earliest inhabitants of the British Isles. Focusing primarily on the Paleolithic and Neolithic cultures of ancient Britain, this course examines the transition from foragers to farmers, the construction of monumental earthworks and stoneworks like Avebury and Stonehenge, and culture connections beyond the islands. Regional variations within and between various island cultures are also addressed.

ANTH 178 Mesoamerican Archaeology 4 Credits
Ancient civilizations of Mesoamerica: Olmec, Zapotec, Maya, Toltec, and Aztec. Reconstructions of urban centers, political and economic organizations, and theories of the Mayan collapse.
Attribute/Distribution: SS

ANTH 182 North American Indians 4 Credits
Culture areas of native North America prior to substantial disruption by European influences north of Mexico. Environmental factors and cultural forms.
Attribute/Distribution: SS

ANTH 183 (AAS 183) Peoples and Cultures of Africa 4 Credits
Studies African modernity through a close reading of ethnographies, social stories, novels, and African feature films.
Attribute/Distribution: SS

ANTH 184 (LAS 184) Indigenous Cultures of Latin America 4 Credits
This course examines social change in Latin America from the perspective of indigenous peoples. Main goals are to develop an appreciation for the diversity of cultures found in Latin America, explore anthropological concepts like cultural ecology, ethnicity, acculturation, and religious syncretism, and to apply these concepts to contemporary issues, including cultural survival, human rights, and environmental sustainability.
Attribute/Distribution: SS

ANTH 187 (ASIA 187) Peoples and Cultures of Southeast Asia 4 Credits
Peoples and cultures of Burma, Laos, Cambodia, Thailand, Malaysia, Singapore, Indonesia, and the Philippines. World view, religion, economy, politics, and social organization.
Attribute/Distribution: SS

ANTH 188 (ASIA 188) Southeast Asian Migrants and Refugees 4 Credits
Focus on migrants and refugees from Southeast Asia to the United States; examines cultures and practices while in Southeast Asia, the migration process, and the ways in which the people and their cultural practices have changed in the United States.
Attribute/Distribution: SS

ANTH 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

ANTH 305 Anthropology Of Fishing 4 Credits
Comparative study of fishing peoples and their technologies. Fishing strategies, control of information, and social organization of marine exploitation in subsistence and modern industrial contexts. Theory of common property resources and the role of social science in commercial fisheries management.
Attribute/Distribution: SS

ANTH 312 The Anthropological Signature of the Past 4 Credits
Covers the basic tenets of different anthropological analyses of premodern cultures. Emphasis on the archaeological traces of different social constructions in the past.
Attribute/Distribution: SS

ANTH 317 (GS 317) So You Want to Save the World: Anthropological Encounters with Humanitarianism and Development 4 Credits
We are often motivated by the desire to “give back”—feed the hungry, heal the sick, and help those less fortunate than ourselves. Anthropological research on humanitarian aid, development projects, and other interventions meant to improve human lives in various contexts shows us why these efforts often go awry. Focusing primarily on settings outside the U.S., students will consider the pitfalls of developmental and humanitarian interventions as well as the crucial role of local knowledge in addressing complex global problems.
Attribute/Distribution: SS
ANTH 320 (GS 320) Global Capitalism 4 Credits
Anthropological approach to the forms and effects of global capitalism. Topics include the structure of contemporary global capitalism, including the growth of multinational corporations, flexible corporate strategies, overseas manufacturing, and global branding and marketing; the impact of global capitalism on the environment and on the lives of people in "Third World" countries; consumer culture and the diversity of non-Western consumption practices; alternative capitalist systems.
Attribute/Distribution: SS

ANTH 321 (ES 321) Information Ecology 4 Credits
Information theory, critical social theory, and ecological principles are combined to model how information organizes human ecosystems. These concepts are applied to environmental policy analysis using case studies.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

ANTH 324 (AAS 324, GS 324) Globalization and Development in Africa 4 Credits
Examines the challenges Africa presents to expectations of modernization and development. Have African societies been left behind by globalization, shut out from it, or do they reflect an unexpected side of globalization processes? What is Africa's place in the neoliberal world order? What role does "African culture" play in generating or blocking social change? How can anthropology illuminate prospects for change on what has long been regarded as the "dark continent"?
Attribute/Distribution: SS

ANTH 325 Economic Anthropology 4 Credits
Cross-cultural perspectives on the ways people produce, distribute, and consume goods; how these systems are organized; and how they are connected with other aspects of society, particularly political and ideological systems.
Prerequisites: ANTH 001 or ANTH 011 or SOC 005 or SOC 021 or PSYC 021 or SOC 001
Attribute/Distribution: SS

ANTH 330 Food For Thought 4 Credits
Symbolic and cultural analyses of foods and cuisines. Examines what people eat, who prepares it, what it means, and the social and religious uses of foods historically and cross-culturally.
Attribute/Distribution: SS

ANTH 335 (REL 335) Religion, Witchcraft And Shamanism 4 Credits
Addresses broad questions about supernatural beliefs as systems of meaning and as practical and moral guides, with a focus on theoretical explanations for supernatural beliefs and the function of religious specialists in the social organization of cultures.
Attribute/Distribution: SS

ANTH 337 (ASIA 337, REL 337) Buddhism and Society 4 Credits
The course approaches Buddhism as a lived tradition rather than as a textural tradition. We examine how Buddhist practices are integrated into local traditions and how religious practices become part of the larger social, political, and value systems. Societies examined include Thailand, Nepal, Japan, China, and the U. S. Students will develop a comparative framework that includes Theravada, Tibetan, and Zen Buddhism.
Attribute/Distribution: SS

ANTH 339 Seminar In Anthropology 4 Credits
Topics in anthropology. Varying semester to semester: human evolution, politics and law, introduction to linguistics, human use of space, anthropology of deviance.
Repeat Status: Course may be repeated.
Prerequisites: ANTH 001 or ANTH 011 or SOC 005 or SOC 021 or PSYC 021 or SOC 001
Attribute/Distribution: SS

ANTH 340 Archaeological Theory 4 Credits
Explores important issues in the interpretation of archaeological material. Issues include variable utility of archaeological analogues, unevenness of data, reconstructions of past cultures, processual and post-processual approaches. Students will write a sample NSF proposal.
Attribute/Distribution: SS

ANTH 352 (ES 352) Environmental Archaeology 4 Credits
This course reviews the various categories of archaeological data used to examine the nature of past human-environmental relationships. We will explore how archaeologists use data to recognize anthropogenic and natural environmental changes, as well as cultural adaptations to local environments.
Attribute/Distribution: SS

ANTH 370 (HIST 370) Historical Archeology 3-4 Credits
This course examines the unique nature of historical archaeology of post contact America. Topics include reconstructing the past through the archaeological and historical record, exhibiting past culture, and capturing the real or imagined past. Course includes fieldwork and visits to famous historical archaeological sites.
Attribute/Distribution: SS

ANTH 371 Special Topics 1-4 Credits
Advanced work through supervised readings. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

ANTH 376 Culture and the Individual 4 Credits
Concepts and methods of studying relations between the individual and the sociocultural milieu. Culture and personality language and thought, cross-cultural studies of cognition.
Attribute/Distribution: SS

ANTH 377 Archaeology Of Death 4 Credits
Examines what we can determine about the past from human remains. Class will study health, age, and disease from the analysis of human bone, the cultural aspects of burial and funerals, and take part in a field project in Nisky Hill Cemetery in Bethlehem.
Attribute/Distribution: SS

ANTH 378 (LAS 378) Blood, Pyramids, and the Tree of Life 4 Credits
This course explores the ways of life of the Maya people. We will take a close look at their religion, their foods, their family life, music, medicine, festivals, etc. An important part of this class explores the long tradition of the Maya, making connections between the modern Maya and the Maya of their past.
Attribute/Distribution: SS

ANTH 389 Honors Project 1-8 Credits
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

ANTH 393 Supervised Research 1-4 Credits
Conducting anthropological research under the supervision of a faculty member. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

ANTH 394 Field School 1-8 Credits
Field school in archaeology or ethnography. Maximum of eight credits for a single season or field experience.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

ANTH 395 Internship 1-4 Credits
Supervised experience involving nonpaid work in a setting relevant to anthropology. Open only to department majors.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

ANTH 399 Senior Thesis 2-4 Credits
Research during senior year culminating in senior thesis. Required for anthropology majors seeking departmental honors. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

Sociology and Anthropology Courses
SOAN 042 (WGSS 042) Sexual Minorities 4 Credits
How minority sexual identities have been the subject of speculation, misunderstanding, and sometimes violent attempts at correction or elimination. Sexual orientation, gender role, including transvestism and "drag", transsexualism, sexism, heterosexism, and homophobia. Emphasis on critical thinking, guest speakers, and discussions.
Attribute/Distribution: SS
SOAN 111 Research Methods and Data Analysis 4 Credits
Research skills in anthropology, sociology and social psychology. Problem formulation; research design; methods and measures; analysis and interpretation of data. Emphasis on the use of statistics in the research process.
Attribute/Distribution: SS

SOAN 112 Development Of Social Theory 4 Credits
This course introduces some of the most influential theoretical ideas in sociology. It focuses on understanding the differences among several classical theoretical traditions and their strengths and weaknesses in analyzing societies. It also helps students learn to apply social theory to contemporary sociological research and problems, learning the ways theory can be used to answer questions and problems societies face today.
Attribute/Distribution: SS

SOAN 120 (ETH 120, HMS 120) Values and Ethics of Community-Engaged Research 4 Credits
The many dimensions of community-engaged research and learning are explored, with special attention to ethical practices, values, research methods, and critical reflection. Experiential and service aspects of the course provide opportunities for students to build skills for social and community change, as well as build capacity for research and critical inquiry.
Attribute/Distribution: SS

Sociology Courses

SOC 001 Introduction to Sociology 4 Credits
Patterns of social interaction, group behavior and attitudes provide a focus on the relationship of the individual to society. Social structure and social change within the institutions of society provide a focus on the relationship of society to the individual. The influences of social class, gender and race are explored at each level of analyses. Theories, methods and research results provide micro and macro models for understanding society.
Attribute/Distribution: SS

SOC 100 Seminar in Sociology 1-4 Credits
Topics in sociology. Repeat Status: Course may be repeated.
Attribute/Distribution: SS

SOC 103 (AAS 103) Race and Ethnicity in the Contemporary U.S. 4 Credits
Examines race and ethnicity from a sociological perspective. Focus on the role of the major racial and ethnic communities in modern American society. Explores the roles of race and ethnicity in identity, social relations, and social inequality. Topics include racial and ethnic communities, minority/majority groups, assimilation, prejudice and discrimination, identity, and the social construction of the concept of "race."
Attribute/Distribution: SS

SOC 104 (POLS 104) Political Sociology 4 Credits
An introduction to political sociology through an examination of the major sociological questions concerning power, politics, and the state. Covers questions concerning state formation, nationalism, social movements, globalization, political culture and participation, and civil society.
Attribute/Distribution: SS

SOC 105 Social Origins Of Terrorism 4 Credits
Examines the social, religious, and political foundations of terrorism by studying the roots of terrorism historically and cross-nationally. We will look at the differing kinds of terrorism, including political terrorism in the Middle East, antilaboration terrorism in the United States, ecoterrorism, and religious and state terrorism throughout the world. Students will have a chance to better understand the beliefs of terrorists, conditions that produce and sustain terrorism, and the origins of political violence more generally.
Attribute/Distribution: SS

SOC 106 (AAS 106, LAS 106) Race and Ethnicity in the Americas 4 Credits
How is it possible that someone who is officially considered black in the United States can embody different racial identities throughout current Latin America? Even more, how is it possible that people considered white nowadays were not officially so in early twentieth-century US (although they were viewed as white in the Latin American context at the same time period)? This course offers a historical comparative analysis of the nature and dynamics of race between the United States and Latin America.
Attribute/Distribution: SS

SOC 110 (WGSS 110) Women's Work in Global Perspective 4 Credits
This course brings to the forefront the intersections of race, class, gender, and nation with women's employment around the world. We will examine women's paid and unpaid work in the U.S., Europe, Asia, Latin America, and Africa in an effort to understand the striking persistence of gender inequality over time and across the world. Topics of study include: work and family relations, women's domestic labor, factory work, and agribusiness. In addition, we will explore the ways in which women have organized for changes in work and in their communities in order to conceive of possibilities for the future of women's work.
Attribute/Distribution: SS

SOC 112 Development of Social Theory 4 Credits
This course introduces some of the most influential theoretical ideas in sociology. It focuses on understanding the differences among several classical theoretical traditions and their strengths and weaknesses in analyzing societies. It also helps students learn to apply social theory to contemporary sociological research and problems, learning the ways theory can be used to answer questions and problems societies face today.
Attribute/Distribution: SS

SOC 114 (ASIA 114) Social Issues in Contemporary China 4 Credits
Dramatic economic, cultural and social changes are underway in China today and have aroused much debate among social scientists, East and West. The following social issues are critical for understanding China's development trajectory: inequality and poverty; rapid demographic shifts; provision of health care services; provision of education services; and becoming an "information society." We will explore how these issues intersect with old hierarchies in China, urban-rural differences, and gender differences.
Attribute/Distribution: SS

SOC 115 A Nation of Immigrants: The American Experience 4 Credits
The course provides an introduction to contemporary immigration, conceptualizing it as a social and economic process, as well as a human experience that is simultaneously liberating and limiting. Through immigration we will analyze processes of assimilation and resistance, the construction of cultural boundaries, the development of modern nation-states, as well as the role race plays in current debates about immigrants. The course advances a critical perspective by questioning how immigration is framed in the West, particularly in the Unites States.
Attribute/Distribution: SS

SOC 116 (GS 116, JST 116) Jewish Community and Identity 4 Credits
A century ago, large Jewish communities existed throughout the world, including North Africa, Europe, the Middle East, and South America. Today, over 80% of all Jews live in North America or Israel. This course focuses on these historical changes in Jewish communities and the transformation of Jewish identities and social life in recent years, particularly in the U.S. and in Israel.
Attribute/Distribution: SS

SOC 125 Social Psychology of Small Groups 4 Credits
Theories and empirical research regarding interpersonal behavior in small groups. Classroom exercises and group simulations.
Attribute/Distribution: SS
SOC 127 (WGSS 127) Human Sexuality 4 Credits
Students in this course view human sexuality through a sociological lens. This includes theory, research methods, and topics such as LGBTQ identities, family formation, sex work, teenage sexuality, sadomasochism, and sexual technologies. We pay particular attention to ways in which sexual behavior is regulated, as well as social constructions of the “normal.” Course material focuses on the United States, although students are encouraged to bring cross-national perspectives into papers and class discussions.
Attribute/Distribution: SS

SOC 128 (WGSS 128) Race, Gender, and Work 4 Credits
Race, Gender and Work is a class designed to help students understand racial and gender inequalities as they relate specifically to work and employment. We explore the origins and histories of inequalities, the ways in which inequalities persist and/or change today, and what steps might be taken toward creating a more equal society.
Attribute/Distribution: SS

SOC 130 Sociology of Sports 4 Credits
This course provides an encompassing explanation of the process of globalization in the twentieth century through exploring the diffusion of sports, inquiring whether the sports has been connected to multiple forms of Empires, i.e. colonialism and imperialism. To do so, we will use sports to explore social and racial tensions, analyze mechanism of resistance, re-conceptualize the boundaries of social, economic and political spheres, examine the adoption of cultural practices, as well as understanding the construction of modern nation-states.
Attribute/Distribution: SS

SOC 135 (COMM 135, JOUR 135) Human Communication 4 Credits
Processes and functions of human communication in relationships and groups.
Attribute/Distribution: SS

SOC 138 The Sociology of Reality TV 4 Credits
How does The Bachelor shed light on courtship rituals, and what can Dance Moms teach us about the social meaning of childhood? Reality television shows may seem like frivolous fun, but they are also illuminating cultural artifacts that reflect contemporary American tastes, norms, and values. In this course—by reading sociological work, paired with episodes of reality shows—students learn to analyze these forms of entertainment through a social scientific lens.
Attribute/Distribution: SS

SOC 141 Breaking the Rules: Social Deviance 4 Credits
What institutions exert control over human behavior, and what are the incentives for adhering to social norms? Why do some people break those rules? What are the consequences of rule breaking? In this course, after examining theoretical scholarship on deviant behavior, students apply those theories to real-world examples— for example, criminal activities and policing, drug use, sexuality, body modification, mental illness, and atypical behavior at school and work. Are you ready? Let’s get weird.
Attribute/Distribution: SS

SOC 142 (WGSS 142) Bad Girls: Gender, Sexuality, Deviance 4 Credits
This course focuses on people who perform their gender and/or sexuality in ways that fall outside of the norm. Topics include, but are not limited to: commercial sex workers, dominatrixes, transpeople, stay-at-home dads, and drag queens. We will regularly discuss the readings in the context of current events and popular culture.
Attribute/Distribution: SS

SOC 144 (AAS 144) Global Hip Hop and Social Change 4 Credits
Hip Hop has become a global phenomenon. We will analyze how and why socially Conscious Hip Hop, as a tool for social change, has expanded to Latin America, Africa, and the Middle East.
Attribute/Distribution: SS

SOC 152 (HMS 152) Alcohol, Science, and Society 4 Credits
Alcohol use and abuse, its historical function in society, moral entrepreneurship, status struggles and conflict over alcohol. Current problems with attention to special population groups and strategies for prevention of alcohol abuse.
Attribute/Distribution: SS

SOC 155 (AAS 155, LAS 155) Afro-Latino Social Movements in Latin America & the Caribbean 4 Credits
This course focuses on Afro-Latinos who make up nearly 70% of the population of the Americas. Despite the large amount of people of African descent living in the Americas, Afro-Latinos are an understudied population who face significant amounts of racial discrimination in their countries. Who are Afro-Latinos? Where do they live? How are they challenging the racism that they face? These are questions we will tackle in this course.
Attribute/Distribution: SS

SOC 160 (HMS 160) Medicine and Society 4 Credits
Sociological perspectives on health, illness, and medical care. Focus on social epidemiology, social psychology of illness, socialization of health professionals, patient-professional relationships, medical care organization and policies.
Attribute/Distribution: SS

SOC 162 (HMS 162) AIDS and Society 4 Credits
Impact of the AIDS epidemic on individuals and on social institutions (medicine, religion, education, politics, etc.); social and health policy responses; international experience; effect of public attitudes and policy on people affected directly by AIDS.
Attribute/Distribution: SS

SOC 163 (AAS 163) Sociology of Hip Hop Culture 4 Credits
Hip Hop culture is a complex form of artistic practices reflecting and impacting the environments in which they were produced. Through readings, music and video, this class will uncover the origins of Hip Hop by examining the musical history of the Afro-diaspora in the 20th century. Further study will reveal how the young Bronx, NY underclass in the 1970s fused elements of past musical styles with their own personal and political expression that sparked a worldwide phenomenon and culture industry.
Attribute/Distribution: SS

SOC 165 Contemporary Social Problems 4 Credits
Studies of major problems facing contemporary society.
Attribute/Distribution: SS

SOC 166 (AAS 166) Wealth and Poverty in the United States 4 Credits
examines the sociology of wealth and poverty affluence and disadvantage, "rags and riches” in American Society. Focus is a critical analysis of the wealth gap, its causes, consequences, and social context. We will consider the roles of wealth and poverty in determining life chances and structuring opportunity, as well as their roles in the perpetuation of social inequality across generations. We will address contemporary debates surrounding public policy, tax laws, antipoverty programs and other reform efforts aimed at decreasing the gap between the "Haves" and the "Have-Nots.”
Attribute/Distribution: SS

SOC 171 (REL 171) Religion And Society 4 Credits
An introduction to the sociology of religion. Covers classical and contemporary approaches to defining and studying the role of religion in society. Emphasis on understanding religious beliefs and practices in the United States, the sources and contours of religious change, and the effects of religion on individuals and society. Specific topics include religious fundamentalism, religious conversion, religious practices and authority, secularization, religion in public life, religion in social change, religious terrorism, and the ways in which religion impacts our personal health, educational attainment, and family life.
Attribute/Distribution: SS

SOC 177 (AAS 177, LAS 177) Cuba: Race, Revolution and Culture 4 Credits
This course analyzes the role of race & “culture” in the Afro Cuban struggle for equality. By focusing on the arts: particularly music, film & literature, this course will analyze the development of race during Cuba’s colonial period; the Afro Cuban challenge to the “race blind” political and cultural movements of the Cuban Republic. We will then wrap up the semester by addressing the significance of contemporary cultural movements that challenge the social issues currently facing Afro Cubans.
Attribute/Distribution: SS
SOC 186 (ASIA 186) Understanding China through Films 4 Credits
In this class, we will use films, both documentary and feature films, to demonstrate how Chinese people experience and interpret social, political, economic and cultural changes. Through sociological interpretation of film, we will focus on the following topics: education provision, migration, environmental concerns, gender relations, poverty, and changing cultural norms and values. We will explore how these social issues have been intensified with economic reform, and how they intersect with major historical hierarchies in China.

SOC 300 Apprentice Teaching 1-4 Credits

SOC 302 The Sociology Of Cyberspace 4 Credits
An examination of social life on the Internet and the World Wide Web. Topics may include sociocultural and psychological aspects of communication in cyber-environments (e.g., email, chat rooms, news groups, MUDs, etc.), interpersonal relationships and group development, the nature of community, the politics of cyberspace (control and democracy), privacy and ethics, and economic dimensions. Examination of past and current case studies.
Attribute/Distribution: SS

SOC 310 (AAS 310, WGSS 310) Gender, Race and Sexuality: The Social Construction of Differences 4 Credits
Students will engage with current debates about the meaning and use of racial and sexual classification systems in society. We will examine the historical and sociological contexts in which specific theories of racial and sexual differences emerged in the U.S. We will also explore the ways in which changes in the images have implications on the role racial, gender, and sexual identity plays in our understanding of the relationship between difference and inequality.
Prerequisites: SOC 103 or SSP 103
Attribute/Distribution: SS

SOC 313 (AAS 313) Keep the Change: Social Movements in Society 4 Credits
Interested in how social change works? Or how to stop it? This seminar provides an introduction to the origins, dynamics, and consequences of historical and contemporary social movements, beginning with the American Civil Rights Movement. Students will discuss and develop their own ideas on these issues through examination of social movement theory and empirical case studies. They will also explore more general questions about the relationship between human agency, social structure, and historical change. More information is available at wordpress.lehigh.edu/zim2/soc313.
Attribute/Distribution: SS

SOC 314 (AAS 314, GS 314, HMS 314) Infections and Inequalities: HIV, TB and Malaria in the Global South 4 Credits
This course will explore the social, economic, and environmental causes of HIV, TB, and malaria in developing nations, with a particular focus on the characteristics and causes of these diseases in Sub-Saharan Africa. Students will engage theories and perspectives on development, globalization, and social inequality to explain trends in HIV, TB, and malaria and to understand why certain groups are more vulnerable to infection than others. Prerequisite: Junior/senior standing with declared major/minor in SOC, ANTH, SOAN, HMS, GS, or AAS.
Attribute/Distribution: SS

SOC 316 (HMS 316) Social Epidemiology 4 Credits
Social epidemiology is the study of the distribution and social determinants of health and disease in human populations. This course introduces the basic principles of epidemiological study design, analysis and interpretation, covering topics such as how a disease spreads across populations and how public health interventions can help control or reduce the spread of disease. This course also reviews epidemiology as a social science by reviewing the social causes and consequences of health.
Attribute/Distribution: SS

SOC 317 Seminar in Globalization and Social Issues 4 Credits
Advanced seminar that focuses on research and discussion of specialized topics in globalization and social issues. Subjects vary by semester. Junior or senior standing and departmental permission required.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

SOC 319 (GS 319) The Political Economy of Globalization 4 Credits
Course studies the relationship among economic, political and cultural forces in an era of globalization. Focus is on how global capitalism, the world market and local economies shape and are shaped by social, cultural and historical forces. Topics include political and cultural determinants of trade and investment; culture and the global economy; global capitalism, especially studied through the lens of culture; globalization and patterns of economic growth; cross-cultural study of consumerism; and poverty and inequality. Typically designated as Writing Intensive.
Attribute/Distribution: SS

SOC 322 (GS 322, HMS 322) Global Health Issues 4 Credits
Sociological dimensions of health, illness, and healing as they appear in different parts of the world. Focus on patterns of disease and mortality around the world; the relative importance of ‘traditional’ and ‘modern’ beliefs and practices with regard to disease and treatment in different societies; the organization of national health care systems in different countries; and the role of international organizations and social movements in promoting health.
Attribute/Distribution: SS

SOC 323 The Child In Family and Society 4 Credits
Influences such as marital discord, family violence, poverty and prejudice on the development of the child from birth through adolescence.
Attribute/Distribution: SS

SOC 325 (HIST 325, WGSS 325) History of Sexuality and the Family in the U.S. 3.4 Credits
Changing conceptions of sexuality and the role of women, men, and children in the family and society from the colonial to the post-World War II era. Emphasis on the significance of socioeconomic class and cultural background. Topics include family structure, birth control, legal constraints, marriage, divorce, and prostitution.
Attribute/Distribution: SS

SOC 326 Social Class in American History 3-4 Credits
Changing role of women, minority groups, and the family during the industrial era. Development of the modern class structure and the impact of the welfare state.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

SOC 327 (JOUR 327) Mass Communication and Society 4 Credits
A review of theories and research on the relationship of mass communication to social processes. Intensive analysis of selected media products (e.g., TV news, dramas, and sitcoms; films; print; music videos, etc.).
Prerequisites: ANTH 001 or SOC 001
Attribute/Distribution: SS

SOC 328 (GS 328) Global Food Systems 4 Credits
Where does our food come from? How does it get to our tables? Why are there famines in some parts of the world and obesity epidemics in other parts of the world? This course will investigate these questions by focusing on food systems – the chains of social action that link food producers to food consumers. We will also explore a range of alternatives to global food systems that emphasize food democracy, security, and sustainability.
Attribute/Distribution: SS

SOC 329 (GS 329) Global Migration 4 Credits
International migration is transforming societies at both the global and national levels, and in both origin and destination areas. Why do people move? What are the consequences of these movements? We will investigate the political and economic explanations for international migration and explore how each act of migration contributes to the transnationalization of social relations, alters existing livelihoods, transforms economic production and social support arrangements, and recreates racial, ethnic, and national identities.
Attribute/Distribution: SS
SOC 330 (LAS 330) Society, Democracy and Revolution in Latin America 4 Credits
Latin America is a region filled with protest and armed guerrilla movements. Since the fall of the Soviet Union in 1989, at least 5 nations in the region elected openly socialist or communist candidates, many of whom are still in power today. What is happening in Latin America? This course will focus on Latin American perspectives on democracy and social revolution. For many Latin American countries, the move to the ‘left,’ and the rejection of American capitalism is not that Latin American people embrace socialism, but rather it is a reflection of larger social dynamics at play... or is it?
Attribute/Distribution: SS

SOC 331 (GS 331, WGSS 331) Gendered Experience of Globalization 4 Credits
Women and men experience globalization differently and globalization affects women in different cultural and national contexts. Gender stratification has been intensified by the transnational flow of goods and people. Provides students with a survey of new development in feminist theories on globalization and on gender stratification and development, and links these theoretical frameworks to empirical research about gender issues that have become more prominent with globalization.
Attribute/Distribution: SS

SOC 333 Social Psychology of Politics 4 Credits
Political behavior viewed from a psychological and social psychological perspective. Department permission.
Prerequisites: (ANTH 001 or SOC 001 or PSYC 001)
Attribute/Distribution: SS

SOC 341 (HMS 341, WGSS 341) Gender and Health 4 Credits
Relationships of sex differences and gender norms to disease and longevity in the U.S. and around the world. Influence of medical systems on men’s and women’s lives and the impact of gender-based consumer health movements on health and medical care. Focus on specific topics, e.g. medicalization and commercialization of women’s bodies, the politics of reproductive choices, masculinity and health, and gender and mental health.
Attribute/Distribution: SS

SOC 343 (HMS 343) Race, Ethnicity, and Health 4 Credits
People who belong to racial and ethnic minority groups are exposed to more health risks, have disproportionately high levels of sickness and excess deaths, and have limited access to good quality healthcare. This course provides students with theoretical and empirical insights into the intersection of race, ethnicity, and health in the U.S. Historical and contemporary patterns in U.S. demography, race relations, residential segregation, environmental justice, and social stratification will be explored in the context of health and health care.
Attribute/Distribution: SS

SOC 345 (AAS 345) Colonialism and the Black Radical Tradition 4 Credits
Karl Marx was not the only figure who developed an influential theory of social revolution. A cadre of theorists from the Global South have extensively theorized about the issues facing their particular nations, and they have developed social theories that have challenged social and global inequality. This theory-based course will focus on the anti-colonial and post-colonial thought of radical black intellectuals from the Black America, the Caribbean, and West Africa.
Attribute/Distribution: SS

SOC 351 (WGSS 351) Gender and Social Change 4 Credits
Changes in gender roles from social psychological and structural perspectives. Comparative analyses of men and women (including people of color) in the social structure; their attitudes and orientations toward work, family, education, and politics.
Attribute/Distribution: SS

SOC 355 Sociology Of Education 4 Credits
Examines the social organization of education as a social institution and the role of schools in society. Focus is primarily on educational processes in the United States. Topics include: IQ, curriculum, tracking, educational inequality, primary/secondary/higher education, private vs. public, informal education and social capital, effects on and of race/class/gender, schools as agents of socialization, educational policy and school reform.
Prerequisites: ANTH 011 or ANTH 012 or SOC 001
Attribute/Distribution: SS

SOC 364 (WGSS 364) Sociology of the Family 4 Credits
Sociological analysis of families in the United States, including investigations of historical and contemporary patterns. Issues addressed include parenting, combining work and family, divorce and remarriage, family policies.

SOC 365 (WGSS 365) Inequalities at Work 4 Credits
Primary focus is on race, gender, and class as axes of disadvantage and privilege in work and employment. We will explore both theories and empirical studies of inequality as well as their social, political, and practical ramifications for the workplace. The course will be conducted seminar-style and the ‘class’ will rely heavily on student participation.
Attribute/Distribution: SS

SOC 366 Sociology of Aging 4 Credits
Residential patterns, social policies and services for the aged. Alternative political strategies, health programs, living arrangements and workplace choices considered. The changing roles of the elderly in American and other societies, and the special problems they face. Impact of changing age structure.
Attribute/Distribution: SS

SOC 370 (ES 370, GS 370) Globalization and the Environment 4 Credits
This course investigates globalization and the environment including how globalization has influenced society-nature relationships, as well as how environmental conditions influence the globalization processes. A key focus will be on the rapidly evolving global economic and political systems that characterize global development dynamics therefore resource use. Particular attention is paid to the role of multi-national corporations, international trade, and finance patterns and agreements. Questions related to consumption, population, global climate change, toxic wastes, and food production/distribution represent key themes.
Attribute/Distribution: SS

SOC 371 Special Topics 1-4 Credits
Advanced work through supervised readings. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

SOC 373 (HMS 373) Seminar In Sociology: Purposeful Curiosity 4 Credits
To be curious is to be engaged. This course will explore collaborative and purposeful curiosity and the inquiry-based model of learning as it relates to sociological phenomena and social good, specifically around health and humanity. Through research approaches such as humanistic inquiry and community-engaged research, learners will explore techniques that value the expertise of diverse stakeholders, identify collaborators, design and conduct imaginative research, and understand the importance of curiosity in fueling creative work and intellectual problem solving.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

SOC 374 Social Stratification: Race, Class, Gender 3 Credits
This course is an introduction to social stratification. Examines social inequality as an organizing principle in complex societies. Explores the intersection of the "great divides" of race, class, and gender. Through readings from classical sociological theory to cutting-edge literature we embark on a critical analysis of the causes and consequences of social stratification and social mobility in the United States and in a global context.
Prerequisites: ANTH 001 or SOC 001
Attribute/Distribution: SS
SOC 375 (REL 375) The Christian Right In America 4 Credits
What do we know about the Christian Right? Who are they? What do they believe? Where do they come from? Seminar explores answers to such questions through a focus on the history of the Christian Right as well as its ideologies and beliefs, the people who are a part of it, and its evolving relationship to the American political system.
Attribute/Distribution: SS

SOC 379 Race And Class In America 4 Credits
This course focuses on the ways in which race and class intersect in the social, economic, and political structures of American society. Through sociological literature, fiction, nonfiction, film, and other media we will explore the place of race and class in American society. We will examine how race and class operate on a personal, "micro" level, while at the same time operating on a large scale, "macro" level.
Attribute/Distribution: SS

SOC 389 Honors Project 1-6 Credits
Repeat Status: Course may be repeated.

SOC 391 Evaluation Research 3 Credits
Application of social research methods of evaluation of the effectiveness of social programs. Measurement, research design, criteria of effectiveness and decision making. Consent of department chair.
Prerequisites: SR 111
Attribute/Distribution: SS

SOC 393 Supervised Research 1-4 Credits
Conducting sociological or social psychological research under the supervision of a faculty member. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

SOC 395 Internship 1-4 Credits
Supervised experience involving nonpaid work in a setting relevant to sociology/social psychology. for credit. Open only to department majors.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

SOC 399 Senior Thesis 2-4 Credits
Research during senior year culminating in senior thesis. Required for sociology/social psychology majors seeking departmental honors. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: SS

SOC 401 Classical Social Theory 3 Credits
Explores influential sociological theory, the differences among classical theoretical traditions, the main strengths and weaknesses of such traditions. Emphasis is placed on understanding the uses of theory in research, and the implications of theoretical models when applied to contemporary research and problems.

SOC 402 Sociology of Cyberspace 3 Credits
The course focus is on case-based discussion in the social psychology and sociology of the Internet and the World Wide Web. Questions of what it means to be an individual online, how relationships develop, the nature of groups, democracy and power, and education are considered.

SOC 404 (ES 404) Socio-cultural Foundations of Environmental Policy 3 Credits
This course is based on the premise that social and ecological sustainability require new policy approaches. Drawing on social, organizational, and behavioral theory, students will learn techniques for analyzing and critiquing existing environmental policies and designing more effective policies. Case studies highlight how cultural values, social norms, public opinion and politics shape policies and their outcomes. We examine the entire policy process from how environmental problems are defined, to how organizations implement policies and how policies are evaluated.

SOC 409 Proseminar in Sociology 3 Credits
The "pro" in proseminar is short for "professional." This course is designed to help you make the most out of your graduate education so that you can become a professional sociologist. In sociological terms, it is an exercise in anticipatory socialization. There are practical as well as philosophical aspects to the course, and active participation is key to your success. Important skills may include: researching and reading academic literature, develop a new research agenda, studying for the comprehensive exam, etc.

SOC 410 Statistics for Sociological Inquiry 3 Credits
Principles of statistical inference including hypothesis testing and analysis of variance. Covers univariate and multivariate techniques, including probability, correlation, test statistics, and regression. Emphasis is on the choice of proper approaches to answer research questions and the interpretation of analysis results.

SOC 411 Advanced Research Methods, Part I: Quantitative 3 Credits
Study of quantitative methods of data collection and analysis, measurement and research design issues at an advanced level.
Prerequisites: SOAN 111

SOC 412 Adv Research Methods, Part II, Qualitative 3 Credits
Study of qualitative methods of data collection and analysis, measurement and research design issues at an advanced level.

SOC 413 Research Practicum 3-6 Credits
Supervised research, either with a faculty member or in a community agency, designed to apply research skills to a particular problem as defined by the faculty member or agency in collaboration with the student and supervising instructor. Final paper should demonstrate theoretical understanding, proper application of methodology and data analysis, and results of the project.

SOC 415 Case Studies Of Social Control 3 Credits
Social control leads to social order and also generates social deviance. The processes involved in this dual production are found in the formal institutions of society and in the informal patterns of interaction within groups. Macro and micro level approaches are explored, especially in the drug and alcohol area.

SOC 416 Social Epidemiology 3 Credits
Social epidemiology is the study of the distribution and social determinants of health and disease in human populations. This course introduces the basic principles of epidemiological study design, analysis and interpretation, covering topics such as how a disease spreads across populations and how public health interventions can help control or reduce the spread of disease. This course also reviews epidemiology as a social science by reviewing the social causes and consequences of health.

SOC 418 (WGSS 418) Gendered Experience of Globalization 3 Credits
Women and men experience globalization differently and globalization affects women in different cultural and national contexts. Gender stratification has been intensified by the transnational flow of goods and people, provides students with a survey of new development in feminist theories on globalization and on gender stratification and development, and links these theoretical frameworks to empirical research about gender issues that have become more prominent with globalization.

SOC 419 Global Food Systems 3 Credits
Where does our food come from? How does it get to our tables? Why are there famines in some parts of the world and obesity epidemics in other parts of the world? This course will investigate these questions by focusing on food systems – the chains of social action that link food producers to food consumers. We will also explore a range of alternatives to global food systems that emphasize food democracy, security, and sustainability.
Attribute/Distribution: SS
SOC 420 Global Migration 3 Credits
International migration is transforming societies at both the global and national levels, and in both origin and destination areas. Why do people move? What are the consequences of these movements? We will investigate the political and economic explanations for international migration and explore how each act of migration contributes to the transnationalization of social relations, alters existing livelihoods, transforms economic production and social support arrangements, and recreates racial, ethnic, and national identities.

SOC 421 (ES 421) Information Ecology 3 Credits
Information theory, critical social theory, and ecological principles are combined to model how information organizes human ecosystems. These concepts are applied to environmental policy analysis using case studies.

SOC 438 Sociology of the Body 3 Credits
This course examines the body not as a biological entity but as a product of complex social forces. We will study how our bodies are connected to social structures, such as class, gender and race. In doing so, students will realize how our bodies are simultaneously expressions of the self as well as powerful social factors. To explore these topics we will analyze the work of thinkers such as Marx, Elias, Goffman, Foucault, Bourdieu, and Butler.

SOC 441 (WGSS 441) Gender and Health 3 Credits
Relationships of sex differences and gender norms to disease and longevity in the US and around the world. Influence of medical systems on men's and women's lives and the impact of gender-based consumer health movements on health and medical care. Focus on specific topics, e.g. medicalization and commercialization of women's bodies, the politics of reproductive choices, masculinity and health, and gender and mental health.

SOC 442 (WGSS 442) Bad Girls: Gender, Sexuality, Deviance 3 Credits
This course focuses on people who perform their gender and/or sexuality in ways that fall outside of the norm. Topics include, but are not limited to: commercial sex workers, dominatrixes, transpeople, stay-at-home dads, and drag queens. We will regularly discuss the readings in the context of current events and popular culture.

SOC 443 Race, Ethnicity, and Health 3 Credits
People who belong to racial and ethnic minority groups are exposed to more health risks, have disproportionately high levels of sickness and excess deaths, and have limited access to good quality healthcare. This course provides students with theoretical and empirical insights into the intersection of race, ethnicity, and health in the U.S. Historical and contemporary patterns in U.S. demography, race relations, residential segregation, environmental justice, and social stratification will be explored in the context of health and health care.

SOC 454 Urban Education: Inequality and Public Policy 1-4 Credits
Social inequality is found throughout American Society but problems of inequality related to education have perhaps received more attention than those of any other contemporary social institution. Researchers, scholars, journalists, social critics, and observers have studied, written, and talked about educational inequality to an enormous extent. Social service organizations, activists, policymakers, legal professionals, and government officials have focused massive reform efforts and political agendas to tackle inequality in education. Many sociologists have long viewed education not just as an arena of inequality but as the solution to the widespread inequalities they see reflected in society. Urban education has been an especially complex and controversial subject of scrutiny in recent scholarly and popular debates. This course will focus with a sociological perspective on urban education, inequality, and public policy in the contemporary United States. The first portion of the course examines research and literature relevant to the contemporary social problems of urban education and inequality. The second portion of the course will explore the role of public policy in perpetuating educational inequality, and as a potentially promising solution to it.

SOC 455 Sociology of Education 3 Credits
Examines the social organization of education as a social institution and the role of schools in society. Focus is primarily on educational processes in the United States. Topics include: IQ, curriculum, tracking, educational inequality, primary/secondary/higher education, private vs. public, informal education and social capital, effects on and of race/class/gender, schools as agents of socialization, educational policy and school reform.

SOC 461 Seminar In Sociology 1-4 Credits
Topics vary.

SOC 465 (WGSS 465) Inequalities at Work 3 Credits
Primary focus is on race, gender, and class as axes of disadvantage and privilege in work and employment. We will explore both theories and empirical studies of inequality as well as their social, political, and practical ramifications for the workplace.

Attribute/Distribution: SS

SOC 471 Special Topics 1-3 Credits
Intensive study in an area of sociology that is appropriate to the interests and needs of staff and students.

SOC 472 Special Topics 1-3 Credits
Continuation of SSP 471.

SOC 473 Social Basis Of Human Behavior 3 Credits
Development of human behavior from a social psychological perspective. Emphasis placed on the impact of society upon school-age children and adolescents.

SOC 476 Issues In Health Policy Analysis 3 Credits
Sociological analyses of health care and health care policy issues of current concern in American and other societies. Application of analytic frameworks to several majors issues such as organization and financing of services, effects of aging populations on needs, impact of new diseases and of new technologies. Students will analyze selected health care problems faced by local communities.

SOC 490 Master’s Thesis 1-6 Credits
Theatre

To study theatre is to examine its many internal disciplines. Acting and directing combine with design, technical theatre, dramatic literature and theatre history to form the body of our art. Students may pursue general theatre studies or focus on particular areas such as performance, design or history and literature. They may major in theatre, minor in theatre or participate strictly in our production program. Students may even complete a minor in theatre from outside the College of Arts and Sciences.

The bachelor of arts degree in theatre is granted after at least 48 credit hours of study. Because we believe that undergraduate theatre education should be broad based with an emphasis on diversity of experience, students are encouraged to take a variety of courses outside the major. Many students complete double majors. Those with the talents and aspirations for a career in theatre have gone to graduate schools offering intense, pre-professional training. Other majors who have not pursued a theatrical career have gone from our program directly into careers in business, social services, sales. Theatre study is an excellent preparation for vocations in which self presentation is important, such as law. The problem solving, analytical and interpersonal skills gained from this discipline are applicable across a wide range of careers. An understanding and appreciation of the complex art of the theatre will enrich a lifetime.

The department's active production program is curricular and promotes collaborative projects involving students, faculty, staff and guest artists. Our large performance facility is the Diamond Theater, a 300-seat thrust theatre housed in the Zoellner Arts Center. The core of our work in this space is dedicated to productions featuring primarily student actors directed by faculty or guest artists. When possible, a highly qualified student may direct or design in this space. In addition to our own productions, we regularly invite outside professional performers and ensembles to work with us and perform. We also operate a lab theatre (Fowler Black Box Theater) for student and faculty experimentation. The availability of valuable hands-on experience and the very close working relationships developed between students and faculty uniquely
characterize the department of theatre. Performance and administrative internships are available to qualified students with guidance from a faculty mentor.

Students interested in designing a major or minor in theatre should consult with the department chairperson. Experienced theatre students with questions regarding accurate placement in any theatre course should, likewise, consult with the chairperson.

Lehigh University is an accredited institution of the National Association of Schools of Theatre.

**Professors.** Erica Hoelscher, MFA (Northwestern University); Kashi K. Johnson, MFA (University of Pittsburgh); Pam Pepper, MFA (Ohio University); Augustine Ripa, Jr., MFA (Northwestern University)

**Associate Professor.** Melpomene Katakalos, MFA (University of California, San Diego)

**Assistant Professor.** Will Lowry, MFA (University of North Carolina Greensboro)

### THEATRE MAJOR

Through the selection of appropriate courses, students may concentrate their major in one of these areas:
- Acting/Directing
- Design/Technical Theatre
- Theatre History/Dramatic Literature
- General Theatre Studies

The major in theatre consists of 48 hours distributed as follows:

<table>
<thead>
<tr>
<th>Coursework required of all majors, 24 hrs:</th>
</tr>
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<tbody>
<tr>
<td><strong>THTR 060</strong></td>
</tr>
<tr>
<td><strong>THTR 087</strong></td>
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<tr>
<td><strong>THTR 127</strong></td>
</tr>
<tr>
<td><strong>THTR 128</strong></td>
</tr>
<tr>
<td>Thtr Acting (any appropriate level)</td>
</tr>
</tbody>
</table>

**AND**

Two courses from the following:
- **THTR 020** Stagecraft I | 2 |
- **THTR 025** Costume Construction I | 2 |
- **THTR 027** Lighting Technology and Production I | 2 |

#### Production Requirement, 8 hrs

Four courses from the following:
- **THTR 021** Stagecraft II |
- **THTR 022** Stage Properties and Decoration |
- **THTR 023** Basic Scene Painting |
- **THTR 026** Costume Construction II |
- **THTR 028** Lighting Technology and Production II |
- **THTR 030** Sound Technology and Production I |
- **THTR 031** Sound Technology and Production II |
- **THTR 035** Performance |
- **THTR 045** Stage Management |
- **THTR 067** Stage Crew |
- **THTR 068** Costume Crew |
- **THTR 069** Lighting Crew |
- **THTR 175** Special Projects |

Advanced courses may be substituted.

**Electives, 16 hrs.**

Four courses carefully selected with an advisor, emphasizing depth or breadth of study.

**Recommended electives from other departments**

The departments of art and architecture, English, modern languages and literature, music and others all offer courses of value to a theatre major or minor. Consult with your advisor about enriching your academic career outside the theatre department.

### THEATRE MINOR

Theatre Minor

The minor in theatre consists of 24 hours of course work selected in consultation with a departmental advisor. Typically, this includes five 4-credit courses and two 2-credit theatre production courses. The minor in theatre must include some academic diversity beyond a single curricular area.

**DEPARTMENTAL HONORS**

The exceptional student may elect to pursue departmental honors in the senior year. This student must have a GPA of 3.3 in all theatre courses presented for the major. No later than the fall of the senior year the student, with faculty supervision, elects a special project in a particular area of theatre. This may take the form of preparing to direct a play, researching a role to be performed, preparing a design presentation or researching in an area of theatre scholarship in preparation for the writing of a substantial report. In the next semester, usually the spring of the senior year, the report or project would be executed. The student would enroll in two, four-credit independent study courses, one each senior semester.

**THE ACTING SEQUENCE**

Students with little or no prior acting experience should elect THTR 011, Introduction to Acting, as their first course. Students with some prior acting experience should consult with the department chairperson for accurate placement and waiver of the THTR 011 prerequisite.

**Courses**

- **THTR 001 Introduction To Theatre 4 Credits**
  Foundations of theatre: historical, literary and practical.
  Attribute/Distribution: HU

- **THTR 011 Introduction To Acting 4 Credits**
  Preparation for scene study and characterization.
  Attribute/Distribution: HU

- **THTR 020 Stagecraft I 2 Credits**
  Introduction to the art of scenic construction and technical theatre. Scenic construction materials, techniques, tools, rigging and safety.
  Practical experience in executing scenery for the stage.
  Attribute/Distribution: HU

- **THTR 021 Stagecraft II 2 Credits**
  A continuation of THTR 00 - Stagecraft I. Specialty tools, materials, methods and problem-solving. Practical experience in executing scenery for the stage.
  Prerequisites: THTR 020
  Attribute/Distribution: HU

- **THTR 022 Stage Properties and Decoration 2 Credits**
  Creating props and decor for the stage. Production assignment as assistant property master.
  Attribute/Distribution: HU

- **THTR 023 Basic Scene Painting 2 Credits**
  Painting for the stage. Production assignments painting with scenic artist.
  Attribute/Distribution: HU

- **THTR 025 Costume Construction I 2 Credits**
  Introduction to the art of costume construction. Costume construction materials, techniques, tools and safety. Practical experience in executing costumes for the stage.
  Attribute/Distribution: HU

- **THTR 026 Costume Construction II 2 Credits**
  Continuation of THTR 25 - Costume Construction I, including pattern drafting, fitting, crafts and accessories. Materials, methods and problem solving. Practical experience in executing costumes for the stage.
  Prerequisites: THTR 025
  Attribute/Distribution: HU

- **THTR 027 Lighting Technology and Production I 2 Credits**
  Introduction to the art of lighting technology and production. Lighting techniques, tools and safety. Practical experience in executing lighting for the stage.
  Attribute/Distribution: HU

**THEATRE ACTIVITIES**

Lehigh University has a wide variety of theatre activities in which interested students may participate. These include: the main annual student productions of the Theatre Department; various productions by the many student theatre groups on campus; or in some cases, the professional productions of the University Theatre, which is run by outstanding students and faculty. Theatre majors and non-majors are encouraged to participate in these activities. For further information, consult the Theatre Department. Lehigh University is a member of the Mid-Atlantic Association of Theatre Schools (MAATS).

- **Lehigh University Theatre:**
  - **THTR 010** Acting/Directing
  - **THTR 015** Design/Technical Theatre
  - **THTR 020** Theatre History/Dramatic Literature
  - **THTR 022** General Theatre Studies
  - **THTR 023** Thtr Acting (any appropriate level)

**Productions**

- **THTR 025** Stage Properties and Decoration 2 Credits
- **THTR 027** Lighting Technology and Production I 2 Credits
- **THTR 035** Performance 4 Credits
- **THTR 040** Stage Management 4 Credits
- **THTR 045** Technical Theatre 4 Credits
- **THTR 050** Technical Theatre 4 Credits
- **THTR 060** Stage Properties and Decoration 2 Credits
- **THTR 065** Basic Scene Painting 2 Credits
- **THTR 070** Costume Construction I 2 Credits
- **THTR 075** Costume Construction II 2 Credits
- **THTR 080** Lighting Technology and Production I 2 Credits
THTR 028 Lighting Technology and Production II 2 Credits
Specially equipment, methods and problem solving. Practical experience in programming the lighting console for production. Assignment as light board operator on a production.
Attribute/Distribution: HU

THTR 030 Sound Technology and Production I 2 Credits
Introduction to the theory, equipment and practice of sound reinforcement for the theatre, including microphone theory, speaker use and placement, digital audio networks, and live mixing.
Attribute/Distribution: HU

THTR 031 Sound Technology and Production II 2 Credits
Advanced Sound Reinforcement techniques including multiple source mixing, specialty equipment and audio system design and installation.
Prerequisites: THTR 030
Attribute/Distribution: HU

THTR 035 Performance 2 Credits
Performing in a department-approved production.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

THTR 045 Stage Management 2 Credits
Not approved for credit toward the major unless instructor permission is obtained. Organization, scheduling, coordination of various production specialties. Production assignment as assistant stage manager.
Attribute/Distribution: HU

THTR 053 (ASIA 053) Bollywood Dance 2 Credits
Bollywood is a term compounded from “Bombay” (now Mumbai) and “Hollywood.” Bollywood dance is the movement form used in Indian films - a unique and energetic style inspired by Indian folk dance and Indian classical dance, Middle Eastern, and modern dance. Explore how each of these unique styles combine to create modern Bollywood dance. Learn the fundamental movements, gestures, and expressions that create the Bollywood dance aesthetic, and how they are applied in choreographed sequences.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

THTR 054 (CLSS 054, ENGL 054) Greek Tragedy 4 Credits
Aspects of Greek theater and plays of Aeschylus, Sophocles, and Euripides in their social and intellectual contexts.
Attribute/Distribution: HU

THTR 055 (ASIA 055) Indian Classical Dance 2 Credits
Introduction to the history and practice of Bharatanatyam, a classical dance style of India. Understanding basic footwork, hand gestures, and body movements, and how they are combined to convey emotion, meaning, and imagery. Traditional repertoire, music, terminology, and the spectator's experience of the dance.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

THTR 056 Jazz Dance 2 Credits
Jazz dance styles and combinations. Fee required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

THTR 057 Modern Dance 2 Credits
Modern dance styles and combinations. Fee required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

THTR 059 (AAS 059) West African Dance 2 Credits
Explore the dance movement and rhythms of West Africa, including African-based dance technique, characteristics, and the fundamental connection between the drums and the dance.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

THTR 060 (ENGL 060) Dramatic Action 4 Credits
How plays are put together; how they work and what they accomplish. Examination of how plot, character, aural and visual elements of production combine to form a unified work across genres, styles and periods. Recommended as a foundation for further studies in design, literature, or performance.
Attribute/Distribution: HU

THTR 062 (AAS 062) Black Theatre 4 Credits
Attribute/Distribution: HU

THTR 065 (ENGL 065) Introduction to Playwriting 4 Credits
An introduction to writing for the stage, with an emphasis on creating characters, exploring story and structure, experimenting with theatrical language, and working within the context of theatrical history and the wider world. This course combines in-class exercises with seminar-style discussion of the student's work.
Attribute/Distribution: HU

THTR 066 (AAS 066) Hip Hop Dance 2 Credits
Techniques, vocabulary, and history behind the various elements of the Hip Hop Movement. Focus upon the cultural influence of Hip Hop dance styles, and the overall social influence of the Hip Hop Movement.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

THTR 067 Backstage Crew 2 Credits
Production run crew assignment.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

THTR 068 Costume Crew 0.2 Credits
Production run crew assignment in wardrobe, hair and makeup.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

THTR 072 (DES 072) Digital Textile Design 4 Credits
Digital textile printing has brought about revolutionary changes in textile design. Digital Textile Design utilizes digital photography, scanning, drawing and image editing software to create botanical and geometric patterns for textiles.
Attribute/Distribution: HU

THTR 076 (AAS 076) Hip Hop Dance II 2 Credits
Students familiar with the music genres and basic dance tropes of the Hip Hop movement will explore, develop, and apply them in combinations that weave the various elements of Hip Hop culture into a high energy dance. Focus on Hip Hop dance as it influences the contemporary world view and global aesthetics.
Repeat Status: Course may be repeated.
Prerequisites: THTR 066 or AAS 066
Attribute/Distribution: HU

THTR 077 Ballet 2 Credits
Classical ballet for beginners and those who have had some training. Fee required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

THTR 087 (DES 087) Performance Design 4 Credits
Introduction to the process of creating integrated designs in theatre production. The study and practice of the principles of visual representation, historical and conceptual research and the study of theatrical styles.
Attribute/Distribution: HU

THTR 088 (DES 088) Digital Rendering 4 Credits
Explore the use of modern technology to develop and communicate design ideas with speed, clarity, and visual punch. Strategies geared toward increasing the young designer’s confidence in presenting artistic concepts. Learn the basics of Photoshop and SketchUp and then apply those skills in creative execution of scenic, costume, and lighting renderings.
Attribute/Distribution: HU

THTR 089 (DES 089) Introduction to Fashion Design 4 Credits
An introduction to conceptual garment design. Research, devise, and develop collections of apparel and accessories. Basic elements of design, fashion theory, design processes, and rendering techniques.
Attribute/Distribution: HU
THTR 111 (DES 111) Sound Design 2 Credits
Introduction to the study of the techniques and equipment used for theatrical sound design. Elements include audio theory, script analysis, field recording and editing audio in digital audio workstations.
Attribute/Distribution: HU

THTR 126 (ARCH 126, ART 126) History of Interior Design and Decor 4 Credits
Survey of architectural interiors and décor examining public and domestic spaces and their contents in terms of period and style. Exploration of major art and design movements through the lens of interior spaces and objects within the context of culture and society. Attribute/Distribution: HU

THTR 127 (ENGL 127) History of Theatre I 4 Credits
A multi-cultural survey of dramatic literature and theatrical practice from its ritual origins to the 18th century.
Attribute/Distribution: HU

THTR 128 (ENGL 128) History of Theatre II 4 Credits
A multi-cultural survey of dramatic literature theatre and theatrical practice from the 18th century to the present day.
Attribute/Distribution: HU

THTR 129 (DES 129, WQSS 129) History of Fashion and Style 4 Credits
Dress and culture in the Western Hemisphere from pre-history to today. The evolution of silhouette, garment forms and technology. The relationship of fashion to politics, art and behavior. Cultural and environmental influences on human adornment.
Attribute/Distribution: HU

THTR 130 Drafting For The Theatre 4 Credits
Theatre drafting techniques and conventions. Material, methods and theory in stage graphics. Model building techniques and practice. An introduction to computer drafting.
Attribute/Distribution: HU

THTR 132 (AAS 132) Hip Hop Theatre 4 Credits
Introduction to the creation and performance of Hip Hop theatre. Exploration of the history and culture of Hip Hop through original written material, live performance, music, film, video and web based content. Public performances. Must audition. Consent of instructor required.
Attribute/Distribution: HU

THTR 135 Playwriting II 4 Credits
For students interested in continuing and deepening their writing for the stage. Instructor approval required.
Attribute/Distribution: HU

THTR 140 (AAS 140) African American Theatre 4 Credits
Studies in African American theatre: literary, and practical and historical. Repeat Status: Course may be repeated.
Attribute/Distribution: HU

THTR 144 Directing 4 Credits
Introduction to the theatrical director’s art. Research, rehearsal techniques, scene work. Acting experience as determined by the department or consent of chair.
Repeat Status: Course may be repeated.
Prerequisites: (THTR 060)
Attribute/Distribution: HU

THTR 145 Advanced Stage Management 1-4 Credits
Advanced application, practice, and leadership development of stage management role and skills: production assignment as stage manager.

THTR 147 Acting Modern Realism 4 Credits
Characterization and scene study in modern realistic drama e.g. Ibsen, Chekov, O’Neill, Hellman, Miller and Williams.
Prerequisites: THTR 011
Attribute/Distribution: HU

THTR 148 Acting Contemporary Drama 4 Credits
Characterization and scene study in modern contemporary drama.
Prerequisites: THTR 011
Attribute/Distribution: HU

THTR 152 Stage Make-up 4 Credits
Theatrical make-up techniques for the actor and designer.
Attribute/Distribution: HU

THTR 154 (DES 154) Scene Painting 4 Credits
Study and practice of basic and advanced methods of painting for the theatre. Includes basic elements and principles of design, color theory, the influence of light, atmosphere and aesthetics for the theatre.
Attribute/Distribution: HU

THTR 155 (DES 155) Model Building and Rendering 4 Credits
The art and practice of model building and rendering for the stage. Special techniques including scale furniture, soldering, acrylic painting and hand drafting.

THTR 175 Special Projects 1-4 Credits
Theatrical topics of current or special interest. Repeat Status: Course may be repeated.
Attribute/Distribution: HU

THTR 177 (JST 177, REL 177) Jews and the Broadway Musical 4 Credits
The history of American musical theater is deeply interwoven with the history of American Jews. This course examines how Jews have taken part in musical theater on multiple levels—as composers, lyricists, producers, and performers, among other roles. It also examines how Jews are depicted in Broadway musicals, with particular attention to gender and ethnicity.
Attribute/Distribution: HU

THTR 181 Theater Management 3 Credits
Concepts, techniques and practices related to managing the theatrical enterprise.
Attribute/Distribution: HU

THTR 185 Production Seminar 1-4 Credits
Practicum in various approaches to theatre production, e.g. performance ensemble. Must audition, or consent of the chairperson required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

THTR 186 (DES 186) Lighting Design 4 Credits
An introduction to the art and practice of lighting design for the theatre. Script analysis, research, and the interplay of lighting technology and design. Students will develop a sense of the dramatic while creating a portfolio of lighting designs.
Attribute/Distribution: HU

THTR 188 (DES 188) Scenic Design 4 Credits
An introduction to the art and practice of scenic design for the theatre. Script analysis, research, drafting and modeling techniques. Students will develop a sense of the dramatic while creating a portfolio of scenic designs.
Attribute/Distribution: HU

THTR 189 (DES 189) Costume Design 4 Credits
An introduction to the art and practice of costume design for the theatre. Script analysis, research, and rendering techniques. Students will develop a sense of the dramatic while creating a portfolio of costume designs.
Attribute/Distribution: HU

THTR 236 Acting Presentational Styles 4 Credits
Elements of characterization and scene study in presentational dramatic literature from classical through post-modern periods. Must have completed 100-level acting course.
Prerequisites: THTR 147 or THTR 148
Attribute/Distribution: HU

THTR 244 Acting Shakespeare 4 Credits
Monologue scene study and ensemble work from Shakespeare’s dramatic and poetic canon.
Prerequisites: THTR 147 or THTR 148
Attribute/Distribution: HU

THTR 245 Advanced Directing 4 Credits
Continuation of Theatre 144. The director’s voice. Supervised practical experience.
Prerequisites: (THTR 144)
Attribute/Distribution: HU
THTR 253 Scene Painting II 4 Credits
Applied advanced scene painting methods for the theatre. Shop management for the scenic artist. Collaboration with designers and stage technology.
Prerequisites: THTR 154
Attribute/Distribution: HU

THTR 260 Design and Technical Practicum 1-4 Credits
Scenic, costume, lighting or sound design or technical production projects for the theatre. Realized design or technical theatre production assignment and portfolio-building. Collaboration, process and presentation. Consent of department required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

THTR 275 Internship 1-4 Credits
Professionally supervised work in theatres and theatrical organizations in the areas of performance, design, technical theatre, theatre administration and management. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

THTR 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

THTR 315 Senior Study 0 Credits
Seminar for senior theatre majors. Enhancement of current theatre studies while preparing for further theatre studies or activity.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

THTR 328 Shakespeare 3,4 Credits
An introduction to Shakespearean drama including comedies, histories, tragedies, and romances. Emphasis on textual study, cultural contexts, and performance strategies.
Attribute/Distribution: HU

THTR 351 Advanced Special Projects 1-8 Credits
Independent study in theatre. Consent of department chair required.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

THTR 387 Scenography II 4 Credits
Advanced projects in theatrical design. Portfolio readiness and resume preparation.
Prerequisites: THTR 087 or DES 087
Can be taken Concurrently: THTR 087, DES 087
Attribute/Distribution: HU

THTR 389 Honors Project 1-8 Credits
Repeat Status: Course may be repeated.

Women, Gender, and Sexuality Studies

Program Director: Monica Najar, PhD (University of Wisconsin, Madison)
Email: najar@lehigh.edu (najar@lehigh.edu) | Phone: 610-758-4424
Website: http://wgs.cas2.lehigh.edu

Supported by the Office of Interdisciplinary Programs, 610-758-3996; incasip@lehigh.edu
Williams Hall, 31 Williams Drive

Women, Gender, and Sexuality Studies (WGSS) at Lehigh University is an interdisciplinary field of academic inquiry that critically examines gender and sexuality from an intersectional model that takes into account the manner in which class, race, and power co-constitutively shape and impact gendered and sexed identity construction. In the best tradition of a liberal arts education, Women, Gender, and Sexuality Studies encourages thinking that is critical and constructive, multifaceted and intersectional in order to redesign knowledge, and gain a better understanding of how identities shape and are shaped by the social world in which we live. Offering an undergraduate major and minor, a Graduate Certificate, and a host of faculty and student-focused events and resources, WGSS works to be a space of professional growth, intellectual development and maturity, and a knowledge leader on campus, in the surrounding Lehigh Valley, and abroad.

Associate Professors: Mary C. Foltz, PhD (State University of NY at Buffalo); Jacqueline Krasas, PhD (University of Southern California); Vera S. Stegmann, PhD (Indiana University Northwest)

Assistant Professor: Olivia Landry, PhD (Indiana University Bloomington)

UNDERGRADUATE MAJOR IN WOMEN, GENDER, AND SEXUALITY STUDIES
The Women, Gender, and Sexuality Studies BA will provide students an in depth education in an interdisciplinary field of academic inquiry that critically examines the diverse realities of women’s lives and the ways in which gender and power differentials shape human lives and human societies. WGSS pursues a fundamental critique of knowledge by challenging the basic assumptions, methods of inquiry, theoretical frameworks, and knowledge claims of traditional fields of inquiry that have thought it unimportant to study women, gender, or sexuality. WGSS seeks to create new paradigms of knowledge and inquiry, to develop more truthful and comprehensive understandings of humans and our world, and to explore nonsexist alternatives for more richly human lives and more fully human social orders.

Each semester, a complete list of WGSS course offerings can be found on the web site or in the Office of Interdisciplinary Programs, Williams Hall, Suite 101.

The WGSS major requires 34-36 credits of coursework and is designed to complement other areas of study within CAS in order to facilitate double-majors for our students. WGSS majors can stand alone; however, many students find the major an invaluable asset as part of a double major. The major will have a core curriculum, a concentration (social sciences or humanities), electives, and a senior experience.

Major Core Courses
Major Core Courses
WGSS 001 Gender and Society (SS) 4
WGSS 350 Seminar in Feminist Theory (ND) 4
Global/Diversity (select one of the following) 1
WGSS/SOAN 042 Sexual Minorities (SS) 4
WGSS/ASIA/MLL 073 Film, Fiction, and Gender in Modern China (HU)
WGSS/SOC 110 Women's Work in Global Perspectives (SS)
WGSS/ANTH 123 Anthropology of Gender (SS)
WGSS/SOC 128 Race, Gender and Work (SS)
WGSS/REL 138 Women in Jewish History (HU)
WGSS/AAS 145 African American Women Writers (HU)
WGSS/AAS/SOC 310 Gender, Race and Sexuality: The Social Construction of Differences (SS)
WGSS/FREN 327 Women Writing in French (HU)
WGSS/POLS/GS 342 Gender and Third World Development (SS)
WGSS/SOC 365 Inequalities at Work (SS)

Major Concentration
Students must concentrate in Social Science (SS) or Humanities (HU) 8
Select two courses in SS or HU 2,3

Major Non-concentration
Select one of the following: 2,3
One SS course if HU concentration
One HU course if SS concentration

Major Electives
Select any combination of SS and HU courses 2,3 8

Major Senior Experience
Select one of the following: 2-4
WGSS 271 Independent Reading and Research (HU/SS)
**HONORS IN WOMEN, GENDER, AND SEXUALITY STUDIES**

In order to receive honors in Women, Gender, and Sexuality Studies, the student must attain a 3.5 grade-point average in courses presented for the major and a 3.2 grade-point average overall, and must take WGSS 399 Senior Thesis and write a thesis during their senior year.

**UNDERGRADUATE MINOR IN WOMEN, GENDER, AND SEXUALITY STUDIES**

The minor in WGSS engages students in the study of three interrelated subjects. The first is an examination of the cultural, historical, and social experiences and contributions of women. The second is an exploration of gender (the social construction of differential identity for males and females) and of the ways in which gender distinctions shape human consciousness and human society. The third is an examination of sex/gender and sexuality systems.

Nearly all academic disciplines have defined human nature and significant achievement in terms of male experience and have underestimated the impact of gender on social structures and human lives. By contrast, WGSS courses attend to women's diverse experiences and perspectives and acknowledge the critical significance of gender and sexuality. By shifting the focus to women, gender, and sexuality, WGSS seeks to provide an alternative paradigm for understanding human experience. Students in WGSS courses are encouraged to reevaluate traditional assumptions about human beings, human knowledge, and human culture and society, and to explore nonsexist alternatives for a more fully human social order.

The minor in WGSS consists of a minimum of 18 credit hours. Students pursuing the minor are required to take the introductory course (WGSS 001) and one upper-level course from among those concerned with the theory and practice of women, gender, and sexuality studies. Courses completed must include at least one course in the arts and humanities and one course in the natural and social sciences. Students arrange their program in consultation with the program director.

### Undergraduate Minor

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>WGSS 001</td>
<td>Women &amp; Men in Society</td>
<td>4</td>
</tr>
<tr>
<td>WGSS 271</td>
<td>Independent Reading and Research</td>
<td>2</td>
</tr>
<tr>
<td>WGSS 330</td>
<td>Internship in Women, Gender and Sexuality</td>
<td></td>
</tr>
<tr>
<td>WGSS 373</td>
<td>Internship in Women's Center</td>
<td></td>
</tr>
</tbody>
</table>

Select one 300-level course

Select two electives or new course as approved

Total Credits: 18

1. One course must be HU and one course must be SS

**GRADUATE CERTIFICATE IN WOMEN, GENDER, AND SEXUALITY STUDIES**

The Graduate Certificate in WGSS is designed as a complement to a disciplinary graduate program or as a standalone post-baccalaureate course of study. The Certificate is a small, flexible program that provides students with breadth and the challenge of working outside their home discipline in concentrated interdisciplinary study of women and gender. In recognition of contemporary educational and employment contexts that are increasingly diverse and international, the WGSS Program offers the graduate certificate as a means to enrich academic, personal, and employment horizons. A certificate in WGSS will be especially beneficial to those who wish to incorporate a broader perspective into their teaching (either in secondary or higher education), and qualifies them for positions that require such expertise. Additionally, individuals interested in fields such as social policy, human resources, and business will also gain from understanding how gender operates at individual, organizational, and institutional levels. Students will work closely with outstanding faculty from diverse disciplinary backgrounds.

### Basic Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>WGSS 450</td>
<td>Seminar in Feminist Theory</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Select three additional courses</td>
<td>9</td>
</tr>
</tbody>
</table>

Total Credits: 12

1. 2 courses outside home department (for matriculating students)
2. No more than 6 credits at the 300-level

### Admissions

Students in degree programs must be in good standing in their programs and are encouraged to apply early in their course of studies. Non-degree students must hold a bachelor's degree or equivalent with a 3.0 GPA.

### Courses

**WGSS 001 Gender and Society 4 Credits**

The course introduces students to key concepts, theoretical frameworks, and interdisciplinary research in the field of Women's and Gender Studies. Examines how gender interacts with race, age, class, sexuality, etc., to shape human consciousness and determine the social organization of human society. The course may include topics such as: gender and work; sexuality and reproduction; women's health; media constructions of gender and race; gender, law, and public policy.

**Attribute/Distribution:** SS

**WGSS 015 (ASIA 015, MLL 015) Sex, War, Women, Art 4 Credits**

Through the study of selected visual and literary works in their historical and social contexts, students will gain knowledge of cultures in Japan. This course examines various cultures from the perspectives of gender and sexuality as constitutive factors of Japanese society. Materials include a film depicting a romantic life of samurai, art works by contemporary artists, and writings on sex workers impacted by the Japanese empire. No prior knowledge of Japanese language is required. An introductory course taught in English.

**Attribute/Distribution:** HU

**WGSS 042 (SOAN 042) Sexual Minorities 4 Credits**

How minority sexual identities have been the subject of speculation, misunderstanding, and sometimes violent attempts at correction or elimination. Sexual orientation, gender role, including transvestism and "drag", transsexuality, sexism, heterosexism, and homophobia. Emphasis on critical thinking, guest speakers, and discussions.

**Attribute/Distribution:** SS

**WGSS 073 (ASIA 073, MLL 073) Film, Fiction, and Gender in Modern China 4 Credits**

Study of the struggle for an individual “modern” identity out of traditionally defined roles for men and women as depicted by Chinese writers and filmmakers. Class, texts, and films in English. Students interested in setting up a corollary Chinese language component for credit as CHIN 371 or CHIN 251, may discuss this possibility with the professor.

**Attribute/Distribution:** HU

**WGSS 091 Special Topics 1-4 Credits**

Intensive study of a topic of special interest not covered in other courses. May be cross-listed with relevant offerings in major department or other programs. Consent of program director required.

**Repeat Status:** Course may be repeated.

**WGSS 104 (ENGL 104) Special Topics in Gender Studies 4 Credits**

This course will involve extended study in a sub-area of English language culture, and literature with a focus on gender, sexuality, and/or race/ethnicity. Prereq: 6 hours of freshman English.

**Repeat Status:** Course may be repeated.

**Attribute/Distribution:** HU

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**WGSS 330 Internship in Women, Gender and Sexuality Studies (SS)**

**WGSS 373 Internship On-Campus (SS)**

**WGSS 399 Senior Thesis (ND)**
WGSS 110 (SOC 110) Women's Work in Global Perspectives 4 Credits
This course brings to the forefront the intersections of race, class, gender, and nation with women's employment around the world. We will examine women's paid and unpaid work in the U.S., Europe, Asia, Latin America, and Africa, in effort to understand the striking persistence of gender inequality over time and across the world. Topics of study include: work and family relations, women's domestic labor, factory work, and agribusiness. In addition we will explore the ways in which women have organized for changes in work and in their communities in order to conceive of possibilities for the future of women's work.
Attribute/Distribution: SS

WGSS 17 (HIST 117, STS 117) Pioneering Women: Women in Science, Medicine and Engineering 4 Credits
This course analyses the careers of professional women in science, medicine and engineering, principally in the United States. It examines historical barriers to training and entry into these professions; cultural stereotypes that shape women's options; women's participation in innovation in their fields; their concern for work/life balance; and their contribution to clients and patients, both male and female. It focuses on three locations of professional work: the laboratory, the clinic, and the job site.
Attribute/Distribution: SS

WGSS 117 (ANTH 123) Anthropology of Gender 4 Credits
Comparative study of the meanings and social roles associated with gender. Psychological, symbolic, and cultural approaches.
Attribute/Distribution: HU

WGSS 121 (ART 121) Women in Art 4 Credits
A history of women artists from Renaissance to present day, with emphasis on artists of the 20th and 21st century from a global perspective. We explore attitudes toward women artists and their work as well as the changing role of women in art world. There may be required visits to museums and/or artists' studios.
Attribute/Distribution: HU

WGSS 122 (HIST 124) Women in America 4 Credits
Roles of women in American society from colonial to present times: attitudes toward women, female sexuality, women's work, and feminism.
Attribute/Distribution: SS

WGSS 125 (HIST 125, HMS 125) Does Sex have a History? The History of Sexuality in the United States 4 Credits
Explores the history of sexuality in the United States from the colonial era to the present. While sexuality can appear timeless and stable, sexual ideologies, categories, and behaviors have consistently evolved and have transformed society in the process. This class pays special attention to relationships between sexuality, race, class, and the state, as well as how law, medicine, and the media have shaped sexual identities and experiences. In so doing, the class develops sophisticated readers of historical and contemporary cultures.
Attribute/Distribution: HU

WGSS 126 (AAS 126, HIST 126) How Black Women Made Modern America 4 Credits
This course introduces students to the significant themes and events that have shaped the African American women's historical experience from slavery to the present. We examine the social, political, and economic meaning of freedom for women of African descent.
Attribute/Distribution: HU

WGSS 127 (SOC 127) Human Sexuality 4 Credits
Students in this course view human sexuality through a sociological lens. This includes theory, research methods, and topics such as LGBT identities, family formation, sex work, teenage sexuality, sadomasochism, and sexual technologies. We pay particular attention to ways in which sexual behavior is regulated, as well as social constructions of “the normal.” Course material focuses on the United States, although students are encouraged to bring cross-national perspectives into papers and class discussions.
Attribute/Distribution: SS

WGSS 128 (SOC 128) Race, Gender and Work 4 Credits
Race, Gender and Work is a class designed to help students understand racial and gender inequalities as they relate specifically to work and employment. We explore the origins and histories of inequalities, the ways in which inequalities persist and/or change today, and what steps might be taken toward creating a more equal society.
Attribute/Distribution: SS

WGSS 129 (DES 129, THTR 129) History of Fashion and Style 4 Credits
Dress and culture in the Western Hemisphere from prehistory to today. The evolution of silhouette, garment forms and technology. The relationship of fashion to politics, art and behavior. Cultural and environmental influences on human adornment.
Attribute/Distribution: HU

WGSS 138 (JST 138, REL 138) Sex, Gender, Jews 4 Credits
How do Jews of all genders tell their stories? What are the varied Jewish approaches to sexuality? How have feminist movements affected Jewish rituals? In this course, we will consider how religion, gender, sexuality, race, and class intersect in the lives of Jews, with a particular focus on North America. Topics will include: Jewish women's memoirs; the voices of LGBTQ Jews; recent innovations in Jewish ritual and leadership; Jewish masculinities; and the gendering of Jewish children's literature, among others.
Attribute/Distribution: HU

WGSS 142 (SOC 142) Bad Girls: Gender, Sexuality, Deviance 4 Credits
This course focuses on people who perform their gender and/or sexuality in ways that fall outside of the norm. Topics include, but are not limited to: commercial sex workers, dominatrixes, transpeople, stay-at-home dads, and drag queens. We will regularly discuss the readings in the context of current events and popular culture.
Attribute/Distribution: SS

WGSS 145 (AAS 145) African American Women Writers 4 Credits
Literature by African American women writers with a focus on the experiences and images of black women in the U.S. Explores the written portraits and voices of 20th century black female novelists and poets, including Hurston, Petry, Morrison, Angelou, and Walker.
Attribute/Distribution: HU

WGSS 146 (PHIL 146) Philosophy of Sex and Gender 4 Credits
An examination of concepts, values, and assumptions relevant to gender and sex(uality) in our diverse society, investigating how they affect our lives in both concrete and symbolic ways. Intersections among gender, sex(uality), race, class, religion, ethnicity, etc., will be explored. Special attention will be paid to how gendered assumptions color our understandings of experiences of embodiment and emotion, reasoning and decision-making, knowledge production, and public and private relationships and activities.
Attribute/Distribution: HU

WGSS 173 (ASIA 173, REL 173) Sex, Celibacy and Sainthood: Gender and Religion in East Asia 4 Credits
This course explores themes of sexuality, celibacy, gender, and sainthood in East Asian religions. We will pay special attention to the experiences of religious women from many walks of life and time periods, from traditions including Buddhism, Daoism, and shamanism. Through film, poetry, autobiography, philosophical writing, visual art, and descriptions of visionary experience, students will encounter Buddhist and Daoist nuns, lay women, mothers, shamanic healers, oracles, activists, and royalty, from Tibet, Korea, Japan, China, and the U.S.
Attribute/Distribution: HU

WGSS 179 (POLS 179) Politics of Women 4 Credits
Selected social and political issues relating to the role of women in American society. Focuses on such questions as economics equality, poverty, and work roles, the older woman, gender gap, political leadership, reproduction technology, and sexual violence.
Attribute/Distribution: SS
WGSS 182 (REL 182) Sex and Gender in the Bible 4 Credits
The Bible is often invoked—and often simplistically—as an authoritative source in contemporary discussions about the role of women and what kinds of human sexual expression is acceptable. This course will examine how sex and gender are constructed in different biblical periods and biblical books. We will see that things are not nearly as simple as they are often made out to be.

Attribute/Distribution: HU

WGSS 184 (REL 184) Religion, Gender, and Power 4 Credits
Gender differences as one of the basic legitimations for the unequal distribution of power in Western society. Feminist critiques of the basic social structures, cultural forms, and hierarchies of power within religious communities, and the ways in which religious groups have responded.

Attribute/Distribution: HU

WGSS 191 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses. May be cross-listed with relevant offerings in major department or other programs. Consent of program director required.

Repeat Status: Course may be repeated.

WGSS 210 (AAS 210, POLS 210) Revolution on Campus 4 Credits
Universities are often sites of political protest. Some of these protests are expressive but ineffective, others can spark revolutions and regime change. Why? What distinguishes universities as sites for resistance? What makes students prone to mobilization? The study of politics can seem like an abstract pursuit, one that is not relevant to our lives. This course takes the scholarly literature on social movements and applies it to the university. Students will engage in social activism as part of this course.

Attribute/Distribution: SS

WGSS 226 (PHIL 226) Feminism and Philosophy 4 Credits
Analysis of the nature, sources and consequences of the oppression and exploitation of women, and justification of strategies for liberation. Topics include women's nature and human nature, sexism, femininity, sexuality, reproduction, mothering. Must have completed one HU designated course in Philosophy or one course in Women, Gender, and Sexuality Studies.

Attribute/Distribution: HU

WGSS 232 (ENGL 232) Gender Issues in Entrepreneurship 4 Credits
Explores role of women entrepreneurs in society & economic development; impacts of women's entrepreneurship in different economic and cultural contexts; research on why women still represent a minority or entrepreneurs; gender differences in patterns of entrepreneurship; related policy challenges. Also addresses pragmatic and personal life choices facing women entrepreneurs, including identifying key characteristics of entrepreneurial opportunities and mapping those against values, skills, ethics and definitions of success; and planning for professional and personal development.

Attribute/Distribution: SS

WGSS 271 Independent Reading and Research 1-4 Credits
Independent study of selected topics designated and executed in close collaboration with a member of Women, Gender, and Sexuality Studies faculty. May be repeated for elective credit. Consent of program director required.

Repeat Status: Course may be repeated.
Attribute/Distribution: HU, SS

WGSS 272 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses. May be cross-listed with relevant offerings in major department or other programs. Consent of program director required.

Repeat Status: Course may be repeated.

WGSS 275 (LAS 275, SPAN 275) Introduction to Hispanic Women Writers 4 Credits
The objective of this class is to introduce students to Hispanic contemporary female authors from Latin America, Spain, and the United States through the analysis of all literary genres (novel, short story, poetry, essay, and drama). This class provides students with a solid introduction to Hispanic women’s writing from the last years of the Nineteenth Century to the present, as well as to feminist literary theory.

Attribute/Distribution: HU

WGSS 291 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses. May be cross-listed with relevant offerings in major department or other programs. Consent of program director required.

Repeat Status: Course may be repeated.

WGSS 300 Apprentice Teaching 1-4 Credits
Supervised participation in various aspects of the teaching of a course. Transcript will identify department in which apprentice teaching was performed. Consent of department chairperson and permission of the Dean. The transcript will reflect the subject area in which the teaching was done.

Repeat Status: Course may be repeated.

WGSS 303 (ENGL 303, GERM 303, MLL 303) Grimm's Fairy Tales: Folklore, Feminism, Film 4 Credits
This intercultural history of the Grimm’s fairy tales investigates how folktales and gender stereotypes developed and became models for children and adults. The course covers the literary fairy tale in Germany, Europe and America. “Little Red Riding Hood”, “Cinderella”, or “Sleeping Beauty” exist not only in the Grimm’s collection but in many forms of world literature/film. Modern authors have rewritten fairy tales in feminist ways, promoting social change. Taught in English. German language students may receive a German component.

Attribute/Distribution: HU

WGSS 304 (ENGL 304) Special Topics in Gender Studies II 3,4 Credits
This course will involve extended study in a sub-area of English language, culture, and literature with a focus on gender, sexuality, and/ or race/ethnicity.

Repeat Status: Course may be repeated.
Attribute/Distribution: HU

WGSS 310 (AAS 310, SOC 310) Gender, Race and Sexuality: The Social Construction of Differences 4 Credits
Students will engage with current debates about the meaning and use of racial and sexual classification systems in society. We will examine the historical and sociological contexts in which specific theories of racial and sexual differences emerged in the U.S. We will also explore the ways in which changes in the images have implications on the role racial, gender, and sexual identity plays in our understanding of the relationship between difference and inequality.

Prerequisites: SOC 103 or SSP 103
Attribute/Distribution: SS

WGSS 311 (ENGL 311) Representations of Gender and Sexuality 3-4 Credits
This course explores constructions of gender and sexuality in literature from different historical periods, traditions, and nationalities. How do female and male writers envision what it means to be a “woman” or to be a “man” at various moments in history and from various places around the world? How have gendered (and sexed) identities been shaped in various constraining and empowering ways in the literary imagination? What specifically gendered issues (such as love and violence) have been represented in literature?

Repeat Status: Course may be repeated.
Attribute/Distribution: HU

WGSS 318 (PSYC 318) Seminar in Gender and Psychology 4 Credits
Gender as shaped by psychological and social psychological processes. Socialization, communication and power, gender stereotypes, methodological issues in sex differences research. Consent of department required.

Prerequisites: PSYC 210
Can be taken Concurrently: PSYC 210
Attribute/Distribution: SS

WGSS 325 (HIST 325, SOC 325) History of Sexuality and the Family in the U.S. 3-4 Credits
Changing conceptions of sexuality and the role of women, men, and children in the family and society from the colonial to the post-World War II era. Emphasis on the significance of socioeconomic class and cultural background. Topics include family structure, birth control, legal constraints, marriage, divorce, and prostitution.

Attribute/Distribution: SS
WGSS 326 (LAS 326, SPAN 326) Tradition and Resistance: Women Writers of Latin America 4 Credits
Study of poetry and narrative works by Latin American women writers. Authors include Rosario Ferré, Rosario Castellanos, Elena Poniatowska, Cristina Peri Rossi, among others.
Prerequisites: SPAN 152
Attribute/Distribution: HU

WGSS 327 (FREN 327) Women Writing in French 4 Credits
Reading and discussion of works written by women in French. The emphasis is on 19th and 20th Century writers, such as G. Sand, Colette S. de Beauvoir, M. Duras, Andrée Chédid.
Attribute/Distribution: HU

WGSS 330 Internship in Women, Gender and Sexuality Studies 1-4 Credits
Supervised work in women's organizations or settings, combined with an analysis, in the form of a major paper, of the experience using the critical perspectives gained in WGSS courses. Placements arranged to suit individual interests and career goals; can include social service agencies, women's advocacy groups, political organizations, etc. Consent of program director required.
Repeat Status: Course may be repeated.
Prerequisites: WGSS 001
Attribute/Distribution: SS

WGSS 331 (GS 331, SOC 331) Gendered Experience of Globalization 4 Credits
Women and men experience globalization differently and globalization affects women in different cultural and national contexts. Gender stratification has been intensified by the transnational flow of goods and people. Provides students with a survey of new development in feminist theories on globalization and on gender stratification and development, and links those theoretical frameworks to empirical research about gender issues that have become more prominent with globalization.
Attribute/Distribution: SS

WGSS 334 (HMS 334, PSYC 334) The Psychology of Body Image and Eating Disorders 4 Credits
The course addresses the psychosocial aspects of the development of healthy and unhealthy body image and eating disorders. The roles of personality traits/individual factors, family and interpersonal functioning, and cultural factors will be examined, as will the impact of representations of body image in mass media. Public health and psychological interventions for prevention and treatment will be explored. Personal accounts/memoirs, clinical case presentations, and documentary and dramatic films will be incorporated in the presentation of topics.
Attribute/Distribution: SS

WGSS 341 (HMS 341, SOC 341) Gender and Health 4 Credits
Relationships of sex differences and gender norms to disease and longevity in the U.S. and around the world. Influence of medical systems on men's and women's lives and the impact of gender-based consumer health movements on health and medical care. Focus on specific topics, e.g. medicalization and commercialization of women's bodies, the politics of reproductive choices, masculinity and health, and gender and mental health.
Attribute/Distribution: SS

WGSS 342 (GS 342, POLS 342) Gender and Third World Development 3-4 Credits
Focus on gender implications of contemporary strategies for Third World economic growth, neo-liberalism. How do economic theories affect 'real people'? How do economic theories affect men vs. women? What is the role of people who want to 'help'? Some background in economic theories and/or Third World politics desired, but not required.
Prerequisites: POLS 001 or WGSS 001
Attribute/Distribution: SS

WGSS 346 (LAS 346, SPAN 346) Contemporary Hispanic Women Writers: The Novelists 4 Credits
This course explores the works of Hispanic women writers who have been oppositional to hegemonic cultural politics during the Twentieth Century in Latin America and Spain. Within their particular contexts, we examine issues these writers define as important in their work, their literary and political impact, use of literature to empower minority positions, and their narratives’ effects on the changing literary canon. Selected topics include: historical interpretations, exile, forms of violence and repression, expressions of desire, and sexuality.
Attribute/Distribution: HU

WGSS 349 (POLS 349) American Social Policy: Race, Class, Gender and Sexuality 4 Credits
This course examines criminal justice, housing, health, education, and welfare policies across US states through the lenses of class, race, gender, and sexuality. Students will learn how social regulations structure opportunities and assess the implications of those opportunity structures.

WGSS 350 Seminar in Feminist Theory 4 Credits
An upper-level seminar serving as a capstone experience that challenges students to systematize insights gained from introductory and elective courses through the more deeply analytical lens of feminist theory. Consent of program director.
Prerequisites: WGSS 001
Attribute/Distribution: ND

WGSS 351 (SOC 351) Gender and Social Change 4 Credits
Changes in gender roles from social psychological and structural perspectives. Comparative analyses of men and women (including people of color) in the social structure; their attitudes and orientations toward work, family, education, and politics.
Attribute/Distribution: SS

WGSS 364 (SOC 364) Sociology of the Family 4 Credits
Sociological analysis of families in the United States, including investigations of historical and contemporary patterns. Issues addressed include parenting, combining work and family, divorce and remarriage, family policies.

WGSS 365 (SOC 365) Inequalities at Work 4 Credits
Primary focus is on race, gender, and class as axes of disadvantage and privilege in work and employment. We will explore both theories and empirical studies of inequality as well as their social, political, and practical ramifications for the workplace. The course will be conducted seminar-style and the class will rely heavily on student participation.
Attribute/Distribution: SS

WGSS 371 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses. May be cross-listed with relevant offerings in major department or other programs. Consent of program director required.
Repeat Status: Course may be repeated.

WGSS 373 Internship On-Campus 1-3 Credits
Supervised work in on-campus student services office such as the Center for Gender Equity, the Pride Center, Office of Gender Violence, etc. allows WGSS students to bring critical perspectives on women and gender into the campus community. This course may be repeated for credit up to a maximum of 6 credits. Prerequisites: WGSS 001 and consent of the Center director and WGSS director.
Repeat Status: Course may be repeated.
Prerequisites: WGSS 001

WGSS 376 (AAS 376, COMM 376) New Media, Race and Gender 4 Credits
This class explores the relationship among race, gender and new media. It examines depictions of racial minorities and women online; how users access and use new media across race and gender (including a look at the digital divide); and differences in use of social media websites across race and gender. The goal is for students to understand how existing racial and gender categorizations are not transmitted to the online community and do/do not become extensions of present social hierarchy.
Attribute/Distribution: SS
WGSS 381 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses. May be cross-listed with relevant offerings in major department or other programs. Consent of program director required.
Repeat Status: Course may be repeated.

WGSS 382 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses. May be cross-listed with relevant offerings in major department or other programs. Consent of program director required.
Repeat Status: Course may be repeated.

WGSS 391 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses. May be cross-listed with relevant offerings in major department or other programs. Consent of program director required.
Repeat Status: Course may be repeated.

WGSS 392 Special Topics 1-4 Credits
Intensive study of a topic of special interest not covered in other courses. May be cross-listed with relevant offerings in major department or other programs. Consent of program director required.
Repeat Status: Course may be repeated.

WGSS 399 Senior Thesis 2-4 Credits
Research during senior year culminating in a senior thesis. Consent of program director required.
Repeat Status: Course may be repeated.
Attribute/Distribution: ND

WGSS 403 (MLL 403) Grimms' Fairy Tales: Folklore, Feminism, Film 3 Credits
This intercultural history of the Grimms' fairy tales investigates how folklore types and gender stereotypes developed and became models for children and adults. The course covers the literary fairy tale in Germany as well as Europe and America. Versions of "Little Red Riding Hood", "Cinderella", or "Sleeping Beauty" exist not only in the Grimms' collection but in films and many forms of world literature. Modern authors have rewritten fairy tales in feminist ways, promoting social change. Taught in English. German language students may receive a German component.

WGSS 405 (CIE 405) Experiencing the United Nations: Gender and Education in International Development 3 Credits
Building on the Lehigh University/United Nations partnership initiative, this course provides a structured practical experience for students to learn about the dynamics of UN and civil society relationships, focusing on the issues of gender and education in international development. Class activities include trips to the UN to attend NGO briefings and other events. Students develop experiences and skills in international development such as policy blogging, brief writing, and education sector analysis.

WGSS 411 (ENGL 411) Gender and Literature 3 Credits
This seminar explores constructions of gender and sexuality in literature from different historical periods, traditions, and nationalities. Content changes each semester.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

WGSS 418 (SOC 418) Gendered Experience of Globalization 3 Credits
Women and men experience globalization differently and globalization affects women in different cultural and national contexts. Gender stratification has been intensified by the transnational flow of goods and people. Provides students with a survey of new development in feminist theories on globalization and on gender stratification and development, and links these theoretical frameworks to empirical research about gender issues that have become more prominent with globalization.

WGSS 430 Internship in Women, Gender and Sexuality Studies 1-3 Credits
Internship related to women, gender, and sexuality studies. Supervised by WGSS faculty. Consent of program director required.

WGSS 441 (SOC 441) Gender and Health 3 Credits
Relationships of sex differences and gender norms to disease and longevity in the US and around the world. Influence of medical systems on men's and women's lives and the impact of gender-based consumer health movements on health and medical care. Focus on specific topics, e.g. medicalization and commercialization of women's bodies, the politics of reproductive choices, masculinity and health, and gender and mental health.

WGSS 442 (SOC 442) Bad Girls: Gender, Sexuality, Deviance 3 Credits
This course focuses on people who perform their gender and/or sexuality in ways that fall outside of the norm. Topics include, but are not limited to: commercial sex workers, dominatrixes, transpeople, stay-at-home dads, and drag queens. We will regularly discuss the readings in the context of current events and popular culture.

WGSS 449 (POLS 449) American Social Policy: Race, Class, Gender and Sexuality 3 Credits
This course examines criminal justice, housing, health, education, and welfare policies across US states through the lenses of class, race, gender, and sexuality. Students will learn how social regulations structure opportunities and assess the implications of those opportunity structures.

WGSS 450 Seminar in Feminist Theory 3 Credits
A graduate seminar providing foundational study of multidisciplinary theoretical frameworks of women, gender, and sexuality studies.
Attribute/Distribution: HU, ND

WGSS 458 (HIST 458) Readings in Gender History 3 Credits
Study in small groups under the guidance of a faculty member on the literature of an issue, period, country or culture within gender history.
Repeat Status: Course may be repeated.
Attribute/Distribution: HU

WGSS 465 (SOC 465) American Social Policy: Race, Class, Gender
and Welfare 3 Credits
Primary focus is on race, gender, and class as axes of disadvantage and privilege in work and employment. We will explore both theories and empirical studies of inequality as well as their social, political, and practical ramifications for the workplace.
Attribute/Distribution: SS

WGSS 468 (PSYC 484) Psychology of Gender 3 Credits
Major theoretical approaches and empirical debates in the psychology of gender, with a focus on the interplay of nature and nurture in producing gender similarities, gender differences and gender variation in personality, social behaviors, cognitive abilities, achievement, sexuality, and mental health. Methodological issues in gender research. Consent of program director required.

WGSS 491 Independent Study 3 Credits
Individually supervised course in area of women, gender, and sexuality studies not ordinarily covered in regularly listed courses. Consent of program director required.
Repeat Status: Course may be repeated.

College of Business

Georgette Chapman Phillips, Dean; Katrina A. Zalatan, Associate Dean and Director, Undergraduate Programs; Yuliang Yao, Associate Dean, Graduate Programs; Paul Brockman, Senior Associate Dean for Faculty and Academic Affairs; C. Bryan Cloyd, Chair, Department of Accounting; Shin-Yi Chou, Chair, Department of Economics; Nandu Nayar, Chair, Perella Department of Finance; Corinne Post, Chair, Department of Management; K. Sivakumar, Chair, Department of Marketing, Catherine Ridings, Interim Chair, Decision and Technology Analytics (DATA) Department.

The College of Business offers the bachelor of science degree in business and economics. In the dynamic global environment of the 21st Century, today's business students face unprecedented challenges. Lehigh's College of Business prepares them to meet these challenges and to succeed. The mission of Lehigh University's College of Business is to provide an intellectual and professional learning environment that advances knowledge through research and scholarship and that develops future leaders through experiential learning, rigorous analysis.
and the discipline of a strong work ethic – the hallmarks of a Lehigh University business education.

The College of Business consists of six departments: accounting, decision and technology analytics (DATA), economics, Perella Department of Finance, management and marketing. Its programs, accredited by the AACSB International—The Association to Advance Collegiate Schools of Business—provide students with a solid foundation in business and economics principles. In addition to the traditional undergraduate majors of accounting, economics, finance, management, and marketing, the College offers innovative programs and courses that respond to today’s unique business requirements, including:

The Business Information Systems major that answers a recognized need in the business world. As businesses seek to make themselves more productive and competitive, they have become more reliant on information technology. Students with a good understanding of information systems can help businesses enhance their use of this technology.

The Supply Chain Management major is another response to the complex environment facing business graduates. This undergraduate major gives students solid exposure to supply management, logistics, business-to-business marketing and operations management.

The College of Business has joined with the College of Engineering to offer two cross-college programs. These programs, Integrated Business and Engineering (IBE) and Computer Science and Business (CSB), are described in full in the following “Crossing Boundaries” section.

All minors offered by the College of Arts and Sciences are available to College of Business undergraduate students. The engineering minor offered by the College of Engineering is also available to all College of Business undergraduates. The following College of Business minors are available to College of Business students: business information systems, supply chain management, management, and financial technology (FinTech).

In order to declare a College of Business minor, students must first have a College of Business declared major. There is no overlapping credit between College of Business major and College of Business minor courses or between College of Business minors.

BREAK BOUNDARIES

As technology and business march ahead together, opportunity abounds for institutions of higher learning. The business makers of tomorrow are groomed in the classrooms of today. Seeking brilliance and purpose, our students explore, evolve and expand new thinking. Our college is a research-based institution that pioneers interdisciplinary learning and fosters the hard-working practical skills employers covet. And our careers are raised ever higher by the adventurous ingenuity Lehigh cultivates. Across disciplines, geographies and ideologies, we see boundless possibilities. We are the students, alumni, professors and friends of the Lehigh College of Business and we break boundaries.

Entrepreneurship Minor

The program aims to prepare students from all undergraduate colleges at Lehigh with the skill sets, attitudes, and understanding of the processes to realize their entrepreneurial goals in either an emerging or established company setting. The program is designed to be generally accessible to students from all disciplines with an emphasis upon innovation, the entrepreneurial process, and cross-functional integration. The minor can be added to any undergraduate degree at the university.

Real Estate Minor

The real estate program is designed to complement a wide range of majors, from art and architecture to civil engineering to environmental science to finance to marketing to economics. Students must take five courses comprised of both required and elective components which draw from several academic disciplines across campus. The program is housed in the Goodman Center for Real Estate and open to undergraduate students of all majors.

Career Placement

The undergraduate programs in the College of Business provide the students with a strong foundation in business and economic principles necessary for success in business. Upon graduation, the majority of students from the College of Business enter business in many different professional positions including accounting, investment banking, advertising, marketing, management consulting, and information systems. Further professional studies in law, graduate business schools or specialized graduate education in economics, operations research, or other related fields are additional options open to graduates.

**Variety of Options**

While preparing students for a career in business and economics, we recognize the importance of a well-rounded individual. At Lehigh, this important exposure to science, language and the arts and humanities is accomplished by distribution requirements, within which the student has wide choice. Students take 48 credits outside the College of Business.

The bachelor of science in business and economics may also lead to admission into the master of business administration program at Lehigh or another institution after graduates have at least 2-3 years of work experience. In addition, the college also offers the following graduate degrees: doctor of philosophy, master of business administration and engineering, master of business administration and educational leadership, master of science in accounting and information analysis, master of science in analytical finance, master of science in applied economics, and master of science in management.

**BACHELOR OF SCIENCE IN BUSINESS AND ECONOMICS**

The College of Business at Lehigh University prepares students to become business and community leaders in a broad range of organizations. Our undergraduate students acquire the knowledge and skills needed to excel in business. Overall, we expect our graduates to be able to successfully solve complex, unstructured business problems.

For the bachelor of science degree in business and economics, 124 credit hours are required. A writing requirement, which is included within the required 124 credit hours, is also a part of the college curriculum.

**Planning Courses of Study**

<table>
<thead>
<tr>
<th>First Year</th>
<th>CR</th>
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<tbody>
<tr>
<td>ENGL 001 or 003</td>
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<td>MATH 021 or 081</td>
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<td>ECO 001</td>
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<td>BIS 044</td>
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<table>
<thead>
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<th>Second Year</th>
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<td>ACCT 152</td>
<td>3</td>
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<tr>
<td>BIS 111</td>
<td>3</td>
</tr>
<tr>
<td>ECO 146 or 119</td>
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<tr>
<td>FIN 125</td>
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<td>MKT 111</td>
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<td>SCM 186</td>
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<td>BIS 244</td>
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<td>MGT 243</td>
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<tbody>
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<td>MGT 301</td>
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</table>

Total Credits: 54
Major Programs (15 credits - 23 credits)
By the end of the second semester of the sophomore year, students select a major consisting of sequential or related courses in one of the following major programs: accounting, business information systems, economics, finance, management, marketing, and supply chain management. A GPA of 2.0 or higher in the major program is required for graduation.

Double Majors
Students in the College of Business may pursue a double major within the college according to college guidelines, which include the requirements of each of the majors and a minimum of 10 courses (30 credits) between the two combined majors. Students must declare a single major prior to declaring a second major. Students planning to pursue a second major within the College of Business must meet a prerequisite GPA of 2.0 or higher.

Globalization and Diversity Requirements
Each student must complete a minimum of 3 credits in Diversity and 3 credits in Globalization. These courses may simultaneously fulfill other College of Business degree requirements.

Electives (52-55 credits) - depending on major
Students will earn 52-55 credits of electives. A minimum of 48 credits are to be taken outside the College of Business.

Students are required to take six (6) credits of humanities (H), six (6) credits of social science (SS), and three (3) credits of science (NS) for a total of 15 credits of distribution requirements. Students should refer to the department in the catalog to determine which course offerings may be taken to satisfy these requirements.

In the College of Business, the pass-fail option is available for elective courses only. A student desiring Lehigh credit for a course taken at another institution must complete a transfer credit form and obtain approval from the appropriate Lehigh academic department in advance.

BUSINESS CERTIFICATE PROGRAMS

Business Analytics Certificate
Today’s business environment challenges firms to use data as a driver in decision making. All sectors of business are bursting with information that needs to be structured and analyzed in order to form meaningful insights. Upon completion of the certificate, students will:
• Understand the field of data science with an understanding of three distinct areas: predictive (forecasting), descriptive (business intelligence and data mining), and prescriptive (optimization and simulation)
• Apply data analytic tools in different business disciplines to formulate and solve business problems
• Demonstrate an understanding of fundamental computer programming constructs and concepts
• Understand how data is collected, prepared, stored, analyzed, modeled, and visualized for analytical business analysis and decision making

The Business Analytics Certificate is a 12-credit program that includes a mix of courses related to business analytics designed to give students exposure to computer programming, business intelligence, computer models, and data management in order to foster decision making in the modern enterprise. The certificate is open to all College of Business students, including CSB and IBE. To earn the certificate, students will take at least 12 credits and earn a grade of "C-" or higher in each course.

For a program overview with course information, please visit the College of Business website.

International Business Certificate
The International Business (IB) Certificate is intended to benefit those students seeking to broaden their understanding of international business and foster the development of their global mindset. The program encompasses a mix of courses relating to international business and management, courses designed to broaden a student’s functional knowledge and or cultural competencies, and requires participation in a global immersive experience. The IB Certificate is open to all undergraduate students from any major with the approval from the Directors of the IB Certificate Program. Students are required to complete a minimum of 12 credits and participate in an immersive global experience.

Students are required to take at least one (1) of the following two (2) courses:
• MGT 346 International Business
• MGT 342 Managing in the International Organization

To successfully complete the program, students must take at least one other approved College of Business course and then any combination of qualifying business or non-business courses to reach the 12 credit hour requirement. To count toward the IB Certificate, the content of courses must be highly salient to international business and the student must obtain a grade of "C-" or higher. Exemplars of international business related courses, as well as qualifying global experiences, can be found on the College of Business website.

BUSINESS MINOR
The purpose of the business minor program is to enable non-business students to pursue a course of business studies which enables them to supplement their major studies and enhances their career options upon graduation. The overall learning objective of the program is to provide non-business students with the knowledge and skills with which to make more informed business decisions.

Courses offered in the business minor program are not open to students currently in the College of Business, nor may these classes count as substitutes for College of Business core classes should a student later decide to transfer into the College of Business.

Program of Studies
The business minor consists of 14 credit hours. The courses are integrated across the entire program and must be taken in a stepped sequence. These 14 credit hours plus the prerequisite consist of the following courses:

Required prerequisite course
ECO 001 – Principles of Economics (4) ECO 001 can be taken in either the freshman or sophomore year and must be completed prior to entering the Business Minor Program.

Required courses

<table>
<thead>
<tr>
<th>First Year</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>BUS 125</td>
<td>3</td>
<td>BUS 127</td>
<td>3</td>
</tr>
<tr>
<td>BUS 126</td>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>4</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Second Year</td>
<td>Credits</td>
<td>Spring</td>
<td>Credits</td>
</tr>
<tr>
<td>BUS 225</td>
<td>3</td>
<td>BUS 226</td>
<td>3</td>
</tr>
<tr>
<td>BUS 326</td>
<td>1</td>
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<tr>
<td></td>
<td>3</td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

Total Credits: 14

Recommended courses
The courses required in the business minor program will be offered in a stepped sequence requiring completion of each course in the sequence before being able to continue to the next course. That is, students must first complete BUS 126 before taking BUS 127, BUS 127 before taking BUS 225, and BUS 225 before taking BUS 226. BUS 125 and BUS 326 are to be taken in conjunction with BUS 126 and BUS 226 respectively.

Program admission requirements
Each spring, approximately 100 students will be accepted into the business minor program for the following fall. Applications to the program will be made by students and submitted to the program director by the last Friday in January. An admissions committee comprised of the business minor program director and the business minor curriculum committee will make admission decisions based on G.P.A., experience, and interest in pursuing business opportunities upon graduation from Lehigh (to be evaluated on the basis of a written essay). Students will be notified of admissions decisions by the first week in March to begin registration for the fall semester. Applications are restricted to students...
from the P.C. Rossin College of Engineering and Applied Science and the College of Arts and Sciences only. The Director of the Business Minor program is Robert Kuchta, Professor of Practice, Department of Management, 330 Rauch Business Center (rok8@lehigh.edu).

GRADUATE PROGRAMS
Graduate degree programs (p. 283) offered by the college include the Master of Business Administration, the Master of Science in Accounting and Information Analysis, the Master of Science in Applied Economics, the Master of Science in Management, and the Ph.D. in Business and Economics. Interdisciplinary degree programs (p. 450) are offered through partnerships with other colleges: P.C. Rossin College of Engineering and Applied Science - Master of Business Administration and Engineering; P.C. Rossin College of Engineering and Applied Science and the College of Arts and Sciences-Master of Science in Analytical Finance: College of Education-Master of Business Administration and Educational Leadership.

Accounting

The Department of Accounting provides a variety of courses to support the College of Business core requirements and to provide an undergraduate major in accounting and a M.S. degree in accounting and information analysis.

The mission of Lehigh University’s Accounting Department is to provide outstanding accounting education and networking opportunities that prepare students (1) to enter the accounting profession upon graduation, (2) to assume positions of leadership in the global business community later in their careers, and (3) to be socially responsible and ethical business professionals. We will also advance the profession of accountancy globally to serve the public interest by producing and disseminating original accounting research and cross-disciplinary scholarship. We are guided by the missions of Lehigh University and the College of Business. The Accounting Department continuously seeks to be recognized as one of a select group of programs in the United States where an educational experience of the highest possible quality is obtainable.

Within the accounting major, there is an opportunity to explore the various career opportunities within the broad field of accounting: Public Accounting Assurance and Tax Services, Financial Services and Corporate Accounting, and Information Systems. In addition to the undergraduate program, the Master of Science in Accounting and Information Analysis degree (see Master of Science in Accounting and Information Analysis program (p. 283)) offers an outstanding opportunity to prepare graduate students for a career in today’s demanding field of accounting. Lehigh’s unique program recognizes the impact of technology on business processes and the value chain while paying respect to the time honored usefulness of accounting information.

The Accounting Program recognizes the learning objectives set forth by the College of Business as an integral part of the curriculum, as well as the College of Arts and Sciences. Core Requirements, typically taken junior year

<table>
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<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>ACCT 315</td>
<td>Intermediate Accounting I</td>
<td>3</td>
</tr>
<tr>
<td>ACCT 316</td>
<td>Intermediate Accounting II</td>
<td>3</td>
</tr>
<tr>
<td>ACCT 311</td>
<td>Accounting Information Systems</td>
<td>3</td>
</tr>
<tr>
<td>ACCT 324</td>
<td>Cost Accounting</td>
<td>3</td>
</tr>
</tbody>
</table>

Concentration, typically taken senior year

Concentration, three courses, one of which is accounting (see below)

<table>
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<td>Fundamentals of Federal Income Taxation</td>
<td>3</td>
</tr>
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<td>3</td>
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<td>ACCT 317</td>
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</table>

Total Credits: 21

CONCENTRATIONS

Public Accounting Assurance and Tax Services

This concentration is suited for students interested in entering public accounting.

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</table>

Total Credits: 9

Financial Services and Corporate Accounting

This concentration may appeal to students seeking accounting positions at financial services firms and industrial corporations. For some time representatives from these companies have sought Lehigh students with a strong accounting background. External constituencies suggest that a dose of finance will strengthen these students and make them even more attractive.

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<td>FIN 323</td>
<td>Investments</td>
<td>3</td>
</tr>
<tr>
<td>FIN 328</td>
<td>Corporate Financial Policy</td>
<td>3</td>
</tr>
<tr>
<td>ACCT 318</td>
<td>Analysis of Financial Statements</td>
<td>3</td>
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Total Credits: 9

Associate Professors. Tamara A. Lambert, PHD (Drexel University); Marietta Peytcheva, PHD (Rutgers University Newark)

Assistant Professors. Bright Asante-Appiah, PHD (Kennesaw State University); Raluca Chioorean, PHD (University of Illinois at Chicago); Jae Bum Kim, PHD (University of Minnesota Minneapolis); Neal Snow, PHD (University of South Florida); Leo Tang, PHD (Rutgers University)

Professors Of Practice. Robert E. Duquette, CPA, MBA (University Maine); David J. Hinrichs, MS (Lehigh University); Joseph M. Manzo, MBA (Lehigh University); Thomas G. Rees, MBA (University of Delaware)

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THE ACCOUNTING MAJOR

The undergraduate program in accounting is accredited by AACSB - The International Association for Management Education. This achievement places the program within a small group of schools which have satisfied a rigorous examination of the program, faculty, and students that extend beyond the accreditation standards applied to the entire College of Business undergraduate and graduate programs.

Sophomore Prerequisites to the Major

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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<tr>
<td>ACCT 151</td>
<td>Introduction to Financial Accounting</td>
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<tr>
<td>ACCT 152</td>
<td>Introduction to Managerial Accounting</td>
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</table>

Total Credits: 6

1 ACCT 151 & 152 are a part of the Business Core and thus are not used as a part of the major GPA calculation.

Accounting Major Requirements (Core and Concentration)

Core Requirements, typically taken junior year

<table>
<thead>
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Information Technology

Public accounting firms seek graduates for the rapidly growing area of global risk management (GRM). Students entering GRM will be responsible for assessing accounting system and computer risks that impact the financial statements of the organization and for evaluating internal controls in place to minimize such risks. Their findings become an important element in the conduct of the financial audit. This new career path thus requires students who possess strong systems skills and an understanding of financial accounting, management accounting, and auditing. Taxes and advanced financial accounting topics are less important in this setting. Therefore, the following courses comprise this concentration.

ACCT 320 Fundamentals of Auditing 3
ACCT 330 Accounting Data and Analytics 3
One 300-level BIS course 3
Total Credits 9

The description and requirements of the Master of Science in Accounting and Information Analysis Program are found under Graduate Study and Research.

Course descriptions for the College of Business graduate courses can be found under Business Graduate courses (p. 283).

Courses

ACCT 108 Fundamentals of Accounting 3 Credits
A one-semester survey of accounting principles and practices designed for those students who includes an introduction to industrial cost systems designed for those non College of Business students planning to take only one accounting course. Other students should take the Actct 151-152 sequence.

ACCT 151 Introduction to Financial Accounting 3 Credits
The organization, measurement and interpretation of economic information. Introduction to accounting theory, concepts and principles, the accounting cycle, information processing, and financial statements. Exposure to controversial issues concerning income determination and valuation. Must have sophomore standing.

ACCT 152 Introduction to Managerial Accounting 3 Credits
An introduction to internal accounting information for all levels of management. Topics include cost flow in a manufacturing operation; planning, evaluating and controlling through budgeting and standard costing; and decision-making using cost-volume-profit analysis, direct costing, and relevant costs.
Prerequisites: ACCT 151

ACCT 307 Fundamentals of Federal Income Taxation 3 Credits
An introductory study of the principles and concepts of federal income taxation of individuals, corporations, partnerships, and fiduciaries; and federal gift and estate taxes. Determination of tax liabilities and opportunities for planning are emphasized. Problem-solving using the source materials of tax law and tax research are important components of the course.
Prerequisites: ACCT 151

ACCT 309 Advanced Federal Income Taxation 3 Credits
An advanced study of the taxation of business organizations, estates, trust, and wealth transfer taxes. Planning and research are the basic components of the course. Problem-solving and written research are emphasized.
Prerequisites: ACCT 307

ACCT 311 Accounting Information Systems 3 Credits
An introduction to the concepts underlying information systems as they relate to organizational structure, managerial decision making and accounting. The course acquaints students with the reports and documents generated by information systems, as well as procedures and controls employed in a variety of business applications. Students apply these concepts, techniques and procedures to the planning, analysis and design of manual and computer-based information systems.
Prerequisites: ACCT 152 and BIS 111

ACCT 315 Intermediate Accounting I 3 Credits
Intensive study of the basic concepts and principles of financial accounting, emphasizing the problems of fair presentation of an entity’s financial position, operating results and cash flows. Understanding of the conceptual framework of accounting, review of the accounting process, and recognition, measurement, valuation and disclosure of current assets, fixed assets, and intangibles. Problem-solving skills and critical analysis are stressed.
Prerequisites: ACCT 152

ACCT 316 Intermediate Accounting II 3 Credits
The sequel to Accounting 315, this course continues with intensive study of recognition, measurement, valuation and disclosure issues relating to such topics as investments, liabilities, leases, pensions, income-taxes, share-based payments, revenue issues, earnings per share, and complexities related to the statement of changes in financial position. Analysis and interpretation of financial statements and problem-solving skills are integral parts of the course.
Prerequisites: ACCT 315

ACCT 317 Advanced Financial Accounting 3 Credits
A study of specialized topics in financial accounting, including partnership accounting, business combinations and consolidated financial statements, segment and interim reporting, foreign currency transactions and translation, and accounting and reporting for governmental and other nonprofit organizations. Involves considerable problem-solving and critical evaluation of controversial theoretical issues.
Prerequisites: ACCT 316

ACCT 318 Analysis of Financial Statements 3 Credits
This course uses financial statement information to analyze companies' profitability and risk. Understanding the form, content and relationships among the financial statements is integrated with the use of ratios and analytic adjustments to augment the information in published financial reports. Current developments, business strategies and off-balance-sheet financing are linked to assessments of companies, performance. Case studies, team projects and presentations involve actual companies, financial statements. Open only to graduating seniors.
Prerequisites: ACCT 316

Can be taken Concurrently: ACCT 316

ACCT 320 Fundamentals of Auditing 3 Credits
An introduction to auditing theory, objectives, and practices related largely to the responsibilities of independent professional accountants. The auditing environment, generally accepted auditing standards, internal control theory, and reporting alternatives are considered. Exposure to operational auditing is provided.
Prerequisites: (ACCT 311 or CSB 311) and (ACCT 315)

ACCT 324 Cost Accounting 3 Credits
An in-depth study of cost concepts appropriate for product costing in a manufacturing operation, planning and controlling routine operations, and nonroutine decision-making. Topics include job order and process costing, joint and by-products, cost allocation, budgeting, standard costing, direct costing, cost-volume-profit analysis, and relevant costs for decisions.
Prerequisites: ACCT 152

ACCT 330 Accounting Data and Analytics 3 Credits
This course uses publicly available financial statement information to programmatically analyze company activities. Obtaining, cleaning, exploring, analyzing with statistical and machine learning methods, and presenting accounting data are explored in a project based format. Non-financial related information analyses are linked to audit and risk assessments. Projects and papers involve actual entities and associated financial information. Credit will not be given for both ACCT 330, Accounting Data and Analytics and MACC 430, Data Analytics for Accountants.
Prerequisites: ECO 045

ACCT 371 Directed Readings 1-3 Credits
Readings and research in various fields of accounting; designed for superior students who have a special interest in some topic or topics not covered by the regularly rostered courses. Written term paper(s) required. Must have preparation acceptable to the department chair.
Repeat Status: Course may be repeated.
ACCT 372 Special Topics 1-3 Credits
Special problems and issues in accounting for which no regularly scheduled course work exists. When offered as group study, coverage varies according to interests of the instructor and students. Must have preparation in accounting acceptable to the department chair.

ACCT 442 Financial Reporting and Analysis 2 Credits
This course focuses on the organization, measurement, and interpretation of economic information in corporate financial reports. It emphasizes the use and interpretation of the financial statements issued by business organizations. Topics include: accounting concepts and principles, accrual accounting, accounting cycle, revenue, expense, asset, liability and equity accounts. Students are exposed to balance sheet valuation, income determination, cash flow analysis, accounting judgment, profit manipulation, evaluation of earnings quality, and the ethical framework to guide business decisions.

ACCT 444 Accounting for Decision Making 2 Credits
This course emphasizes the organization, measurement and interpretation of internal accounting information that managers use to make business decisions. Students learn techniques such as cost analysis, budgeting, performance evaluation, and employee motivation. Topics include: cost flows in service and manufacturing enterprises; product and process costing; transfer pricing; resource planning, evaluation and control through budgeting, make-or-buy decisions; activity-based costing; standard costing, and variance analyses; pricing and production decision making using cost-volume-profit analysis.

Prerequisites: ACCT 442

Business

The designation of “business” refers to general business courses.

Business Minor
Program Admission Requirements: Each spring, approximately 100 students will be accepted into the Business Minor Program for the following fall. Applications to the program will be made by students and submitted to the program director by the last Friday in January. An admissions committee comprised of the Business Minor Program director and the Business Minor curriculum committee will make admission decisions based on G.P.A., experience, and interest in pursuing business opportunities upon graduation from Lehigh (to be evaluated on the basis of a written essay). Students will be notified of admissions decisions prior to registration for the fall semester. Applications are restricted to students from the P.C. Rosin College of Engineering and Applied Science and the College of Arts and Sciences only.

Business Courses
BUS 001 Foundations of Business 1 Credit
This course orients students in the College of Business to the study of business and to the college’s expectations of undergraduates. Different types of business organizations and their goals are introduced, including overviews of the functional areas of business, their contributions to organizations, and their related careers. Students will begin to identify their professional interests, understand the wider context of business, and be exposed to the College of Business programs and resources available to support their academic and professional success.

BUS 003 Business Communication I 1.5 Credit
Good business communication skills are essential for success on the job and career advancement. In this course, students are introduced to the frameworks and skills necessary to deliver communications that are professional, clear, concise, evidence-driven, and persuasive. Emphasis is on basic business communications including memos, reports, and presentations.

Prerequisites: BUS 001 or IBE 050
Can be taken Concurrently: BUS 001, IBE 050
Corequisites: BIS 044

BUS 125 Behavioral Skills Workshop 1 Credit
BUS 125 is a seminar to equip students to work with others in a business setting in making business decisions. The focus of the class is on effective decision making and includes topics such as group and team decision making, conflict resolution and negotiation, ethical decision making, and creative problem solving. This course is offered as a series of intensive workshops in the fall semester and is heavily focused on experiential learning.

Prerequisites: ECO 001

BUS 126 Developing, Producing, and Marketing Products and Services I 3 Credits
Introduction to the key elements in the marketing framework of a corporation. Focus on defining marketing, analyzing the market and competitors, developing effective marketing strategies, segmenting the market, creating customer value, satisfaction and loyalty, analyzing consumer and business markets, creating brand equity, and managing an effective marketing program to deliver the right products and services to the right audience at the right time at the right price and the right time. Experiential learning through the development of a marketing plan.

Prerequisites: BUS 125
Can be taken Concurrently: BUS 125

BUS 127 Developing, Producing, and Marketing Products and Services II 3 Credits
This course extends the marketing management principles initiated in BUS 126 with the development of critical functions needed to implement service strategies for a competitive advantage across various industries. Emphasis is on the measurement and management of service quality, service recovery, linking customer measurements to performance measurements, service blueprinting, and customer co-creation. Additional emphasis on business writing skills and problem solving. Experiential learning through the development of a company service plan.

Prerequisites: BUS 126

BUS 173 Non-Major Summer Internship 1-4 Credits
CBE internships expose students to the business world, enriching their understanding of ideas and problems encountered in their business courses. This course is available summers and open to students in the College of Business & Economics and those in the following programs: CSB, IBE, and Business Minor. Students are evaluated on a directed writing assignment and on a detailed evaluation provided by the work supervisor. A minimum of 150 hours of work must be completed in the internship, and verified by work supervisor. Course registration and related arrangements must be made in advance of the work experience. This course does not satisfy any major requirements. Must have completion of a minimum of 24 college credits.

BUS 203 Business Communication II 1.5 Credit
This course builds on the basic communication frameworks and skills from BUS 003 to enhance students’ business communications related to data, particularly oral communication. Students will translate data and analysis into narratives that provide context for their messages and make persuasive recommendations in written and oral formats.

Prerequisites: BUS 003 and BUS 244 or CSB 311
Can be taken Concurrently: BUS 244, CSB 311

BUS 225 Information Analysis and Financial Decision Making I 3 Credits
An integrated introduction to business, accounting, and finance. Students are introduced to the goals, people, and activities of business before focusing on the fundamental elements of accounting and finance, including financial statement construction and analysis, time value of money, financing and investing with equity and debt, and the impact of various operating decisions on business. Experiential learning and development of team/communication skills are encouraged through portfolio simulation and financial analysis projects.

Prerequisites: BUS 127
BUS 226 Information Analysis and Financial Decision Making II 3 Credits
This course builds upon the foundational teachings of BUS 225 through examination of topics in portfolio management, capital investment decision making, business planning, analysis and reporting, and various specialized topics such as entrepreneurship, business law, ethics, internal control systems, and E-business. Experiential learning and development of team/communication skills are encouraged through group projects and guest speakers.
Prerequisites: BUS 225

BUS 300 Apprentice Teaching 1-3 Credits

BUS 326 Business Strategy 1 Credit
Business Strategy is a capstone covering total enterprise problems in determination, execution, and control within a global setting. The course integrates the theories of production, marketing, finance and organization and provides an opportunity to study the function of higher level management as related to the total business environment through a team-based business simulation. Students will develop a business strategy and make decisions that impact performance metrics of the firm.
Prerequisites: BUS 226
Can be taken Concurrently: BUS 226

BUS 347 Practicum in Real Estate I 2 Credits
This course is an interdisciplinary study of the creation of value in commercial real estate. Organized into groups, with each group assigned a different subject commercial real property, the class engages in the study of the physical and locational characteristics of commercial real estate as they relate to value including: property history; architecture; physical attributes that add to or detract from value; tenant mix; the immediate neighborhood environment; and, the specific market in which the real property competes for tenants. Each group submits a written report of their findings and produces a 10-minute video documentary on their subject property. Permission of the instructor. Students enrolling in this course must also commit to enrolling in the follow-on course - BUS 348 - Practicum in Real Estate II.
Prerequisites: (ECO 145 or ECO 045 or ECO 146) and ACCT 151 and FIN 225

BUS 348 Practicum II in Real Estate 2 Credits
This course is a continuation if the interdisciplinary study of the creation of value in commercial real estate begun in Bus 347 - Practicum in Real Estate I. Organized into groups, with each group continuing with the subject commercial real property assigned to them in Bus 347, the class engages in the study of the market and financial characteristics of commercial real estate as they relate to value through: a financial analysis of the market in which their property is located to include market rents, market vacancy rates and market absorption rates; and, financial analysis of the subject property to include both historical results, and pro forma estimates of revenues, expenses, cash flow and residual value.
Prerequisites: BUS 347

BUS 490 Thesis (Moc) 1 Credit
BUS 499 Dissertation (Moc) 1 Credit

Business and Economics Graduate Programs and Courses
The College of Business is accredited by AASCB International - the Association to Advance Collegiate Schools of Business. Graduate degree programs offered by the college include the Master of Business Administration, the Master of Science in Accounting and Information Analysis, the Master of Science in Applied Economics, the Master of Science in Management, and the Ph.D. in Business and Economics. Interdisciplinary degree programs (p. 450) are offered through partnerships with other colleges: P.C. Rossin College of Engineering and Applied Science - Master of Business Administration and Engineering; P.C. Rossin College of Engineering and Applied Science and the College of Arts and Sciences-Master of Science in Financial Engineering; College of Education-Master of Business Administration and Educational Leadership.
Courses for the programs are taught by faculty from the Accounting (p. 280); Data and Technology Analytics (DATA), Economics (p. 299), Finance (p. 309), Management (p. 311), and Marketing (p. 313) departments.

GRADUATE DEGREES IN BUSINESS ADMINISTRATION AND ECONOMICS
Candidates for admission to graduate study in the College of Business must provide the results obtained in the Graduate Management Admissions Test (GMAT) for the degree in accounting and information analysis. The GMAT or the Graduate Record Examination general test (GRE) must be submitted for degrees in business administration, analytical finance, economics, and management. International applicants are required to take the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IELTS) for admission to the program. Please consult with your program of choice to determine which English tests are appropriate for submission.

MASTER OF BUSINESS ADMINISTRATION
Lehigh MBA programs provide rich learning experiences for students. The College of Business offers two MBA programs: the One Year Full-Time MBA program (1-MBA) and the Flex MBA program.

ONE YEAR FULL-TIME MBA PROGRAM

1-MBA Mission Statement
The One Year Full-Time MBA Program (henceforth 1-MBA) develops and positions students for organizational and career success as strategic thinkers in an environment that seeks solutions beneficial to business and society. In a 12-month program format, it provides not only a rigorous and comprehensive coverage of fundamental business principles but also helps students use an integrated framework for addressing large, multi-stakeholder organizational challenges. Students in the 1-MBA program will apply their learning in a year-long consulting practicum experience, where students will learn about the consulting mindset and translate this, along with their other MBA coursework, into C-level consulting engagements with real companies. 1-MBA students also have opportunities for extensive networking with peers, alumni, experienced executives, faculty, and coaching professionals.

The One Year Full-Time MBA Program (henceforth 1-MBA) is designed for individuals who already have at least two years work experience and wish to either pivot their careers into a business-related area which may not be in their previous field of employment or accelerate their career within their chosen field. This MBA program is designed to accommodate those from non-business related fields, as well as students whose undergraduate major is in business but who may want to change their focus, such as from finance to marketing.

The 1-MBA program, which starts each summer, is a cohort-based, lockstep program initially to develop core knowledge of functional areas and team building. These courses emphasize a stakeholder perspectives approach. A consulting practicum provides students with substantive and practical hands-on experience. The final part of the program emphasizes building domain expertise via electives and a focus on data analytics and leadership. Another feature is a dedicated coaching team consisting of a professional staff member, an alumnus, and a faculty member.

Program Admission Requirements
Admission to the 1-MBA program will be based on standardized scores on the GMAT or GRE, college transcripts with undergraduate degree conferred, 2 recommendation letters, candidate essays, and interviews. Two (2) years of professional work experience is required. International students must show English proficiency as measured by the TOEFL or IELTS.

Further information about the 1-MBA Program may be obtained by contacting the Graduate Programs Office of the College of Business, Lehigh University, College of Business, 621 Taylor Street, Bethlehem PA 18015
phone: (610) 758-4386
email: mba.admissions@lehigh.edu (mbd.admissions@lehigh.edu)
https://cbe.lehigh.edu/academics/graduate/mba-one-year
FLEX MBA PROGRAM
Lehigh's FLEX MBA curriculum is a fully integrated model which simulates the business environment in the classroom. Business issues are viewed and taught from the perspective of the firm as a whole rather than along departmental lines. FLEX MBA students acquire skills in leadership, managerial communication, and resource allocation coupled with a comprehensive understanding of complex domestic and global business issues.

Due to the compact and integrated core, students have increased flexibility to tailor the program to their individual needs. Students may select a concentration in business analytics, corporate entrepreneurship, finance, international business, marketing, project management, or supply chain management or pursue a broader experience by selecting courses from a variety of disciplines. Students may only have one concentration.

The FLEX MBA program is available both on campus and online. Students may opt to attend class through both methods of delivery. FLEX MBA concentrations in business analytics, finance, international business, marketing, and supply chain management are currently available through online study.

FLEX MBA Mission Statement
The FLEX MBA program will further the development of organizational leaders and managers. This is accomplished by honing students' knowledge, skills and abilities through a comprehensive and integrated core curriculum and customized concentrations designed to meet individual needs. The FLEX MBA program will also foster life-long learning through continuing professional education programs.

Innovative Structure
Core Courses
MBA 401 Introduction to the Organization and its Environment 2
MBA 402 Managing Financial and Physical Resources 4
MBA 403 Managing Information 4
MBA 404 Managing Products and Services 4
MBA 405 Managing People 4
MBA 406 Integrative Experience 3

Electives
Select 15 credit hours of elective course work. Students may design an area of study in consultation with their advisor or select an area of concentration. Concentrations require the completion of 12 credit hours of the 15 credits required for elective course work. Students may also complete a maximum of six credit hours of electives outside of the College of Business (but within Lehigh University) with proper approvals. All elective courses must be at the 400 level.

Total Credits 36

Business Analytics Concentration
Credits Required 12
Directed Electives (6 credits)

BIS 458 Data Management for Managers 3
AND

BIS 448 Predictive Analytics in Business 3
OR

BIS 456 Business Analytics for Decision Making 3
Choose 6 credits:
BIS 452 Advanced Topics in Business Analytics 3
ECO 403 Econometric Software 3
GBUS 424 Advanced Topics in Financial Management 3
GBUS 466 Marketing Research and Analysis 3
MACC 430 Data Analytics for Accountants 3

Corporate Entrepreneurship Concentration
Credits Required 12

Select 12 credits from any of the following courses:

GBEN 401 Business Plan I 2
GBEN 402 Business Plan II 2
GBEN 403 Anatomy of Entrepreneurship 1
GBEN 404 Market Opportunity 1
GBEN 405 Intellectual Property 1
GBEN 406 Performing Due Diligence 1
GBEN 407 Startups & pivots 1
GBEN 409 Financial Forecasting 1
GBEN 410 Financing Startups 1
GBEN 412 Going Public 1
GBEN 413 Integrative Experience/New Venture Internship 1-4
GBEN 414 Ventures in Brand Licensing 1
GBEN 415 LehighSiliconValley 1-3
GBEN 492 Special Topics 1-3

Finance Concentration
Credits Required 12
Directed Electives (6 credits)

GBUS 419 Financial Management 3
GBUS 420 Investments 3
Choose 2 of 3 courses (6 credits)
GBUS 424 Advanced Topics in Financial Management 3
GBUS 426 Financial Markets and Institutions 3
GBUS 473 International Finance 3

International Business Concentration
Credits Required 9
Select 9 credits from the following courses:

GBUS 473 International Finance 3
GBUS 475 Global Marketing Strategies 3
GBUS 492 Special Topics (Repeatable, includes immersion trips) 1-4

Marketing Concentration
Credits Required 12
Select 12 credits from the following:

GBUS 460 Strategic Marketing Management 3
GBUS 465 Creating Breakthrough Innovations 3
GBUS 466 Marketing Research and Analysis 3
GBUS 467 Sales Management 3
GBUS 470 Marketing Communications Strategies 3
GBUS 471 Strategic Brand Management 3
GBUS 475 Global Marketing Strategies 3

Project Management Concentration
Credits Required 12
Directed Electives (7 credits)

PMGT 409 Project Management Fundamentals
PMGT 410 Project Requirements and Scope Management
PMGT 411 Project Scheduling, Estimating & Budgeting
PMGT 413 Project Risk Management
PMGT 416 Decision Making and Ethics on Projects
Choose 5 credits:
PMGT 412 Advanced Scheduling & Scheduling Tools
PMGT 414 Managing Project Quality
PMGT 415 Project Procurement & Negotiation
PMGT 417 Project Leadership
PMGT 418 Facilitation and Teamwork for Projects
Flexible Class Scheduling

Classes are scheduled Monday through Thursday evenings, with seminars offered on Fridays and Saturdays and full week immersions available. Part-time students may complete the entire program with evening classes. Many students accelerate completion of the program by taking courses during the two six-week summer sessions.

Further information about the FLEX MBA Program may be obtained by contacting the Graduate Programs Office of the College of Business, Lehigh University, College of Business, 621 Taylor Street, Bethlehem PA 18015

phone: (610) 758-4386
email: mba.admissions@lehigh.edu (mbd.admissions@lehigh.edu)

www.lehigh.edu/mba

MASTER OF BUSINESS ADMINISTRATION AND EDUCATIONAL LEADERSHIP

The MBA & Educational Leadership joint degree program offers students the opportunity to acquire a solid foundation in both business and education. Designed to develop the administrative skills required in today’s educational systems, the MBA/Ed. Leadership provides a framework where excellent education and sound business practices can flourish. The MBA/Ed. Leadership will provide an additional option for business students in educational leadership. The program will enhance the students’ marketability in private and public sector education while providing students with an understanding of the cultures of both business and education. Core courses from both colleges will ensure that recipients of the joint degree will bring to their future positions an extraordinary medley of skills to manage human and financial resources efficiently while employing expertise in instructional supervision and training in both education and corporate settings. This program of study will enhance training and skills for those currently in the area of business and financial management in the field of education. The Lehigh MBA and Educational Leadership degree is a joint, 45 credit hour program.

ADMISSION REQUIREMENTS

Applications need to be approved through both the MBA Program and the Educational Leadership program. Students are required to take the GMAT. Students must have at least 2 years of professional post graduate work experience to apply for this joint degree program.

Further information about the program may be obtained by contacting Dr. Floyd D. Beachum, Associate Professor, College of Education, 610-758-5955 or fdb209@lehigh.edu.

MASTER OF BUSINESS ADMINISTRATION AND ENGINEERING

The University is committed to developing leaders in business and in industry; the MBA & Engineering degree unites two premier programs in one powerful joint degree by offering a solid foundation in both business and engineering.

Graduates of the MBA & Engineering program will be prepared to assume leadership positions in industrial planning, venture capital, and engineering management; and as senior managers in roles requiring both technical and business acumen.

The 45 credit hour program is taught in an interactive manner by faculty who are leaders in their fields with a wealth of practical experience; it also combines core business courses and a core of engineering courses:

The basic 45 credit hour course sequence consists of:

- MBA core courses
- Engineering core courses
- Business electives
- Engineering electives
- Free electives
- Integrated project

Total Credits 45

Students can choose an appropriate engineering curriculum from any of the following programs – chemical engineering, civil engineering, computer engineering, computer science, electrical engineering, environmental engineering, industrial and systems engineering, manufacturing systems engineering, materials science and engineering, mechanical engineering, or polymer science and engineering.

MBA Core Courses

<table>
<thead>
<tr>
<th>MBA Core Course</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBA 401</td>
<td>Introduction to the Organization and its Environment</td>
<td>2</td>
</tr>
<tr>
<td>MBA 402</td>
<td>Managing Financial and Physical Resources</td>
<td>4</td>
</tr>
<tr>
<td>MBA 403</td>
<td>Managing Information</td>
<td>4</td>
</tr>
</tbody>
</table>
Applications who do not have an undergraduate business degree will likely require two years to complete the program. The first year is devoted to background courses and the second to the graduate program itself.

Mission Statement
Lehigh University’s Master of Science in Accounting and Information Analysis provides a broad business education and the specialized coursework for a professional career in accounting. Graduates aspire to leadership positions at top-tier organizations in fields that include public accounting, corporate accounting, financial services, consulting, and information systems. Through this program, Lehigh continues a long tradition of providing accounting majors with the necessary educational requisites for licensure as certified public accountants within the United States and its territories. The program seeks only the best and the brightest applicants: motivated, dedicated to their studies, not afraid of challenges, possessing confidence, self-discipline, and the ability to articulate their ideas orally and in writing. The program continually pursues the excellence necessary to meet the standards of only the highest-quality educational institutions.

Core Program
The MSAIA core consists of eighteen credits in the courses shown below and thirty credits overall. Designed specifically for this program, and dedicated to it, these innovative courses seek to develop a set of skills and experiences not available in undergraduate programs that will enhance MSAIA students’ ability to perform throughout their chosen careers. Core courses are offered once each academic year.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MACC 412</td>
<td>IT Auditing</td>
<td>3</td>
</tr>
<tr>
<td>MACC 413</td>
<td>The Corporate Financial Reporting Environment</td>
<td>3</td>
</tr>
<tr>
<td>MACC 424</td>
<td>Governance, Risk and Control</td>
<td>3</td>
</tr>
<tr>
<td>MACC 420</td>
<td>Fraud Examination and Forensic Accounting</td>
<td>3</td>
</tr>
<tr>
<td>MACC 427</td>
<td>Reporting and Auditing Fair Value Estimates</td>
<td>3</td>
</tr>
<tr>
<td>MACC 430</td>
<td>Data Analytics for Accountants</td>
<td>3</td>
</tr>
<tr>
<td>ELECTIVES</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Total Credits</td>
<td></td>
<td>30</td>
</tr>
</tbody>
</table>

Electives
The MSAIA curriculum provides for twelve elective credits that students may use to specialize in an area of interest or to augment one’s general business education. Frequently-taken electives include graduate-level courses in predictive analytics, business information systems, taxation and business decisions, financial statement analysis, corporate financial management, investments, strategic supply management, managerial economics, and strategic marketing management.

Waiver Policy
There are no waivers for courses in the M.S. in Accounting and Information Analysis Program.

GMAT Scores
All applicants are required to take the Graduate Management Admissions Test (GMAT). GMAT scores have been averaging 670. A score of at least 600 and 50th percentile in the quantitative sections will improve the prospects for admission. Undergraduate students should take the exam in the senior year. To make an appointment to take the GMAT exam call 1-800-717-GMAT (4628) or by registering online at www.mba.com (http://www.mba.com). The GMAT is waived for Lehigh accounting majors.

President’s Scholars
President’s Scholars must meet normal admission standards.

International Students/TOEFL®
International students must have 16 years of formal education, including four years at the university level, to be considered for admission to Lehigh’s graduate programs. Applicants whose native language is not English are required to take the Test of English as a Foreign Language (TOEFL®). For information, contact www.ets.org/toefl (http://www.ets.org/toefl). The MSAIA program features considerable student/faculty interaction in class. Very good English language skills are
therefore highly important to success in the program. An internet-based TOEFL (IBT) of 105 will improve the prospects for admission. Admitted applicants typically are required to complete the English as a Second Language American Business English (ABE) program before beginning their graduate program.

Further information about the MSAIA program may be obtained by contacting the Graduate Programs Office of the College of Business, Lehigh University, 621 Taylor Street, Bethlehem PA 18015; phone: (610) 758-4386 email: business@lehigh.edu; or Professor David Hinichs, Director, M.S. in Accounting and Information Analysis Program, phone: (610) 758-4674 email: djh404@lehigh.edu.

http://cbe.lehigh.edu/msaia

MASTER OF SCIENCE IN APPLIED ECONOMICS

The program requires 30 credit hours, typically completed in 16 months starting in the fall of one academic year and finishing in the fall of the subsequent year. Some students may complete the program in 12 months by taking extra courses in the fall and spring semesters and in the summer session.

**Core Required Courses**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECO 402</td>
<td>Managerial Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECO 403</td>
<td>Econometric Software</td>
<td>3</td>
</tr>
<tr>
<td>ECO 412</td>
<td>Mathematical Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECO 415</td>
<td>Econometrics I</td>
<td>3</td>
</tr>
<tr>
<td>ECO 417</td>
<td>Advanced Macroeconomic Analysis</td>
<td>3</td>
</tr>
</tbody>
</table>

**Program Tracks - choose one of the two tracks below**

A. Competition and Market Analysis

<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECO 404</td>
<td>Applied Microeconometrics</td>
<td>3</td>
</tr>
<tr>
<td>ECO 447</td>
<td>Economic Analysis of Market Competition</td>
<td>3</td>
</tr>
</tbody>
</table>

Plus one of the following:

<table>
<thead>
<tr>
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<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECO 431</td>
<td>Quantitative Market Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ECO 456</td>
<td>Industrial Organization</td>
<td>3</td>
</tr>
<tr>
<td>ECO 463</td>
<td>Topics in Game Theory</td>
<td>3</td>
</tr>
<tr>
<td>ECO 325</td>
<td>Consumer Insights through Data Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ECO 336</td>
<td>Antitrust, Regulation, and the New Economy</td>
<td>3</td>
</tr>
<tr>
<td>BIS 448</td>
<td>Predictive Analytics in Business</td>
<td>3</td>
</tr>
</tbody>
</table>

B. Policy Economics

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<tbody>
<tr>
<td>ECO 404</td>
<td>Applied Microeconometrics</td>
<td>3</td>
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</table>

Plus two of the following:

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<tr>
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<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECO 425</td>
<td>Cost-Benefit Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ECO 440</td>
<td>Labor Economics I</td>
<td>3</td>
</tr>
<tr>
<td>ECO 441</td>
<td>Labor Economics II</td>
<td>3</td>
</tr>
<tr>
<td>ECO 428</td>
<td>Electricity Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECO 460</td>
<td>Time Series Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ECO 303</td>
<td>Economic Development</td>
<td>3</td>
</tr>
<tr>
<td>ECO 311</td>
<td>Environmental Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECO 322</td>
<td>Competitor and Market Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ECO 328</td>
<td>Electricity Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECO 336</td>
<td>Business and Government</td>
<td>3</td>
</tr>
<tr>
<td>ECO 339</td>
<td>International Trade</td>
<td>3</td>
</tr>
<tr>
<td>ECO 340</td>
<td>International Finance</td>
<td>3</td>
</tr>
<tr>
<td>ECO 345</td>
<td>Political-Economy of Iraq</td>
<td>3</td>
</tr>
<tr>
<td>ECO 353</td>
<td>Public Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECO 365</td>
<td>Business, Government, and Macroeconomic Policy</td>
<td>3</td>
</tr>
<tr>
<td>ECO 368</td>
<td>Health Economics</td>
<td>3</td>
</tr>
</tbody>
</table>

**Elective Courses**

Substitutions may be permitted for courses that count toward the program tracks, with approval of the M.S. program advisor. Students may choose to write an master’s thesis as part of their elective credits.

The thesis is worth up to six credit hours and is particularly encouraged for those who may be considering a Ph.D. in economics.

Further information about the M.S. in Applied Economics Program may be obtained by contacting the Graduate Programs Office of the College of Business or Dr. Seth Richards-Shubik, Director M.S. in Applied Economics Program, Lehigh University, College of Business, 621 Taylor Street, Bethlehem PA 18015, email sethrs@lehigh.edu.

Further information about the M.S. in Applied Economics Program may be obtained by contacting the Graduate Programs Office of the College of Business, Lehigh University, 621 Taylor Street, Bethlehem PA 18015; phone: (610) 758-6243 email: business@lehigh.edu.

http://cbe.lehigh.edu/mseco

MASTER OF SCIENCE IN MANAGEMENT

The M.S. in Management (M²) is a nine-month program designed to build core business education onto the foundation of a liberal arts or scientific degree (such as engineering or nursing). M² prepares students with liberal arts or scientific undergraduate education to enter the workforce and ready to hit the ground running from day one. Eligible applicants are college seniors or recent (one year out) graduates without undergraduate business degrees or majors. Economics majors are welcome. College calculus is helpful but not mandatory for admission.

Students will have classes that include accounting, finance, statistics, management, economics, and marketing. The program is structured to provide classroom instruction in the fall and spring semesters. In addition, the program will include career exploration (such as trips to New York and Washington DC), and professional development (such as presentation skills and business etiquette). During the January intersession, students will have the opportunity to have an optional experiential engagement through internships, consulting projects, and/or international immersion experiences.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCT 442</td>
<td>Financial Reporting and Analysis</td>
<td>2</td>
</tr>
<tr>
<td>ACCT 444</td>
<td>Accounting for Decision Making</td>
<td>2</td>
</tr>
<tr>
<td>BIS 423</td>
<td>Management Information Systems</td>
<td>2</td>
</tr>
<tr>
<td>BIS 456</td>
<td>Business Analytics for Decision Making</td>
<td>3</td>
</tr>
<tr>
<td>ECO 427</td>
<td>Statistical Analysis for Management</td>
<td>2</td>
</tr>
<tr>
<td>ECO 448</td>
<td>Business Economics</td>
<td>3</td>
</tr>
<tr>
<td>FIN 418</td>
<td>Principles of Corporate Finance and Investments</td>
<td>3</td>
</tr>
<tr>
<td>LAW 417</td>
<td>Regulatory Environment of Business</td>
<td>2</td>
</tr>
<tr>
<td>MGT 416</td>
<td>Managing Talent</td>
<td>3</td>
</tr>
<tr>
<td>MGT 462</td>
<td>Experiential Learning Capstone</td>
<td>3</td>
</tr>
<tr>
<td>MKT 415</td>
<td>Marketing Foundations</td>
<td>3</td>
</tr>
<tr>
<td>MKT 425</td>
<td>Contemporary Topics in Marketing</td>
<td>2</td>
</tr>
<tr>
<td>SCM 423</td>
<td>Supply Chain Operations Management</td>
<td>2</td>
</tr>
</tbody>
</table>

**Total Credits** 32

Further information about the M² program may be obtained by contacting the Graduate Programs Office of the College of Business, Lehigh University, 621 Taylor Street, Bethlehem PA 18015, email: business@lehigh.edu; or Alyssa Clapp, Director, M.S. in Management Program, phone: (610) 758-2353, email: a(clapp@lehigh.edu).

www.lehigh.edu/m2

DOCTOR OF PHILOSOPHY

Program Requirements

The Ph.D. program requires a minimum of 48 semester hours of study (including dissertation) beyond the master’s degree or 72 hours of study beyond the bachelor’s degree. Each student is required to choose one major field and one minor field of specialized study. Students must take core courses in microeconomics, macroeconomics, econometrics, and mathematical economics. Students must also take written, qualifying examinations in microeconomic theory and econometrics as well as an examination in their major field of study. As a condition for advancement to candidacy, a student must write an original third-year
paper (the pre-dissertation research project) suitable for submission to a scholarly journal. The major fields of specialization normally available include, but are not necessarily limited to, health economics, labor economics, applied econometrics, applied macroeconomics, and industrial organization.

Under the guidance of a dissertation chairperson and committee, the candidate undertakes research culminating in a dissertation. The Ph.D. is awarded upon the successful completion of the doctoral dissertation and its oral defense.

Further information about the Ph.D. in Business and Economics Program may be obtained by contacting the Graduate Programs Office of the College of Business or the Director of the Ph.D. in Business and Economics Program, Lehigh University, College of Business, 621 Taylor Street, Bethlehem PA 18015.

Email: business@lehigh.edu

http://cbe.lehigh.edu/phd

Professors. Paul Brockman, PHD (Louisiana State University); Shin-Yi Chou, PHD (Duke University); James A. Dearden, PHD (The Pennsylvania State University); Mary E. Deily, PHD (Harvard University); Frank R. Gunter, PHD (Johns Hopkins University); Kathleen W. Hanley, PHD (University of Florida); Richard J. Kish, PHD (University of Florida); Judith A. McDonald, PHD (Princeton University); Matthew A. Melone, JD (University of Pennsylvania); Chad Meyerhoefer, PHD (Cornell University); Vincent G. Munley, PHD (State University of NY at Binghamton); George A. Nation, III, JD (Villanova University); Nandkumar Nayar, PHD (University of Iowa); Georgette C. Phillips, JD (University of Pennsylvania); John R. McNamara, PHD (Rensselaer Polytechnic Institute); Theodore W. Schlie, PHD (Northwestern University); Bruce M. Smackey, PHD (Rensselaer Polytechnic Institute); John E. Stevens, PHD (University of Cincinnati); Stephen F. Thode, DBA (Indiana University Bloomington); Robert J. Thornton, PHD (University of Illinois)

Business Information Systems Courses

BIS 423 Management Information Systems 2 Credits
This course examines the role of information systems (IS) and information technology (IT) in the organization. The focus of the course is the organizational uses of IS and IT to compete effectively. Both technical and managerial aspects of information systems are explored.

The course includes technical infrastructure, management decision-making, trends and innovations in IS, and business process issues critical to the understanding of operational and strategic information systems.

BIS 448 Predictive Analytics in Business 3 Credits
The course covers theories and practices in predictive analytics in business. Students will have hands-on experience on analyzing business data for business intelligence and improved business decision making. Includes: key theories, concepts, and models of predictive analytics; and data mining tools to formulate and solve business problems. The course uses data analytics software and real data. Topics include prediction, forecasting, classification, clustering, data-visualization and data reduction techniques. Not available to students who have credit for BIS 348 or BIS 456.

Prerequisites: BUEC or ECO 045

BIS 452 Advanced Topics in Business Analytics 3 Credits
This course covers advanced analytic methods for understanding and solving business problems. The emphasis is on understanding and applying a wide range of modern techniques to specific decision-making situations. Using the programming language R, the course covers advanced topics such as machine learning, text mining, and social network analysis. Upon completion, students will have valuable practical analytical skills to handle large datasets and make business decisions. Credits will not be given for both BIS 352 and BIS 452.

Prerequisites: BUEC or ECO 045

BIS 456 Business Analytics for Decision Making 3 Credits
Provides students with a theoretical and practical understanding of core data analytics concepts and techniques, and develops hands-on experience in applying these techniques to practical real-world business problems using R software. As an applied course, the emphasis will be less on the inner working of each method and more on when and how to use each technique and how to interpret the results. Not available to students who have credit for BIS 348 or BIS 448.

Prerequisites: MBA 440 or ECO 045

BIS 458 Data Management for Managers 3 Credits
Covers fundamentals of database management, including database development, processing, logical and physical design, access, implementation and administration, and design and deployment of cloud services solutions. Students will gain extensive experience in developing data models, creating relational databases, formulating and executing complex queries, and understanding cloud services solutions in cloud resource costing, deployment management, network design, data storage, security, scalability and elasticity, cloud migration and hybrid architecture. Hands-on experiences such as such as Oracle Database and Amazon Web Services are included.
Economics Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECO 401</td>
<td>Basic Statistics for Business and Economics 3 Credits</td>
<td>3</td>
<td>Descriptive statistics, probability and probability distributions, estimation, hypothesis testing, correlation and regression, chi-square analysis, and analysis of variance. Computer applications.</td>
</tr>
<tr>
<td>ECO 402</td>
<td>Managerial Economics 3 Credits</td>
<td>3</td>
<td>Application of economic and statistical analysis to managerial decision-making. Business and economic forecasting. Empirical estimation of demand, production, and cost functions. Resource allocation and pricing strategies in various market structures. Decisions under risk and uncertainty. Government regulation of business cases. Prerequisites: MATH 021 and (MATH 022 or MATH 096) and ECO 401</td>
</tr>
<tr>
<td>ECO 403</td>
<td>Econometric Software 3 Credits</td>
<td>3</td>
<td>The fundamentals of data management and analysis using statistical software, such as Stata and/or SAS. Data management and programming skills using the Stata or SAS system will be developed. An introduction to R and basic programming in R will be included as well. Working with big data will provide hands-on, practical experience. Upon completion of this course students will be able to manage data to boost their research and analysis skills.</td>
</tr>
<tr>
<td>ECO 404</td>
<td>Applied Microeconomics 3 Credits</td>
<td>3</td>
<td>The purpose of this course is to expose students to econometric techniques frequently used in applied microeconomic research. The course features critical reading of empirical research papers and the implementation of econometric methods on actual data sets.</td>
</tr>
<tr>
<td>ECO 406</td>
<td>Econometric Software 3 Credits</td>
<td>3</td>
<td>The role of financial intermediation in the U.S. economy, the process of money creation, impacts of fiscal and/or monetary policy on the goals of macroeconomic policy, inflation and unemployment.</td>
</tr>
<tr>
<td>ECO 412</td>
<td>Mathematical Economics 3 Credits</td>
<td>3</td>
<td>Applications of various mathematical techniques in the formation and development of economic concepts and theories. Consent of instructor required.</td>
</tr>
<tr>
<td>ECO 413</td>
<td>Advanced Microeconomics Analysis 3 Credits</td>
<td>3</td>
<td>A survey of methods of decision-making at the microeconomic level; price theory and econometric applications. Prerequisites: ECO 402</td>
</tr>
<tr>
<td>ECO 414</td>
<td>Advanced Topics in Microeconomics 3 Credits</td>
<td>3</td>
<td>Resource allocation and price determination. Theories of choice of consumers, firms, and resource owners under various market forms. Prerequisites: ECO 413</td>
</tr>
<tr>
<td>ECO 415</td>
<td>Econometrics I 3 Credits</td>
<td>3</td>
<td>Computer applications of standard econometric techniques using regression analysis in a single-equation context. Discussion of problems of multicollinearity, heteroscedasticity and autocorrelation. An introduction to simultaneous equation models, identification and estimation problems.</td>
</tr>
<tr>
<td>ECO 416</td>
<td>Econometrics II 3 Credits</td>
<td>3</td>
<td>Mathematical and statistical specification of economic models. Statistical estimation and tests of parameters in single and multiple equation models. Prediction and tests of structural change. Prerequisites: ECO 415</td>
</tr>
<tr>
<td>ECO 417</td>
<td>Advanced Macroeconomic Analysis 3 Credits</td>
<td>3</td>
<td>Macroeconomic theory and policy. Emphasis on theoretical models and policy implications.</td>
</tr>
<tr>
<td>ECO 418</td>
<td>Advanced Topics in Macroeconomics 3 Credits</td>
<td>3</td>
<td>Models of employment, income and growth in monetary economies. Policies for economic stability and growth. Prerequisites: ECO 417</td>
</tr>
<tr>
<td>ECO 423</td>
<td>Real Options 3 Credits</td>
<td>3</td>
<td>This is an introductory graduate level course in financial economics. It is intended for students with strong technical backgrounds who are comfortable with mathematical arguments. The course is divided into three major parts: deterministic finance, single-period uncertainty finance, and options theory and its applications. Prerequisites: GBUS 420</td>
</tr>
<tr>
<td>ECO 425</td>
<td>Cost-Benefit Analysis 3 Credits</td>
<td>3</td>
<td>Theory and methods of cost-benefit analysis; efficiency and equity as criteria in program evaluation; proper measurement of market and non-market costs and benefits; consideration of risk, uncertainty, appropriate discounting techniques, and distributional consequences; applications to the evaluation of health care policies and therapies. Prerequisites: ECO 402 and ECO 415</td>
</tr>
<tr>
<td>ECO 427</td>
<td>Statistical Analysis for Management 2 Credits</td>
<td>3</td>
<td>Descriptive statistical measures, probability and probability distributions, statistical inference (estimation and hypothesis testing), correlation and regression. EXCEL will be used for statistical computing.</td>
</tr>
<tr>
<td>ECO 428</td>
<td>Electricity Economics 3 Credits</td>
<td>3</td>
<td>The course will focus on the intersection between economics and electricity systems, and the market structures available in the electric energy industry. The course is intended to provide a background on basic economic theory applied to power systems, to understand operations objectives, pricing and incentives and non perfect competition situations that arise in the network. Different dispatch optimization problems used in the restrucutres electricity market will be discussed, approaches to solve these problems, and the existence of non-convex markets. Prerequisites: ECO 001 and (ECO 146 or MATH 023)</td>
</tr>
<tr>
<td>ECO 429</td>
<td>Monetary Theory 3 Credits</td>
<td>3</td>
<td>The role of money in the economy from theoretical and empirical perspectives. The influence of money and prices, interest rates, output, and employment.</td>
</tr>
<tr>
<td>ECO 430</td>
<td>Public Finance 3 Credits</td>
<td>3</td>
<td>The economics of public spending and taxation; principles of government debt management; theories of budgeting and cost-benefit analysis and public choice.</td>
</tr>
<tr>
<td>ECO 431</td>
<td>Quantitative Market Analysis 3 Credits</td>
<td>3</td>
<td>The course covers the application of empirical approaches to theoretical frameworks in the analysis of market structure, firm strategies, and consumer behavior. Students learn econometric methods to identify causal relationships, and the course emphasizes the role of theoretical models in developing hypotheses and interpreting data. The course covers methods of field experiments and causal inference using non-experimental data. Topics include pricing and market conduct, demand analysis, marketing, and online marketplaces. Students cannot receive credit for both ECO 366 and ECO431.</td>
</tr>
<tr>
<td>ECO 440</td>
<td>Labor Economics I 3 Credits</td>
<td>3</td>
<td>The economics of labor markets and various labor-market institutions with emphasis on current theoretical and empirical research. Topics include labor supply and demand, human capital, the structure of labor markets, labor market regulation, information and job search, labor mobility, unionism, and labor market discrimination. Prerequisites: ECO 402</td>
</tr>
<tr>
<td>ECO 441</td>
<td>Labor Economics II 3 Credits</td>
<td>3</td>
<td>An examination of empirical research in labor economics, focusing on topics such as human resource management and internal labor market outcomes, wage and income inequality and poverty, unemployment, and other issues current in the literature. Prerequisites: ECO 402 and ECO 415</td>
</tr>
<tr>
<td>ECO 447</td>
<td>Economic Analysis of Market Competition 3 Credits</td>
<td>3</td>
<td>Mathematical models based on game theory and industrial organization. Cases are used to analyze the strategic interaction of firms and governments as competitors and partners. Prerequisites: ECO 402</td>
</tr>
<tr>
<td>ECO 448</td>
<td>Business Economics 3 Credits</td>
<td>3</td>
<td>Applications of economic analysis to business decision-making; technology in economic systems; resource allocation and pricing strategies in various market structures; decisions under risk and uncertainty; and government regulation and support of business and innovation.</td>
</tr>
<tr>
<td>ECO 454</td>
<td>Economics of Environmental Management 3 Credits</td>
<td>3</td>
<td>Economic theory of natural resources. Optimal policies for the development of renewable and nonrenewable resources and environmental quality. Prerequisites: ECO 402</td>
</tr>
</tbody>
</table>
ECO 455 Health Economics I 3 Credits
Economic theory and empirical analysis of health production, the
demand for health services, and health insurance. Implications for the
current institutional structure of health care and health delivery systems
will also be discussed. Additional topics and extensions will be selected
based on developments in the literature.
Prerequisites: ECO 402 and ECO 415

ECO 456 Industrial Organization 3 Credits
The goal of the course is to examine theoretical and empirical attempts by
economists to understand market structures lying between the extremes
of perfect competition and monopoly. The course will focus first on
describing the current U.S. industrial structure and reviewing models
of imperfect competition. The course then shifts to a closer study of
individual firm behavior. The final segment of the course is an overview
of two significant relationships between government and industry caused
by the existence of imperfect.
Prerequisites: ECO 415 and ECO 447

ECO 457 Bio-Pharmaceutical Economics 3 Credits
Characteristics of the market for pharmaceuticals; barriers to entry,
competition and innovation; pricing and regulation; physician prescribing
behavior; commercialization and financing of biotech startups;
international comparisons of public policy.
Prerequisites: ECO 401 and ECO 402

ECO 460 Time Series Analysis 3 Credits
Classical decomposition of time series, trend analysis, exponential
smoothing, spectral analysis and Box-Jenkins autoregressive and
moving average methods.

ECO 461 Forecasting 3 Credits
Methods of economic and business forecasting.

ECO 463 Topics in Game Theory 3 Credits
A mathematical analysis of how people interact in strategic situations.
Topics include normal-form and extensive-form representations of
games, various types of equilibrium requirements, the existence and
characterization of equilibria, and mechanism design. The analysis is
applied to micro-economic problems including industrial organization,
inter-national trade, and finance. Must have completed two semesters of
calculus.
Prerequisites: ECO 412 and ECO 413

ECO 464 Applied Econometrics I 3 Credits
This course focuses on the identification of causal relationships using
cross-sectional and panel data. The objectives are to 1) familiarize
students with identification assumptions for causal inference; and 2)
enable students to select appropriate econometric tools for empirical
economic problems and policy evaluation. Topics include robust
inference and bootstrap; quantile and nonparametric regression methods;
treatment effect analysis, and models for discrete choices, panel data,
and social interactions.
Prerequisites: ECO 416

ECO 465 Applied Econometrics II 3 Credits
Econometric analysis of skewed and truncated distributions, discrete
outcomes, and missing or incomplete data. The first part of this course
will involve the functional specification and testing of appropriate
estimators in these situations, while the second part of the course
will focus on conducting causal inference using nonlinear models in
the presence of unobserved heterogeneity. Emphasis will be given to
common applications in health and labor economics.
Prerequisites: ECO 416

ECO 466 Health Economics II 3 Credits
Selected topics in the literature on health economics with an emphasis
on the application and evaluation of econometric techniques and
identification strategies. Both demand and supply side issues will be
addressed. Examples of the former include the demand for health,
health insurance and health care services, while examples of the latter
include the regulation of supplier behavior and industrial organization
issues.
Prerequisites: ECO 402 and ECO 416

ECO 472 International Trade Theory 3 Credits
Theories of comparative advantage, factor price equalization, trade and
welfare, tariffs, trade and factor movements.
Prerequisites: ECO 413

ECO 473 International Monetary Economics 3 Credits
Theory of the balance of payments, the microeconomics of international
finance, various approaches to balance-of-payments adjustments,
theories of foreign exchange-rate determination, and macroeconomic
policy under fixed and flexible exchange rates.
Prerequisites: ECO 417

ECO 490 Master’s Thesis 0-6 Credits
ECO 492 Special Topics in Economics 1-3 Credits
Extended study of an approved topic not covered in scheduled courses.
Repeat Status: Course may be repeated.

ECO 493 Doctoral Pre-Dissertation Research Project - Independent
Study 1-9 Credits
Independent study on a topic that is being pursued to fulfill the third year
paper requirement, and has been approved by the student’s interim
advisor.

ECO 499 Dissertation 1-15 Credits
Repeat Status: Course may be repeated.

Finance Courses
FIN 418 Principles of Corporate Finance and Investments 3 Credits
This course provides students with a basic foundational knowledge of
finance principles, working knowledge of various aspects of corporate
finance, and the principles of investments. Short-term financial decisions
will be discussed. Long-term capital investment will be explored
starting with the basics of time value of money and capital investment
techniques. Topics include the determination of the appropriate
investment discount rate, the organization of capital and hurdle rates, the risk-reward tradeoff, and specific financial instruments.

Grad Business Entrepreneurship Courses
GBEN 401 Business Plan I 2 Credits
This course focuses on the need to validate that a market exists for
a new product or service. As a project-based course, students work
independently on a venture of their own choosing. They are challenged
to make use of primary market research methods to identify demand
determinants and test for the presence of first-time buyers. Students
search available databases and gather information to estimate market
size and growth potential.

GBEN 402 Business Plan II 2 Credits
This course focuses on the need to create a business plan to launch a
new enterprise. As a project-based course, students work independently
on a venture of their own choosing. Emphasis is given to all the
elements needed to commercialize a new enterprise from a marketing,
sales, operations, technology, facilities, and financial perspective. The
presentation format of the business plan receives close attention as a
tool to attract potential investors.
Prerequisites: GBEN 401

GBEN 403 Anatomy of Entrepreneurship 1 Credit
This course focuses on the personality traits and characteristics of
a founder. The leadership style and management of a startup
are highlighted as the venture moves through various stages of
development. Real-life situations are brought into the classroom and
students are challenged to formulate decisions in the role of the founder.

GBEN 404 Market Opportunity 1 Credit
This course focuses on entrepreneurial marketing and the methods
employed by emerging growth companies to successfully penetrate
and disrupt markets. Speakers and cases illustrate branding strategies,
selling approaches, pricing alternatives, and digital marketing tactics
peculiar to startups who are constrained by scarce resources and
saddled with expertise in the hands of a few.
GBEN 405 Intellectual Property 1 Credit
This course focuses on IP strategy and valuation with emphasis on the technology-driven startup. Early stage companies must demonstrate proof-of-concept to their investors, a huge milestone that verifies the potential of real-world application. Speakers and cases deal with the harsh trade-offs of IP decision-making and the constant need to raise capital to accelerate technology development.

GBEN 406 Performing Due Diligence 1 Credit
This course focuses on due diligence as a creative and time-sensitive process that can open or close doors for startups. Speakers and cases illustrate what potential investors or acquirers do to validate the accuracy, integrity, and completeness of information provided before finalizing an investment decision. Students learn performing due diligence is a labor-intensive investigative process that unfolds in stages where the results also speak to the credibility of the entrepreneur.

GBEN 407 Startups & Pivots 1 Credit
This course focuses on the need to pivot, or shift direction, when market conditions and revenue shortfalls dictate major change. Speakers and cases highlight what startups do to breathe new life into a troubled venture. Students learn how founders raise capital under adverse circumstances in order to buy time to re-configure product, transition to another market and type of customer, and test a new business model.

GBEN 409 Financial Forecasting 1 Credit
This course focuses on the use of pro forma financial statements and projections to value and finance an early stage company. Cases illustrate key assumptions and various scenarios that figure into a multi-year forecast. Business models are evaluated for their profit potential during a period of expansion and growth. Students learn the art and science of valuing a startup.

GBEN 410 Financing Startups 1 Credit
This course focuses on the separate but overlapping worlds of angel investors, venture capitalists, and strategic investors. Their funding role, investment objectives, and market behaviors are analyzed in capital raises for seed through late stage companies. Cases give attention to venture capital and their term sheets. The course culminates in a simulated deal negotiation involving students.

GBEN 412 Going Public 1 Credit
The course focuses on the initial public offering [IPO] or how the venture capital-backed company moves from being privately-held to publicly-held. Major emphasis is placed on the role of the investment banker and the workings of the Securities & Exchange Commission [SEC]. Actual IPOs traded on the NYSE or NASDAQ are dissected from every angle before, during, and after a company goes public.

GBEN 413 Integrative Experience/New Venture Internship 1-4 Credits
Only students enrolled in the Entrepreneurial concentration may elect one of these hands-on, project-orientated s. Integrative Experience must meet the requirements of formal independent study and involve a new venture situation with a startup or existing company. Students employed in a New Venture Internship may also qualify for credit if the same requirements are satisfied.

GBEN 414 Ventures in Brand Licensing 1 Credit
This course focuses on the art and science of building new enterprises by utilizing licensing strategies to leverage the power and influence of brands. A wide cross-section of deal structures and negotiation strategies are explored. Key elements of a licensing contract are dissected from a market, economic, and legal perspective. The approach to learning is hands-on with speakers, interactive exercises, and real-life situations shedding light on the emergence of brand licensing as an alternative path to new venture creation.

GBEN 415 LehightSiliconValley 1-3 Credits
Immersion study-abroad-like program focused on venture capital-backed companies and the paths taken to start, build, and exit an enterprise. Offered in the hub of entrepreneurship, Silicon Valley, live cases draw on seasoned practitioners from all reaches of the venture community. Students strategically analyze and evaluate startups, lead discussion, and assess team performance in recommending go-forward strategies. Emphasis on real companies, real players, and real situations in real time create a highly charged learning environment. Winter term. Includes pre-trip sessions. Competitive admission. Program fees.

GBEN 424 Entrepreneurship & Innovation: From Idea to Opportunity 3 Credits
Thought about starting a business but wonder where to begin? focuses on the idea stage of new venture creation where discovery plants seeds of future enterprises. Student projects, case studies and speakers introduce personal, interpersonal, financial, and legal challenges startups encounter. Drawing on research on entrepreneurial decision-making, students learn to think and behave entrepreneurially. Participants "kick the tires" on their own and others’ just-emerging ideas and improve them. For those interested in starting a business sometime in their lives.

GBEN 492 Special Topics 1-3 Credits
GBEN 497 1-3 Credits
Repeat Status: Course may be repeated.

Graduate Business Courses
GBUS 401 Financial Reporting for Managers and Investors 3 Credits

GBUS 408 Advanced Business Speaking and Pragmatics 2 Credits
Designed to assist international business students become capable communicators within the U.S. and the global marketplace. Students will increase their oral communicative competence and socio-cultural communication awareness through assignments designed to help them learn successful behaviors and customs that are essential elements of oral communication in U.S. graduate business courses, job searching, networking, business presentations, and career development. Students are assessed through their successful use of advanced language functions during the application of face-to-face business settings including business-style negotiations, interviews, presentations, and panel discussions.

GBUS 409 Advanced Business Writing and Reading 2 Credits
Designed to introduce international business students to the types of rhetoric and written structures required in an American university graduate business program, as well as in most business environments; and to provide them with the skills and strategies that are necessary to produce cogent academic essays and papers, as well as business summaries and briefs for the global marketplace. Utilizing a process writing approach, students model expository, chronological order/process, compare and contrast, cause and effect, argumentative, and problem-solution styles, as well as formal and informal business written communication styles. Students are assessed through their successful use of these rhetorical models in writing, their advanced level of academic vocabulary and grammatical structures, as well as through summaries and analyses of research-level articles that include appropriate academic publication conventions.

GBUS 413 Advanced Management Accounting 3 Credits
Prerequisites: MBA 403

GBUS 414 Financial Statement Analysis and Interpretation 3 Credits
This course focuses on analysis of financial statements. It develops the skills necessary to interpret and use financial statement information effectively to assess profitability and risk and is intended for individuals likely to become intensive users of financial accounting information. Requirements include readings, case studies, presentations, and written analysis of actual financial statements.
Prerequisites: (MBA 402) or (ACCT 151 and FIN 125 or FIN 225)
GBUS 419 Financial Management 3 Credits
An intermediate level course in corporate finance. Coverage includes capital budgeting techniques including real options, decision tree analysis, risk analysis, advanced cost of capital theories, capital structure theory, dividend policy, working capital management, mergers and acquisitions, restructuring, and bankruptcies. The course emphasizes both theory and practice through lectures, cases, and financial modeling exercises. Students not possessing the relevant prerequisites must obtain waivers from the designated finance faculty representative.
Prerequisites: (MBA 402) or (ACCT 151 and FIN 125)

GBUS 420 Investments 3 Credits
Prerequisites: (MBA 402) or (ACCT 151 and FIN 125)

GBUS 421 Advanced Investments 3 Credits
Advanced topics relating to specific areas within investment finance such as valuation/security analysis; portfolio/risk management; fixed investment securities; mutual funds; hedge funds; microstructure; and trading. Consent of designated finance faculty representative required.
Repeat Status: Course may be repeated.
Prerequisites: GBUS 420

GBUS 422 Derivatives and Risk Management 3 Credits
The theory and application of a variety of derivative instruments (options, futures contracts, etc.) used in corporation finance and the financial services industry. The focus is on the risk management application vs. a rigorous development of option pricing theory and similar topics. Consent of designated finance faculty representative required.
Prerequisites: GBUS 420

GBUS 424 Advanced Topics in Financial Management 3 Credits
Advanced topics relating to specific areas of corporate finance such as: theoretical and empirical examination of recent developments in financial management, asset valuation and capital budgeting including the role of uncertainty, imprecise forecasts, risk preferences, inflation, market conditions, and the global marketplace, working capital management, leasing, mergers, and financing. The course content may vary between instructors or each time the course is offered. Consent of designated finance representative.
Repeat Status: Course may be repeated.
Prerequisites: MBA 419

GBUS 425 Real Estate Financing and Investing 3 Credits
An upper-level course in modern real estate financing techniques from the perspectives of both the borrower and the lender. Subject matter encompasses the following areas: The principles of financing decisions; financing methods and techniques; institutional sources of funds for real estate; and real estate financing decisions. Consent of designated finance faculty representative required.
Prerequisites: (MBA 402 and GBUS 420)

GBUS 426 Financial Markets and Institutions 3 Credits
Functions and portfolios of financial intermediaries. Sectional demand and supply of funds, nature and role of interest rates, term structure and forecasting, impact of inflation and regulations on financial intermediaries and markets, and current developments in the financial system. Management of assets and liabilities within the U.S. financial institution's legal and economic constraints. Consent of designated finance faculty representative.
Prerequisites: (GBUS 420)

GBUS 431 Quantitative Finance 3 Credits
Relationship of quantitative models to financial theory and applications. Capital budgeting, portfolio selection, security evaluation, cash management, inventory policy and credit analysis. Consent of designated finance faculty.
Prerequisites: MBA 402

GBUS 432 Demand and Supply Chain Planning 3 Credits
Students will learn how businesses work together to build relationships and integrate demand and supply planning activities across the supply chain to deliver superior value to customers. They will also learn about tools and technologies that enable integration as well as the critical drivers and the key metrics that support supply chain performance. Current readings and case studies, simulations and written assignments will be used.

GBUS 437 Federal Taxation and Business Decisions 3 Credits
Impact of federal taxation on the structure and timing of business decisions. Problem-solving methods and research techniques from a managerial perspective.
Prerequisites: ACCT 307

GBUS 442 Seminar in Management Consulting 3 Credits
A study of consulting practices in general and their application to small business. Processes include a field study/counseling service to a local business. Emphasis is on the identification and analysis of multidisciplinary problems and opportunities and the implementation of recommendations. Must have completion of MBA background courses (or equivalent). Consent of instructor required.

GBUS 448 Leadership 3 Credits
This course is an examination of leadership at the organization and group/team levels, and aims to develop and build a student's leadership skills and the ability to diagnose leadership needs in different situations. In identifying and building these leadership skills, the course will focus on the decisions leaders need to make, and the appropriate leadership decision-making processes required in various contexts and at different stages of an organization's existence. Cases and developmental exercises including in-depth decision-making exercises are utilized and cover diverse situations and cross-cultural dimensions including specific situations such as a crisis or ethically difficult decisions.

GBUS 450 Strategic Supply Management 3 Credits
A survey course designed to introduce the MBA/MSE student to the vital role played by supply management in achieving overall effectiveness for the firm in today's global economy. The course starts by examining the traditional purchasing process and then moves on to an examination of the evolution of purchasing into supply management and, finally, to the role purchasing plays in improving effectiveness of the entire value chain. Consists of lectures, discussion and case analysis.

GBUS 453 Transportation and Logistics Management 3 Credits
The control of physical distribution and inventories; the flow of information, products and cash through the integrated supply chain.

GBUS 456 Applied Supply Chain Models 3 Credits
This course will present applied and analytic approaches for developing inventory and forecasting models, supplier selection, supply chain quality management, and production planning and supply chain network design.

GBUS 460 Strategic Marketing Management 3 Credits
The course studies the management of contemporary organizations from the perspective of a marketing manager. While the course content addresses the activities required to maintain a strategic fit between an organization's environment and its particular set of objectives and resources, the central focus is on designing strategic marketing actions for various types of organizations. The course pedagogy emphasizes the application of marketing and other business principles through seminars, simulations, or case discussion.
Prerequisites: MBA 404
GBUS 462 Pharmaceutical Marketing 3 Credits
The course provides an introduction and overview of the various healthcare system components as they relate to the pharmaceutical industry. This course will (1) focus on product decisions of the firm, requiring an occasional shift in focus from that of corporate management to that of operating managers of new product activities or established brands; (2) recognize the importance of marketing research as input to product decisions; (3) take a managerial orientation; (4) recognize the need to tailor product policy approaches to the characteristics of the decision-maker and the firm. The course will be a mixture of lectures, discussions, case analyses, and group exercises. Graduate students only.
Prerequisites: MBA 404

GBUS 464 Business-to-Business Marketing 3 Credits
This course focuses on marketing strategies and tactics in firms whose customers are other institutions, not individuals. Topics covered include organizational buying behavior, managing strategic buyer-seller relationships, sales force deployment, communication strategies, and so on. Specific attention is given to the impact of information technology and globalization in the business to business context.

GBUS 465 Creating Breakthrough Innovations 3 Credits
Most products and services either fail or do average business, but some are phenomenally successful. Such products and services that provide phenomenal financial returns and become market leaders can be called “Breakthrough Products and Services”. The main objective of the course is to improve our understanding of the process of creating breakthrough products and services. It is accomplished by in-class discussions of cases, assignments, and the state-of-the-art research work in academia and industry. The course concludes with a term paper that integrates the concepts learned from class discussions, reference books, and research papers and applies them to a real product. Must have graduate student status plus two years of postgraduate work experience.

GBUS 466 Marketing Research and Analysis 3 Credits
This course focuses on procedures for collecting and analyzing relevant information for informed decision making by managers. The process of identifying research questions, developing instruments for collecting information, appropriate interpretation of information, and appropriateness of research methods are some of the topics discussed in this course. The course focuses on the process of doing marketing research as well as the techniques for analyzing information. Discussion of concepts and cases, developing data collection instruments, and doing actual marketing research projects will form the key elements of this course.
Prerequisites: (ECO 401 or BUEC )

GBUS 467 Sales Management 3 Credits
This course takes an integrated approach to the study of sales management, including formulation of strategically sound programs and the implementation of selling initiatives and the evaluation and control of the organization’s sales activities. Topics include the role of the sales manager in the divergent demands of multiple constituencies; the development of effective sales organizations; lead generation and quota setting; territory management; and motivation and reward systems. Learning methods include case studies where students’ diagnose problems and develop viable alternatives.

GBUS 470 Marketing Communications Strategies 3 Credits
This course focuses on how various elements of communications are integrated to achieve various organizational objectives. In addition to the traditional communication media such as advertising and point of purchase media, emphasis will also be placed on new media and strategies made possible due to the advances in technology. The course will involve discussion of concepts, case analysis and discussion, insights from practitioners, and group projects.

GBUS 471 Strategic Brand Management 3 Credits
This course approaches the study of brand management by illustrating the formulation of strategically sound brand management programs and the evaluation and control of the implementation of key brand initiatives (new products, advertising support, etc.). Focus is on theories and models to develop and manage brand equity. Specific learning modules include customer development, brand strategy development, brand extension development and annual brand planning. Specific attention is focused on case studies and team projects in building, measuring and managing brand equity.

GBUS 472 Strategies for Services Marketing 3 Credits
The course focuses on the challenges of marketing and managing services (whether in a manufacturing or service business) and discusses the development of strategies for addressing these challenges. The need for cross-functional integration to provide effective service is stressed. Illustrative topics include service quality gap analysis, relationship between superior service and profitability, service encounter analysis, customer lifetime value analysis, services guarantees, and service demand and capacity management.

GBUS 473 International Finance 3 Credits
Consideration of problems arising from the risks associated with international investing and multinational corporation finance (currency, political, etc.). Focus is on (a) investing in international market given the institutional constraints and differences between domestic markets, and (b) managerial issues relating to corporations, investors, and financial institutions. Consent of designated finance faculty representative.
Prerequisites: GBUS 419

GBUS 475 Global Marketing Strategies 3 Credits
The course is designed to provide a framework within which global marketing operation can be analyzed, understood, and undertaken. The course focuses on issues that are being faced by firms in today's global marketplace, particularly those that are related to strategy formulation and implementation. The learning experience in this course is placed on global business decision-making, through the use of case studies, projects, exercises, and lectures.

GBUS 490 Thesis 0-6 Credits

GBUS 492 Special Topics 1-4 Credits
Repeat Status: Course may be repeated.

GBUS 494 Field Projects 1-4 Credits
The field projects course will provide MBA students with an opportunity to apply MBA concepts with an employer, corporate partner or other suitable organization. Students will work with a supervising professor and a corporate representative on a project designed by the student. Students must prepare a written proposal for the project including the expected outcomes and an estimate of the hours required for completion. Students will present their proposal to a faculty member of their choice for approval. The academic rigor and time required to complete the project will determine the number of credits earned.

GBUS 499 Dissertation 1-12 Credits
Graduate MBA Core Courses

MBA 401 Introduction to the Organization and its Environment 2 Credits
An MBA core course designed to provide a thorough understanding of business organizations by examining strategies middle and senior managers use to create and sustain organizational competitive advantage. The course examines the organization from an overall perspective within the context of the firm’s internal and external environment. The second aspect of this course deals with the ability to communicate effectively in today's business and professional environment. Students will examine and practice the written and verbal communications strategies and skills that are essential to their success in business.
MBA 402 Managing Financial and Physical Resources 4 Credits
An MBA core course designed to integrate financial and managerial concepts into operations decisions. Disciplines of accounting, finance and economics are combined to provide substantive foundations for discussing and analyzing data. Implications of analysis are applied to facilitate decision-making in other areas such as marketing, operations (manufacturing, logistics and engineering), human resources, information technology and general management. The major learning objectives will be applied through a series of "living" cases that are centered on analyzing historical financial performance, preparing a business plan, and valuing a business.
Prerequisites: (MBA 401 and GBUS 401 or BUAC )
Can be taken Concurrently: MBA 401

MBA 403 Managing Information 4 Credits
An MBA core course dealing with concepts and methods involved in the collection, organization and dissemination of information that helps managers make operational and strategic decisions. The course also deals with attributes of information and examines enterprise-wide impacts of local decisions. Revenue, cost, time and quality-based information are accorded equal emphasis, while students are exposed to alternative evaluation methods for decisions related to different parts of the value chain. Topics include: activity-based costing; activity-based management; transaction analysis; operational and strategic decisions such as outsourcing, design partnerships, etc; investment analysis for short lifecycle investments; evaluation of uncertainty, risk and ambiguity; metrics development; compensation policies; segment evaluation methods; target costing and functional analysis; quality function deployment; total cost of ownership; and transfer pricing. In addition, the course deals with: information technology enablers which allow firms to improve value delivered to customers; and evaluation and management of emerging forms of Cooperation, such as joint ventures and project based strategic alliances.
Prerequisites: (ECO 401 or BUEC ) and (GBUS 401 or BUAC and MBA 401)
Can be taken Concurrently: MBA 401

MBA 404 Managing Products and Services 4 Credits
An MBA core course focusing on the management of products and services within a firm's value chain. The course addresses exceeding customer expectations, establishing total quality as the core foundation, developing a strong customer focus, creating value through supply chain management, developing new products for competitive advantage, matching aggregate supply with customer demand, and designing market channels and influencing customers.
Prerequisites: MBA 401
Can be taken Concurrently: MBA 401

MBA 405 Managing People 4 Credits
An MBA core course that examines how effective organizations are created, maintained, and improved. The course will focus on how good people are attracted to an organization and how to make them productive. Topics include: organizational design, job design, staffing, training and development, performance, teams, influence, diversity, change, ethical decision-making and current people issues facing today's organizations.
Prerequisites: MBA 401
Can be taken Concurrently: MBA 401

MBA 406 Integrative Experience 3 Credits
An MBA course where students apply the body of knowledge acquired in MBA 401 through 405 through a simulation, case presentations and the cross core project. This course places an emphasis on strategic management and takes the point of view of the general manager to view the organization from an overall perspective in the context of the firm's internal and external environment. In doing so, students examine historical perspectives, contemporary theories, and practical applications all in the spirit of helping them develop a broad understanding of strategic management issues and solutions. By combining high-level class discussions, case analyses, a computer simulation competition and the crosscore project this course exposes students to rigorous theoretical analysis while providing hands-on, simulated real world business experiences.
Prerequisites: (MBA 401 and MBA 402 and MBA 403 and MBA 404 and MBA 405)
Can be taken Concurrently: MBA 403

MBA 440 Quantitative Methods 3 Credits
The course develops an understanding of the foundational methods and skills of quantitative analysis to a variety of business and economic situations. Areas of focus include probability concepts, data description and visualization, estimation, hypothesis testing, correlation, and regression. Software packages are used for statistical computing and data analysis.

MBA 441 Professional Development 1 Credit
The course focus is on career-enhancing skills that aid professional development. Assessment tools are used to understand preferred communication styles, motivators and competencies, and facilitation of effective collaboration through high-performance team building. Networking, interviewing, presentation, and communication skills are also covered.
Repeat Status: Course may be repeated.

MBA 451 Accounting 1-MBA 1.5 Credit
This course trains students in corporate decision making using financial information that is prepared under mandated accounting principles for external financial statement users. The course also covers accounting practices which provide information for internal users. It studies the use and interpretation of financial statements with a focus on the effect of economic transactions on financial statements and key ratios. Topics include: introduction to financial accounting concepts and principles, the accounting cycle, cost accounting information processing and impact on decision making.

MBA 452 Economics and Markets 1-MBA 1.5 Credit
Fundamental principles and tools of microeconomics with a focus on managerial decision-making. Topics include consumer behavior, input selection, cost analysis, production, and pricing strategies in various market structures, decision making under uncertainty, international trade, information asymmetry and organizational design, and game theory as it applies to business strategy.

MBA 453 Finance 1-MBA 1.5 Credit
This course explores the application of fundamental finance concepts in modern business. Topics covered include Risk and return, Capital budgeting techniques and analysis, financial statement analysis and forecasting, valuation basics, corporate cost of capital, and other corporate finance issues such as capital structure, dividend policy, and working capital policy.

MBA 454 Management - OB/HR 1-MBA 1.5 Credit
This course focuses on understanding human behavior at work and how it is influenced by individual differences, group dynamics, and by the organizational context in which people are employed. Key organizational behavior theories will be applied to fundamental human resource management issues with an emphasis on aligning an organization's talent with its strategy to maximize performance. Topics will include: staffing and selection, training and development, motivation, performance management, leadership, and optimizing effectiveness by understanding behavioral factors of individuals and groups.
MBA 545 Marketing 1-MBA 1.5 Credit
This course provides a contemporary perspective to introduce the student to the fundamentals of strategic marketing. The course explores the functional marketing operations of organizations and tracks the marketing manager's decision processes including segmentation and target market development, product/brand positioning and the development of the value proposition, and the integration of the marketing mix elements into a cohesive strategy. Specific learning modules are concerned with the development, evaluation, and implementation of strategic marketing plans.

MBA 456 Strategy 1-MBA 1.5 Credit
Within the context of a multi-stakeholder approach to organizations, strategic management covers overall organizational issues in intent, analysis, strategy formulation, execution, and control within a global environment. The objectives of this course are to provide the student with a better understanding of business organizations and to clarify the way senior managers create and sustain organizational competitive advantage.

MBA 461 Financial Claimants 1-MBA 1.5 Credit
This course will focus on various financial claimants in the modern corporation. The focus will be on the theory behind and practice related to information needs and use by stockholders, bondholders, and other intermediate financial claimants (e.g., preferred stockholders, warrant holders). Coverage will include related governance and agency theory principles as well as the impact of disclosure, fair value accounting, and regulation on financial claimants.
Prerequisites: MBA 451 and MBA 453

MBA 462 Government & Society 1-MBA 1.5 Credit
Economic and strategic analysis of the role of government and social forces in markets and business policies. Topics include environmental controls, consumer protection, antitrust and the promotion of market competition, intellectual property and inventions, and taxation.

MBA 463 Suppliers and Customers 1-MBA 1.5 Credit
Explores how organizations identify customer needs and develop downstream flows, and downstream (forward through the channel systems) to deliver goods and services that exceed customer expectations and create societal value. Covers demand/customer management, supply/capacity planning, raw material/component sourcing, inventory planning, distribution/merchandising, and quality management. Focused on how marketing and supply chain managers make decisions regarding effectiveness vs. efficiency trade-offs. Concerned with the development, evaluation, and implementation of marketing strategy and supply chain.
Prerequisites: MBA 455

MBA 464 Employees 1-MBA 1.5 Credit
This course will focus on the evolving social contract between employers and employees in the modern corporation, their causes and consequences. Topics will build on the basics from the Management OB/HR course from the first session. In particular, coverage will include the following issues: procedural justice and fairness; privacy and freedom of speech; work-life balance, diversity, inclusion, and the bottom line; job security and alternative work arrangements; compensation; employee ownership; performance management and career development.

Law Courses

LAW 417 Regulatory Environment of Business 2 Credits
This course is designed to provide students with a basic understanding of the various legal, regulatory, and market constraints in which business operates. Students are introduced to the interplay between legislation, regulations, and court decisions in establishing the regulatory environment in which a business operates as well the allocation of power among federal and state authorities. Conflict of law issues will also be explored for businesses that operate internationally. Contract law, forms of business, and ethics are covered in depth.

ManagemenCourses

MGT 416 Managing Talent 3 Credits
The course is fundamentally about understanding and improving the behavior and performance of individuals in the workplace. As such, we will draw upon key theories in organizational behavior to address human resource issues arising from the employment relationship. Topics will address key areas in the talent pipeline from sourcing and selection, training and development, motivation and performance management, talent management metrics and analytics.

MGT 461 Strategic Management 1 Credit
Strategic Management covers overall organizational issues in determination, analysis, execution, and control within a global environment. This capstone course integrates theories and concepts from production, marketing, finance, and accounting and provides an opportunity to simulate the function of top level management as it relates to the total business environment through a team-based business simulation. Through readings, written assignments, presentations, in-depth group discussions, and a team-based simulation competition, students will broaden their understanding and practice the art of strategic decision making.

MGT 462 Experiential Learning Capstone 3 Credits
The Experiential Learning Capstone in the M2 curriculum immerses students in the study of how historical, iconic companies, under the guise of strategic management principles, created disruptive/game-changing industry innovation. Built on the foundational courses in the M2 curriculum, the capstone integrates classroom lectures with a combination of company visits and externship projects. Students apply their foundational learning in the study of how birth was given to a select set of companies.

Marketing Courses

MKT 415 Marketing Foundations 3 Credits
This course is designed to provide students with a comprehensive analytical framework to develop, implement and evaluate competitive marketing strategies that achieve organizational goals and objectives. It explores the functional marketing operations of organizations and examines the key elements of a marketing manager's decision making process. Examples of learning modules include: customer and market analysis, segmentation, targeting and positioning, marketing mix decisions (product, price, placement and promotion).

MKT 425 Contemporary Topics in Marketing 2 Credits
The objective of this course is to build on the principles learned in Marketing Foundations and study a series of contemporary topics relevant for the marketing function in organizations. The focus is on key factors that are driving changes in the marketplace and the implications to the organization when devising strategies. Students will obtain an understanding of how to identify emerging trends, explore the underlying antecedents and consequences of these trends, and learn how organizations can proactively manage these trends.
Prerequisites: MKT 415

Masters Accounting Courses

MACC 409 Advanced Federal Income Taxation 3 Credits
An advanced study of the taxation of business organizations, estates, trusts, and wealth transfer taxes. Planning and research are the basic components of the course. Problem-solving and written research are emphasized. Credit will not be given for both ACCT 309 and MACC 409.
Prerequisites: ACCT 307

MACC 412 IT Auditing 3 Credits
Addresses internal control and audit issues in an Information Technology (IT) environment. Structured around the COSO internal control framework. Audit procedures for the review of IT general and application controls are examined. Students perform substantive tests on financial databases using audit software. Topics covered: Internal controls in centralized and distributed IT environments, IT outsourcing, IT governance, Data modeling, network and database security ACL software, SAP process and control issues.
MACC 413 The Corporate Financial Reporting Environment 3 Credits
This course addresses the nature of corporate financial reporting, its role in providing decision-useful information to capital market participants, standard-setting and the FASB conceptual framework, and theoretical and empirical assessments of its performance.

MACC 420 Fraud Examination and Forensic Accounting 3 Credits
This course focuses on developing student understanding of forensic accounting and fraud investigation for introduction to the forensic accounting profession. Course provides enhanced knowledge of occupational fraud, with emphasis on financial statement fraud. Topics include the nature/theories of fraud, fraud prevention/detection techniques and the legal and auditing framework for fraud investigation. Course integrates data analytic techniques in fraud examination and detection, analysis of SEC cases involving fraud allegations and incorporates materials provided by the Association of Certified Fraud Examiners (ACFE).

Prerequisites: ACCT 320

MACC 424 Governance, Risk and Control 3 Credits
This course focuses on developing in students an understanding of corporate governance, risk oversight and internal control monitoring from an accounting professional’s perspective. Topics include agency theory, fundamentals of corporate governance, risk and internal control, functions of the board of directors and the audit committee, independent auditor and impediments to audit quality, internal auditor’s role, and SEC regulations and laws impacting governance, risk and control. Class discussions, interactive group exercises, role plays, field projects, and real-life cases are used.

Prerequisites: ACCT 320 or BUAM 399/410

MACC 427 Reporting and Auditing Fair Value Estimates 3 Credits
Explores the theory and mechanics of financial reporting of assets and liabilities presented at fair value. The course focuses on U.S. GAAP standards relating to the recognition, measurement, valuation, and disclosure of fair value in financial statements. The course also examines management incentives in reporting and issues faced by auditors in providing assurance regarding these estimates.

MACC 430 Data Analytics for Accountants 3 Credits
This course uses publicly available financial statement information to programatically analyze company activities. Obtaining, cleaning, exploring, analyzing with statistical and machine learning methods, and presenting accounting data are explored in a project based format. Non-financial related information analyses are linked to audit and risk assessments. Projects and papers involve actual entities and associated financial information. Credit will not be given for both MACC 430, Data Analytics for Accountants and ACCT 330, Accounting Data and Analytics.

Prerequisites: ECO 045

Project Management Courses

PMGT 409 Project Management Fundamentals 3 Credits
Introduction to project management – survey of the knowledge areas and approaches to managing projects. Looks at the relationship of projects to organizational strategy and culture, how to initiate a project, principles of planning and project execution and control, managing stakeholders, and communicating effectively. A review of the competencies required to address the complexities and challenges of projects. Hands-on approach to developing project management work artifacts and simulated project management game are used.

PMGT 410 Project Requirements and Scope Management 1 Credit
Focuses on understanding the principles and nuances of managing project and project scope: the boundaries of inclusion and exclusion of the product – its features and functions, and of the project – the work involved to create the project’s product. Addresses the methods for eliciting and managing product and project requirements, defining the project scope, creating a scope baseline, and managing changes to control scope creep.

Prerequisites: PMGT 409
Can be taken Concurrently: PMGT 409

PMGT 411 Project Scheduling, Estimating & Budgeting 1 Credit
This course explores the methods and challenges of developing project estimates, schedules, and budgets. Expectations about project timelines and costs cause a great deal of friction and frustration in projects. In this course students will learn how to build a schedule using the critical path method, methods for resource loading, developing contingency reserves, and time and cost estimates. They will also learn how to present schedule information to manage expectations and deal with slippages when they occur.

Prerequisites: PMGT 409 and PMGT 410
Can be taken Concurrently: PMGT 409, PMGT 410

PMGT 412 Advanced Scheduling & Scheduling Tools 1 Credit
This course deals with developing a schedule in MS Project in a hands-on class. Students will learn to build a fully resource loaded, networked, and baselined schedule in MS Project, and how to manage from that schedule. Students will also explore the principles of critical chain scheduling, dealing with risks in schedules, and using the schedule to forecast outcomes and communicate effectively with stakeholders about time expectations.

Prerequisites: PMGT 409 and PMGT 410 and PMGT 411

PMGT 413 Project Risk Management 1 Credit
As projects always involve a new and unique endeavor to the performing organization, uncertainty is a part of every project. Effective project management prepares for the risks - both uncertainties and opportunities - presented by these uncertainties. In this class we will explore both the classic and some more advanced methods for dealing with project risks.

Prerequisites: PMGT 409 and PMGT 410
Can be taken Concurrently: PMGT 409, PMGT 410

PMGT 414 Managing Project Quality 1 Credit
Students will explore the key concepts of quality management and how they apply in projects. This class discusses the use of the quality management tools and methods, practices for holding quality reviews, and for developing project quality management plans.

Prerequisites: PMGT 409 and PMGT 410
Can be taken Concurrently: PMGT 409, PMGT 410

PMGT 415 Project Procurement & Negotiation 1 Credit
This class focuses on the tools and practices used in managing procurement on projects, and best practices for negotiation and supplier management. It explores the role of the contract, types of contracts, developing the statement of work, RFP, screening & selection criteria, and the procurement management plan. It also looks at how to manage contractors throughout the project.

Prerequisites: PMGT 409 and PMGT 410
Can be taken Concurrently: PMGT 409, PMGT 410

PMGT 416 Decision Making and Ethics on Projects 1 Credit
This class looks at the factors and processes for making effective and ethical decisions on projects. The unknowns, complexities, time and cost pressures, and cross-functional stakeholders make good decision-making imperative for both long-term and short-term success. Students will use a variety of tools and techniques for team decision-making. Class includes a role-play game based on the Challenger accident to explore issues.

Prerequisites: PMGT 409
Can be taken Concurrently: PMGT 409

PMGT 417 Project Leadership 1 Credit
Good management skills alone will not create project success. Leadership, which is much more elusive, is equally if not more important. This class will explore models of leadership and how they apply to projects, styles of leadership, motivation, influence, politics, and dealing with difficult stakeholders.

Prerequisites: PMGT 409
Can be taken Concurrently: PMGT 409
PMTG 418 Facilitation and Teamwork for Projects 1 Credit
This class focuses on the principles and practices of teamwork, an essential element for projects. Students will examine the effectiveness of different types of team structures and maturity levels for teams and organizations. They will learn methods for dealing with conflict, facilitating groups, and the different types of meetings used in projects. This class will use case studies as well as hands-on methods.
Prerequisites: PMGT 409
Can be taken Concurrently: PMGT 409

PMTG 419 Adaptive and Agile Project Management 1 Credit
In this class we will explore the new methods used for more extreme projects – those with more complexity, market acceptance, time pressure, and advanced technology. Students will examine the factors affecting complex projects with cross-functional and dispersed teams as well as principles for Agile project approaches. This class will use case studies as well as hands-on methods.
Prerequisites: PMGT 409 and PMGT 410 and PMGT 411 and PMGT 414

PMTG 420 Managing Projects for Innovation 1 Credit
Traditional project management tries to instill discipline in a seemingly chaotic process, but for innovation to thrive we must couple discipline with creativity. In this class students will explore the paradoxes innovations create, and look at ways to remove blocks and spark imagination while producing value for the organization. Case studies and hands-on techniques will be utilized in this course.
Prerequisites: PMGT 409 and PMGT 410 and PMGT 411 and PMGT 413

PMTG 421 Project Management Capstone 1-3 Credits
This class is conducted as an independent study and involves applying the principles and practices of the previous project management classes to a real-life project or approved case study. You will develop a set of project documents and provide a critical analysis of the project to demonstrate your mastery of the project management skills prescribed for a predictive (plan-based) project.
Prerequisites: PMGT 409 and PMGT 410 and PMGT 411 and PMGT 413 and PMGT 416

Supply Chain Management Courses

SCM 423 Supply Chain Operations Management 2 Credits
This course provides an essential understanding of managing global supply chains and operations within the context of an integrated value chain. Topics addressed include the fundamentals of supply chain management; supply chain risk management; quality management; demand and supply chain planning, including forecasting, capacity planning, aggregate planning, and scheduling; the components of a lean supply chain; inventory and working capital management; distribution and transportation management; and performance measurement. Special emphasis is given to managing supply chains from a financial perspective.

Business Information Systems
The BIS major, housed in the Department of Decision and Technology Analytics (DATA), provides students with a strong foundation in cross-functional business processes and the application of information systems to support them. The use of technology and data analytics to improve business performance and effectively support strategic business plans is a major focus of the program. Career opportunities for BIS majors include: business analyst, data analyst, systems analyst, and information systems consultant.

Professor. Yuliang Yao, PhD (University of Maryland, College Park)
Associate Professor. Catherine M. Ridings, PhD (Drexel University)
Assistant Professors. Jing Gong, PhD (Carnegie Mellon University); Haoyan Sun, MBA (University of Washington); Dawei Zhang, PhD (University of Calgary)
Lecturer. Chitra S. Nayar, MBA (University of Iowa)
Professor Of Practice. Troy Adair, PhD (Indiana University Bloomington)
Emeritus. Susan A. Sherer, PhD (University of Pennsylvania)

The Business Information Systems major requires three (3) courses and three (3) electives beyond the core requirements of the College of Business and Economics. Students are required to take BIS 111, Introduction to Information Systems, as part of the business and economics core. Other courses are as follows:

Required Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIS 311</td>
<td>Managing Information Systems Analysis and Design</td>
<td>3</td>
</tr>
<tr>
<td>BIS 324</td>
<td>Business Data Management</td>
<td>3</td>
</tr>
<tr>
<td>BIS 335</td>
<td>Application Development for Business</td>
<td>3</td>
</tr>
</tbody>
</table>

Elective Courses
Select three of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIS 333</td>
<td>Enterprise Security and Risk Management</td>
<td></td>
</tr>
<tr>
<td>BIS 342</td>
<td>e-Business Enterprise Applications</td>
<td></td>
</tr>
<tr>
<td>or SCM 342</td>
<td>e-Business Enterprise Applications</td>
<td></td>
</tr>
<tr>
<td>BIS 344</td>
<td>Cloud Computing for Business</td>
<td></td>
</tr>
<tr>
<td>BIS 348</td>
<td>Predictive Analytics in Business</td>
<td></td>
</tr>
<tr>
<td>BIS 352</td>
<td>Advanced Topics in Business Analytics</td>
<td></td>
</tr>
<tr>
<td>BIS 372</td>
<td>Special Topics in Information Systems</td>
<td></td>
</tr>
<tr>
<td>ACCT 311</td>
<td>Accounting Information Systems</td>
<td></td>
</tr>
<tr>
<td>ENTP 304</td>
<td>Technology and Software Ventures</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits: 18

Courses focusing on different applications of IS in business, including: Data Warehousing and Mining, HR Applications in IS, Numerical Methods of Business Decisions, etc. Consult Professor Ridings for other related courses.

Business Information Systems Minor

This minor provides an overview of the major technical functions in IS, such as design of systems and the development and management of databases. In addition, the student explores the applications of IS to business problems in one of several electives. This minor is available only to students with a declared major in the College of Business.

Program of Studies: The BIS minor consists of 3 courses equaling 9 credit hours. These credit hours consist of the following courses:

Program of Studies: The BIS minor consists of 3 courses equaling 9 credit hours. These credit hours consist of the following courses:

Required Courses (2):

<table>
<thead>
<tr>
<th>Course</th>
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</tr>
</thead>
<tbody>
<tr>
<td>BIS 311</td>
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<td>3</td>
</tr>
<tr>
<td>BIS 324</td>
<td>Business Data Management</td>
<td>3</td>
</tr>
<tr>
<td>Select one of the following:</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>BIS 333</td>
<td>Enterprise Security and Risk Management</td>
<td></td>
</tr>
<tr>
<td>BIS 335</td>
<td>Application Development for Business</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>BIS 348</td>
<td>Predictive Analytics in Business</td>
<td></td>
</tr>
<tr>
<td>BIS 352</td>
<td>Advanced Topics in Business Analytics</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits: 9

Courses

BIS 044 Business Analytics I 1.5 Credit
This course covers the basic concepts of data, including the collection, organization, exploration, and understanding of data with an emphasis on complex business data. The focus is on data as an organizational asset, and how data is structured for use in business to optimize business decisions and processes. Students will implement data analytic techniques through hands on programming.

Corequisites: BUS 003
BIS 111 Introduction to Information Systems 3 Credits
This course examines the fundamental role of information systems in supporting and managing all business functions and enabling firms to compete effectively. Both technical and managerial aspects of information systems are introduced. The course integrates technical infrastructure, database concepts, management decision-making, and business process issues critical to the understanding of operational and strategic information systems. It introduces business applications that support accounting, finance, supply chain management, and marketing.

BIS 244 Business Analytics II 1.5 Credit
This course covers techniques and algorithms for creating effective visualizations of complex business data. The emphasis will be on the use of data visualization in business decision making. Students will implement data analysis and visualization through hands on programming and visualization tools.
Prerequisites: BIS 044 and (ECO 045 or MATH 231)

BIS 300 Apprentice Teaching 1-4 Credits
BIS 311 Managing Information Systems Analysis and Design 3 Credits
This course focuses on managing the requirements analysis and system design methodology and techniques for business information systems. Students learn current methods and techniques for system requirement analysis as well as system design, and apply them to real world projects. It covers cost benefit analysis and risk management of business systems development, JAD and structured walkthroughs, structured object oriented methodologies, and software package evaluation. It emphasizes the factors for effective communication and integration with users and user systems and encourages interpersonal skill development with client users, team members, and others associated with development, operation, and maintenance of the system.
Prerequisites: ACCT 311 or CSB 311 or BIS 111

BIS 324 Business Data Management 3 Credits
This course covers the fundamentals of database management systems (DBMS), including database development, processing, logical and physical design, access, implementation and administration. Students will gain extensive experience in developing data models, creating relational databases, and formulating and executing complex queries. The focus in the course will be on analyzing the connections between data and business organizational information needs and decisions, and understanding the principles of managing organizational data. A project with hands-on experience with a large scale DB is included.
Prerequisites: BIS 111

BIS 333 Enterprise Security and Risk Management 3 Credits
This course explores the management of enterprise IT solutions. The focus is on the management of applications and infrastructure security. Students will be introduced to frameworks for infrastructure management, system administration, critical security principles that enable them to plan, develop, and perform security tasks. The course will address hardware, software, processes, communications, applications, and policies and procedures with respect to enterprise IT Security and Risk Management. These topics are addressed both within and beyond the organization, with attention paid to managing risk and security within audit and compliance standards.
Prerequisites: BIS 111

BIS 335 Application Development for Business 3 Credits
This course provides an introduction to planning, designing, developing and maintenance of high quality computer applications that solve business problems. Students will learn basic system development and computer programming concepts by designing, coding, and testing in an object oriented computer language. Emphasis will be placed on learning introductory programming concepts, such as declaring variables, control statements, subroutines, functions, and arrays. Additionally, students will develop event-driven graphical user interfaces. Some previous experience with programming helpful but not required.
Prerequisites: BIS 111

BIS 342 (SCM 342) e-Business Enterprise Applications 3 Credits
Introduction to the implications of key information technologies used within and across businesses to conduct e-business. The course covers the functionality of various enterprise applications and their integration: customer relationship management, enterprise resource planning, supply chain management, supplier relationship management, data warehousing and mining, business intelligence, and product lifecycle management.
Prerequisites: BIS 111

BIS 344 Cloud Computing for Business 3 Credits
This course focuses on understanding risk assessment, security guidance, design and deployment of cloud services solutions. Students will demonstrate an understanding of high availability and business continuity, cloud resource costing, deployment management, network design, data storage, security, scalability and elasticity, cloud migration and hybrid architecture. The applied portion of the course gives students hands-on experience designing and deploying cloud environments and services on platforms such as Amazon Web Services.
Prerequisites: BIS 311

BIS 348 Predictive Analytics in Business 3 Credits
The course covers theories and practices in predictive analytics in business. Students will have hands-on experience on analyzing business data for business intelligence and improved business decision making. Includes: key theories, concepts, and models of predictive analytics; and data mining tools to formulate and solve business problems. The course uses data analytics software and real data. Topics include prediction, forecasting, classification, clustering, data visualization and data reduction techniques. Not available to students who have credit for BIS 448 or BIS 456.
Prerequisites: BIS 111 and (ECO 045 or MATH 012 or MATH 231)

BIS 350 (MGT 350) Project Management 3 Credits
Key processes and tenets of project management including scope, time, cost, quality, human resources, communications, risk, procurement, and integration management. Both technical and behavioral aspects of project management are applied within the context of either IS management, HR management, Supply Chain Process Management, Small Business Management. Topics include: expectations management, change management and consulting engagement management. Introduces both software project monitoring tools and project team collaboration techniques and tools. Must have completion of all other courses in either BIS or Management major.
Prerequisites: BIS 335 and BIS 324

BIS 352 Advanced Topics in Business Analytics 3 Credits
This course covers advanced analytic methods for understanding and solving business problems. The emphasis is on understanding and applying a wide range of modern techniques to specific decision-making situations. Using the programming language R, the course covers advanced topics such as machine learning, text mining, and social network analysis. Upon completion, students will have valuable practical analytical skills to handle large datasets and make business decisions. Credits will not be given for both BIS 352 and BIS 452.
Prerequisites: BIS 111 and (ECO 045 or MATH 012 or MATH 231)

BIS 360 Business Information Systems Practicum 3 Credits
The business information systems practicum provides an opportunity for students to work on an intensive consulting engagement with a business. Students work with client firms on individual or team projects, which focus on information systems activities such as developing requirements, designing, and implementing systems. Students complete written reports and make formal presentations to clients. May not be taken concurrently with MGT 311. Cannot be used to satisfy BIS major or minor requirements.

BIS 371 Directed Readings 1-3 Credits
Readings and research information systems; designed for superior students who have special interest in some topic(s) not covered by the regularly scheduled courses. Written term paper(s) required. Must have preparation in information systems acceptable to program coordinator.
Repeat Status: Course may be repeated.
BIS 372 Special Topics in Information Systems 1-3 Credits
Special problems and issues in information systems for which no regularly scheduled course work exists. When offered as group study, coverage varies according to interests of the instructor and students. Must have preparation in information systems acceptable to program coordinator.
Repeat Status: Course may be repeated.

BIS 373 Business Information Systems Internship 1-3 Credits
Based on a student's work experience, a sponsoring faculty member shall direct readings, projects, and other assignments—excluding a "capstone report." It should be noted that the work experience (at least 80 hours per credit), by itself, is not the basis for academic credit. The faculty directed activity must be provided concurrent with the work. Course registration and related arrangements, including designating a sponsoring faculty member, must be made in advance of the work engagement. This course must be taken Pass/Fail, cannot be used to satisfy BIS major or minor requirements. Declaration of a BIS major or minor, junior standing, and consent of department required.
Prerequisites: BIS 311

BIS 388 (FIN 388) FinTech Capstone 3 Credits
This course combines experiential learning via a semester long hands-on project with a series of lectures on relevant topics. Students will learn how to apply the information technologies and financial concepts they learned in the other courses to issues in the creation, distribution, servicing, or operations of financial products and services. These issues may include cybersecurity, payment processing, algorithmic trading, credit scoring, blockchain, cryptography, artificial intelligence, machine learning, peer-to-peer lending, online banking, and mobile banking.
Prerequisites: (CSE 012 or CSE 017) and BIS 352 and (BIS 348 or CSE 347 or ISE 364 or ISE 365) and (BIS 324 or CSE 241 or ISE 224) and FIN 330

BIS 423 Management Information Systems 2 Credits
This course examines the role of information systems (IS) and information technology (IT) in the organization. The focus of the course is the organizational uses of IS and IT to compete effectively. Both technical and managerial aspects of information systems are explored. The course includes theoretical infrastructures, management decision-making, trends and innovations in IS, and business process issues critical to the understanding of organizational and strategic information systems.

BIS 448 Predictive Analytics in Business 3 Credits
The course covers theories and practices in predictive analytics in business. Students will have hands-on experience on analyzing business data for business intelligence and improved business decision making. Includes: key theories, concepts, and models of predictive analytics and data mining tools to formulate and solve business problems. The course uses data analytics software and real data. Topics include prediction, forecasting, classification, clustering, data-visualization and data reduction techniques. Not available to students who have credit for BIS 348 or BIS 456.

BIS 452 Advanced Topics in Business Analytics 3 Credits
This course covers advanced analytic methods for understanding and solving business problems. The emphasis is on understanding and applying a wide range of modern techniques to specific decision-making situations. Using the programming language R, the course covers advanced topics such as machine learning, text mining, and social network analysis. Upon completion, students will have valuable practical analytical skills to handle large datasets and make business decisions. Credits will not be given for both BIS 352 and BIS 452.
Prerequisites: BUEC or ECO 045

BIS 456 Business Analytics for Decision Making 3 Credits
Provides students with a theoretical and practical understanding of core data analytics concepts and techniques, and develops hands-on experience in applying these techniques to practical real-word business problems using R software. As an applied course, the emphasis will be less on the inner working of each method and more on when and how to use each technique and how to interpret the results. Not available to students who have credit for BIS 348 or BIS 448.
Prerequisites: MBA 440 or ECO 045

BIS 458 Data Management for Managers 3 Credits
Covers fundamentals of database management, including database development, processing, logical and physical design, access, implementation and administration, and design and deployment of cloud services solutions. Students will gain extensive experience in developing data models, creating relational databases, formulating and executing complex queries, and understanding cloud services solutions in cloud resource costing, deployment management, network design, data storage, security, scalability and elasticity, cloud migration and hybrid architecture. Hands-on experiences such as such as Oracle Database and Amazon Web Services are included.

Economics
Though economics is variously defined, modern-day definitions generally suggest that it is the study of the principles that govern the efficient allocation of resources. One of the greatest of the 19th century economists who did much to uncover these principles suggested a broader definition. Alfred Marshall described economics as “a study of mankind in the ordinary business of life and a part of the study of man.” This dual nature of economics, technical and humanistic, is reflected in the fact that at Lehigh the Economics Major is available to students in the College of Arts and Sciences as well as in the College of Business.

Professors. Shin-Yi Chou, PHD (Duke University); James A. Dearden, PHD (The Pennsylvania State University); Mary E. Deely, PHD (Harvard University); Frank R. Gunter, PHD (Johns Hopkins University); Judith A. McDonald, PHD (Princeton University); Chad Meyerhoefer, PHD (Cornell University); Vincent G. Munley, PHD (State University of NY at Binghamton); Larry W. Taylor, PHD (University of North Carolina, Chapel Hill); Todd A. Watkins, PHD (Harvard University)

Associate Professors. Ernest Kong-Wah Lai, PHD (University of Pittsburgh); Alberto Lamadrid, PHD (Cornell University); Oleksandr Nikolaev Rzhewskyi, PHD (University of Houston University Park); Ahmed S. Rahman, PHD (University of California Davis); Seth Richards-Shubik, PHD (University of Pennsylvania); Muze Yang, PHD (University of California, Berkeley)

Professors Of Practice. Luis F. Brunstein, PHD (University of California, Riverside); Yuval Erez, PHD (Cornell University)

Emeriti. J. Richard Aronson, PHD (Clark University); Nicholas W. Babkkins, PHD (Rutgers University); Thomas J. Hyclak, PHD (University of Notre Dame); Jon T. Innes, PHD (University of Oregon); Arthur E. King, PHD (Ohio State University); John R. McNamara, PHD (Rensselaer Polytechnic Institute); Anthony Patrick O'Brien, PHD (University of California, Berkeley); Robert J. Thornton, PHD (University of Illinois)

COLLEGE OF BUSINESS
Major in Economics
Students in the College of Business electing to major in economics must take the college core courses listed in the College of Business section of this catalog. The College of Business core requires that students take ECO119 and ECO146, as well as at least 12 credits of elective economics courses for a total of 18 credits beyond this catalog. The College of Business core requires that students take the college core courses listed in the College of Business section of this catalog. The College of Business core requires that students take ECO119 and ECO146, as well as at least 12 credits of elective economics courses for a total of 18 credits beyond the core requirements. The Economics Major provides students with a solid grounding in the basic tools and models used in economic analysis. Combined with the College of Business core, it prepares students for careers in business, consulting, non-profit organizations, or government. The requirements beyond the College of Business core are:

Common Economics Core
- ECO 119 Intermediate Macroeconomic Analysis 3
- or ECO 146 Intermediate Microeconomic Analysis 3

Quantitative Economics Core
- ECO 157 Statistical Methods II 3
- Students must take 12 credits from the following electives. There must be at least one course from each list, and at least two of the four courses must be at the 300 level.

Electives - Field Courses
- ECO 209 Comparative Economic Systems 3
- ECO 229 Economics of Money and Banking 3
ECONOMICS

COLLEGE OF ARTS AND SCIENCES

B.A. Major in Economics

The BA in Economics provides students with a solid grounding in the basic tools and models used in economic analysis. It is meant for students interested in consulting careers, careers in business or public policy, or in pursuing advanced degrees such as law. The requirements are:

### Common Economics Core

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECO 201</td>
<td>Federal Reserve Challenge</td>
<td>1-3</td>
</tr>
<tr>
<td>ECO 203</td>
<td>Microfinance: Financial Inclusion for the Poor</td>
<td>3</td>
</tr>
<tr>
<td>ECO 247</td>
<td>Sabermetrics</td>
<td>3</td>
</tr>
<tr>
<td>ECO 259</td>
<td>Athletic Complex Design</td>
<td>3</td>
</tr>
<tr>
<td>ECO 273</td>
<td>Community Consulting Practicum</td>
<td>3</td>
</tr>
<tr>
<td>ECO 274</td>
<td>Supervised Research *</td>
<td>1-3</td>
</tr>
<tr>
<td>ECO 301</td>
<td>Econometric Software</td>
<td>3</td>
</tr>
<tr>
<td>ECO 314</td>
<td>Energy Economics</td>
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</tr>
<tr>
<td>ECO 324</td>
<td>The Economics of the Sports Industry</td>
<td>3</td>
</tr>
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<td>ECO 325</td>
<td>Consumer Insights through Data Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ECO 328</td>
<td>Electricity Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECO 333</td>
<td>The Economics of Business Decisions</td>
<td>3</td>
</tr>
<tr>
<td>ECO 335</td>
<td>Cost-Benefit Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ECO 336</td>
<td>Antitrust, Regulation, and the New Economy</td>
<td>3</td>
</tr>
<tr>
<td>ECO 342</td>
<td>Economic Development in China</td>
<td>3</td>
</tr>
<tr>
<td>ECO 345</td>
<td>Political Economy of Iraq</td>
<td>3</td>
</tr>
<tr>
<td>ECO 357</td>
<td>Econometrics</td>
<td>3</td>
</tr>
<tr>
<td>ECO 360</td>
<td>Time Series Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ECO 366</td>
<td>Quantitative Market Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ECO 367</td>
<td>Applied Microeconometrics</td>
<td>3</td>
</tr>
<tr>
<td>ECO 371</td>
<td>Special Topics in Economics *</td>
<td>1-3</td>
</tr>
<tr>
<td>ECO 389</td>
<td>Honors Project</td>
<td>1-6</td>
</tr>
</tbody>
</table>

**Total Credits: 18**

* Students can apply at most 3 credits earned in this course toward the elective requirement.

**Electives - Applying Economics**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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</tr>
</thead>
<tbody>
<tr>
<td>ECO 368</td>
<td>Health Economics</td>
<td>3</td>
</tr>
</tbody>
</table>

**Electives - Field Courses**

Students must take three courses from the following list, at least two at the 300 level:

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>ECO 209</td>
<td>Comparative Economic Systems</td>
<td>3</td>
</tr>
<tr>
<td>ECO 229</td>
<td>Economics of Money and Banking</td>
<td>3</td>
</tr>
<tr>
<td>ECO 235</td>
<td>Labor Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECO 303</td>
<td>Economic Development</td>
<td>3</td>
</tr>
<tr>
<td>ECO 311</td>
<td>Environmental Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECO 312</td>
<td>Mathematical Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECO 322</td>
<td>Competitor and Market Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ECO 338</td>
<td>International Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECO 353</td>
<td>Public Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECO 358</td>
<td>Game Theory</td>
<td>3</td>
</tr>
<tr>
<td>ECO 365</td>
<td>Business, Government, and Macroeconomic Policy</td>
<td>3</td>
</tr>
</tbody>
</table>

**Electives - Applying Economics**

Students must take two courses from the following list, at least one at the 300 level, earning at least 6 credits overall:

<table>
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<tr>
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<td>ECO 342</td>
<td>The Economics of the Sports Industry</td>
<td>3</td>
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<td>Econometrics</td>
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</tr>
<tr>
<td>ECO 389</td>
<td>Honors Project</td>
<td>1-6</td>
</tr>
</tbody>
</table>

**Electives - Breadth Requirement**

Students must take one course from an approved list, earning at least 3 credits. Students should select a class that helps prepare them for some potential area of further study.

<table>
<thead>
<tr>
<th>Course</th>
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<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>or MATH 021</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 051</td>
<td>Survey of Calculus I</td>
<td>4</td>
</tr>
</tbody>
</table>

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<tr>
<td>ECO 335</td>
<td>Cost-Benefit Analysis</td>
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<td>ECO 336</td>
<td>Antitrust, Regulation, and the New Economy</td>
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<td>ECO 342</td>
<td>Economic Development in China</td>
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<td>ECO 345</td>
<td>Political Economy of Iraq</td>
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<td>ECO 357</td>
<td>Econometrics</td>
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<td>ECO 360</td>
<td>Time Series Analysis</td>
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<td>ECO 366</td>
<td>Quantitative Market Analysis</td>
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<td>ECO 367</td>
<td>Applied Microeconometrics</td>
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<tr>
<td>ECO 371</td>
<td>Special Topics in Economics *</td>
<td>1-3</td>
</tr>
<tr>
<td>ECO 389</td>
<td>Honors Project</td>
<td>1-6</td>
</tr>
</tbody>
</table>

**Total Credits: 38-39**

* Students can earn at most 3 credits.

2 Potential areas of further study include, but are not limited to, law or some other non-quantitative graduate degree, or for employment in business, government, or the non-profit sector. Students are responsible for making sure they have fulfilled any course pre-requisites.

3 The approved list includes the following courses: ACCT 108, ACCT 151, CSE 001 & CSE 002 (total of 4 credits), ENTP 101, ENTP 304, ENTP/IR/SDEV 307, ENTP/POLS 310, ENTP 315, ES 107, FIN 125, IR 225/POLS 225, IR 226, IR 226, LAW 101, MGT 314/ENTP 314, PHIL 172, POLS 103, POLS 109, POLS 306, SDEV 10, TE 211.
The requirements are:

**Common Economics Core**
- ECO 001 Principles of Economics 4
- ECO 119 Intermediate Macroeconomic Analysis 3
- ECO 146 Intermediate Microeconomic Analysis 3

**Quantitative Economics Core**
- ECO 045 Statistical Methods 3
- or MATH 231 Probability and Statistics 3
- ECO 157 Statistical Methods II 3
- ECO 357 Econometrics 3

**Collateral Requirement**
- MATH 021 Calculus I 4
- MATH 022 Calculus II 4
- MATH 043 Survey of Linear Algebra 3
- or MATH 205 Linear Methods 3
- or MATH 242 Linear Algebra 3
- CSE 001 Breadth of Computing 2
- CSE 002 Fundamentals of Programming 2

**Electives - Field Courses**
- Students must take four courses from the following list, at most two at the 200-level:
  - ECO 209 Comparative Economic Systems 3
  - ECO 229 Economics of Money and Banking 3
  - ECO 235 Labor Economics 3
  - ECO 303 Economic Development 3
  - ECO 311 Environmental Economics 3
  - ECO 312 Mathematical Economics 3
  - ECO 322 Competitor and Market Analysis 3
  - ECO 338 International Economics 3
  - ECO 353 Public Economics 3
  - ECO 358 Game Theory 3
  - ECO 365 Business, Government, and Macroeconomic Policy 3
  - ECO 368 Health Economics 3

**Electives - Applying Economics**
- Students must earn 12 credits by taking at least four courses from the following list, at most two at the 200-level:
  - ECO 201 Federal Reserve Challenge Competition 1-3
  - ECO 203 Microfinance: Financial Inclusion for the Poor 3
  - ECO 247 Sabermetrics 3
  - ECO 259 Athletic Complex Design 3
  - ECO 273 Community Consulting Practicum 3
  - ECO 274 Supervised Research 1 1-3
  - ECO 301 Econometric Software 1
  - ECO 314 Energy Economics 3
  - ECO 324 The Economics of the Sports Industry 3
  - ECO 325 Consumer Insights through Data Analysis 3
  - ECO 328 Electricity Economics 3
  - ECO 333 The Economics of Business Decisions 3
  - ECO 335 Cost-Benefit Analysis 3
  - ECO 336 Antitrust, Regulation, and the New Economy 3
  - ECO 342 Economic Development in China 3
  - ECO 345 Political-Economy of Iraq 3

**Electives - Applying Economics**
- ECO 360 Time Series Analysis 3
- ECO 366 Quantitative Market Analysis 3
- ECO 367 Applied Microeconomics 3
- ECO 371 Special Topics in Economics 1 1-3
- ECO 389 Honors Project 1 1-6

**Total Credits**
- 58-59

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**COLLEGE OF ARTS AND SCIENCES**

**MAJOR IN INTERNATIONAL RELATIONS AND ECONOMICS**

This major combines international economics, which is the study of markets and economic policy, with international political economy, which studies international institutions and the interactions of states with those institutions and each other. This major is designed for students who wish to be considered for departmental honors. Students must consult with their major advisor and request departmental honors. To be eligible for departmental honors, a student must have a 3.5 or better GPA in economics courses, completed at least three 200-level or 300-level economics courses before beginning the thesis work, and found a faculty member willing to advise the work and another willing to serve as the second reader. To begin, the student must submit a well-written and well-thought-out thesis proposal to the advisor. To graduate with honors, the student must submit a written thesis and an oral presentation of the work. Students fulfilling all requirements of the honors program will receive credit for ECO 389; these credits may be applied toward the elective requirements of the Economics Major. Interested students should contact the Director of the Economics Honors Program.

**MINOR IN ECONOMICS**

This minor is available to all students in the College of Arts and Sciences (CAS). Interested students should contact the minor advisor. A minor in economics consists of 12 credit hours beyond ECO 001. Required courses in the minor are:

- ECO 119 Intermediate Macroeconomic Analysis 3
- ECO 146 Intermediate Microeconomic Analysis 3
- Two elective courses 1 2

1 Electives must be chosen from among 200- and 300-level economics offerings, with at least one course being a 300-level elective. None of the following courses may be used to satisfy the requirement.

**Courses**

**ECO 001 Principles of Economics 4 Credits**

A one-semester course in the principles of economics. General topics covered are: supply and demand; pricing and production decisions of firms; the role of government in the economy; the determination of national income; money and banking; monetary and fiscal policy; and government finance.

**Attribute/Distribution:** SS
ECO 029 Money, Banking, and Financial Markets 3 Credits
The nature and functions of money. Global money and financial markets. The role of commercial and central banks. Effects of the interest rate, exchange rate, and the money supply on the economy. Examination and evaluation of current and past monetary policies.
**Prerequisites:** ECO 001
**Attribute/Distribution:** SS

ECO 045 Statistical Methods 3 Credits
Descriptive statistics, probability and probability distributions, sampling, estimation, hypothesis testing, chi-square tests, simple regression and correlation. Note: CBE students may not take MATH 012 as a replacement for ECO 045.

ECO 119 Intermediate Macroeconomic Analysis 3 Credits
Macroeconomic measurement, theory and policy. The use of alternative macroeconomic models to analyze the level of national income, inflation, unemployment, economic growth; the balance of payments, and exchange rate determination.
**Prerequisites:** (ECO 001) and (MATH 021 or MATH 031 or MATH 051 or MATH 081 or MATH 076)
**Attribute/Distribution:** SS

ECO 146 Intermediate Microeconomic Analysis 3 Credits
The application of economic analysis to managerial and public policy decision-making. Not available for credit to students who have taken ECO 105.
**Prerequisites:** (ECO 001) and (MATH 021 or MATH 031 or MATH 051 or MATH 081 or MATH 076)
**Attribute/Distribution:** SS

ECO 157 Statistical Methods II 3 Credits
The course is a continuation of Economics 045 that gives broader coverage of linear regression and the construction of empirical models. Topics include the analysis of variance, simple and multiple regression, time series analysis, and forecasting.
**Prerequisites:** MATH 012 or MATH 231 or ECO 045

ECO 173 Economics Internship 1-3 Credits
Based on a student’s work experience, a sponsoring faculty member shall direct readings, projects, and other assignments—including a “capstone report.” It should be noted that the work experience (at least 80 hours), by itself, is not the basis for academic credit. Course registration and related arrangements must be made in advance of the work engagement. This course must be taken Pass/Fail, cannot be used to satisfy economics major requirements. Declaration of an economics major and consent of department required.
**Prerequisites:** ECO 001

ECO 201 Federal Reserve Challenge Competition 1-3 Credits
To prepare for the Federal Reserve Challenge Competition. Course may be repeated for credit. Credits are assigned based on role - 1 credit for 1st time researchers, 2 credits for 2nd time researchers, and 3 credits for speakers. Up to three credits of the course can be counted toward the economics major, but the course cannot count toward the economics minor. Department permission is required for enrollment.
**Repeat Status:** Course may be repeated.
**Prerequisites:** ECO 119
**Can be taken Concurrently:** ECO 119
**Attribute/Distribution:** SS

ECO 203 Microfinance: Financial Inclusion for the Poor 3 Credits
Non-technical survey of the global microfinance industry, which provides financial services to the poor on a large scale, mostly in developing nations. Historical origins and industry evolution. Nature and developmental role of microenterprises and informal finance. Methods and technologies used by microfinance institutions (MFIs). Case studies of leading MFIs and the lives of their clients. Policy and regulatory environments. Debates over profiting from the poor, and over health and environmental goals. Conflicting evidence on economic and social impact. Meetings with practitioners.
**Prerequisites:** ECO 001
**Attribute/Distribution:** SS

ECO 209 Comparative Economic Systems 3 Credits
An analysis of the micro- and macro-economic, institution and political dimensions of various economic systems, with particular emphasis on former centrally planned economies in their transition to a market orientation.
**Prerequisites:** ECO 001 or ECO 011 or ECO 012
**Attribute/Distribution:** SS

ECO 211 Introduction to Environmental Economics 3 Credits
An examination of the interactions between our economic systems and the environment. Pollution as a consequence of human activity within a framework for analyzing the relationships between environmental quality, scarcity of resources and economic growth. How to develop appropriate policies to deal with these issues.
**Attribute/Distribution:** SS

ECO 229 Economics of Money and Banking 3 Credits
This course studies the economics of money, banking, interest rates, and monetary policy as they apply to the US and other economies. This course has two main objectives. One is to study the main aspects of banks through their role in financial intermediation and the effects on monetary policy. The second objective is to study the role of money, central banking, and the conduct of monetary policy.
**Prerequisites:** ECO 001 and ECO 119
**Can be taken Concurrently:** ECO 119
**Attribute/Distribution:** SS

ECO 235 Labor Economics 3 Credits
The economic analysis of labor markets, with emphasis on labor supply and demand, wage and employment theory, and the economics of unionism and other labor market institutions.
**Prerequisites:** ECO 001 or (ECO 011 and ECO 012) or (ECO 011 and ECO 022) or (ECO 012 and ECO 021)
**Attribute/Distribution:** SS

ECO 247 Sabermetrics 3 Credits
The class will discuss the development and theory of quantitative analysis in baseball. Students will be introduced to modern sabermetric theory and introduced to various data sets, publications, database skills, and research methods commonly used in the sabermetric industry. Topics will include hitting, pitching, and defensive analysis, player valuation and the free agent market, in-game strategy, and the amateur draft.
**Prerequisites:** ECO 001 and (ECO 045 or PSYC 110 or ISE 111 or CEE 012 or MATH 231 or MATH 012)

ECO 259 Athletic Complex Design 3 Credits
This course is for students to participate in cross discipline Integrated Learning Experience (ILE) research projects. The twin purposes of the course are to provide real-world, team-oriented learning experiences and to apply economic analysis in evaluating the costs and benefits of newly proposed, or renovations and expansions of, existing athletic facilities.
**Prerequisites:** ECO 105 or ECO 146

ECO 273 Community Consulting Practicum 3 Credits
This course involves teams of students in community-oriented research projects. The twin purposes of the course are to provide real-world, team-oriented learning experiences and to provide a resource for local governments and community organizations that would allow them to draw upon the expertise of our students as consultants in analyzing problems and formulating policy.
**Prerequisites:** ECO 001

ECO 274 Supervised Research 1-3 Credits
Apprenticeship in ongoing faculty research program. Literature review, experimental design, data collection and analysis, and professional writing under faculty supervision. Consent of faculty sponsor required. Up to three research credits can be used toward the CAS and CBE economics majors, and three credits may be used to satisfy the consulting project requirement of the business economics major. Supervised research credits may not be applied to the economics minor.
**Repeat Status:** Course may be repeated.
**Prerequisites:** ECO 119 or ECO 146 or ECO 245
**Attribute/Distribution:** SS
ECO 300 Apprentice Teaching 1-3 Credits

ECO 301 Econometric Software 3 Credits
The fundamentals of data management and analysis using statistical software, such as Stata and/or SAS. Data management and programming skills using the Stata or SAS system will be developed. An introduction to R and basic programming in R will be included as well. Working with big data will provide hands-on, practical experience. Upon completion of this course students will be able to manage data to boost their research and analysis skills.

ECO 303 Economic Development 3 Credits
Economic development, economic growth and their political environment are discussed in detail. The principal economic development theories are examined. These theories are used to examine a variety of development issues including planning, poverty, rural-urban relationships, physical and human capital accumulation, international trade, and the environment. Emphasis on institutions and development policy.
Prerequisites: ECO 105 or ECO 115 or ECO 146
Attribute/Distribution: SS

ECO 311 Environmental Economics 3 Credits
Resource allocation implications of environmental degradation. Analysis of the benefits and costs associated with alternative pollution control programs and strategies.
Prerequisites: ECO 146

ECO 312 Mathematical Economics 3 Credits
Applications of various mathematical techniques in the formation and development of economic concepts and theories. Students cannot receive credit for both ECO 312 and ECO 412.
Prerequisites: ECO 146 and MATH 022 and MATH 231

ECO 314 Energy Economics 3 Credits
The economic theory of natural resource allocation over time. Economics of exhaustible and renewable resources. Environmental effects of energy production and consumption. Government regulation of the energy industry. Computer models for energy system forecasting and planning.
Prerequisites: ECO 105 or ECO 146
Attribute/Distribution: SS

ECO 322 Competitor and Market Analysis 3 Credits
Competitors, partners, and firms and governments strategically interact. This course uses game theory to analyze issues like pricing by competitors, vertical integration and contracting issues in supplier-buyer relationships, collective actions and joint ventures, and research and development programs. Students use both mathematical models and cases to analyze these interactions.
Prerequisites: (ECO 105 or ECO 115 or ECO 146) and (ECO 145 or ECO 045 or MATH 012 or MATH 231 or ISE 111 or IE 111 or SR 111) and (MATH 021 or MATH 031 or MATH 051 or MATH 081 or MATH 076)
Attribute/Distribution: SS

ECO 324 The Economics of the Sports Industry 3 Credits
This course analyzes the role of basic economic forces in shaping today’s sports industry. Topics include: competition in the market for professional franchises; public subsidies for stadiums and arenas; compensation of professional athletes; the NCAA as an economic enterprise; and the impact of athletics on a university’s budget.
Prerequisites: ECO 105 or ECO 146
Attribute/Distribution: SS

ECO 325 (MKT 325) Consumer Insights through Data Analysis 3 Credits
Explores marketing analytic approaches aimed to improve the understanding of customer and customer perceptions thereby enhancing the effectiveness of marketing decision making and implementation. Foundational data analysis techniques are examined in such areas as advertising, customer acquisition and retention (customer relationship management), segmentation, customer loyalty, lifetime-value analysis of the customer, pricing, sales force management, sales promotions and new products. The development, implementation, and utilization of quantitative models on customer data are emphasized. Prerequisites as noted below.
Prerequisites: MKT 111 and ECO 146
Attribute/Distribution: ND

ECO 328 (ECE 328) Electricity Economics 3 Credits
The course is intended primarily for students who are interested in an exploration of the electricity market, its operation and the main considerations to implement it, in the wake of a smart grid implementation, with basic college-level calculus.
Repeat Status: Course may be repeated.
Prerequisites: ECO 001 and (MATH 023 or ECO 146)
Attribute/Distribution: SS

ECO 333 The Economics of Business Decisions 3 Credits
Students analyze business problems using economic logic and techniques like mathematical programming, marginal analysis, and decision making under risk and uncertainty. New topics like asymmetric information and the analysis of organizations are introduced. Case studies are emphasized.
Prerequisites: (ECO 105 or ECO 115 or ECO 146) and (ECO 145 or ECO 045 or MATH 012 or MATH 231 or ISE 111 or IE 111 or SR 111) and (MATH 021 or MATH 031 or MATH 051 or MATH 081 or MATH 076)
Attribute/Distribution: SS

ECO 335 Cost-Benefit Analysis 3 Credits
Theory and methods of cost-benefit analysis; efficiency and equity as criteria in program evaluation; rationale(s) for government intervention in free market economies, proper measurement of market and non-market costs and benefits; consideration of risk, uncertainty, appropriate discounting techniques, and distributional consequences.
Prerequisites: ECO 146
Attribute/Distribution: SS

ECO 336 Antitrust, Regulation, and the New Economy 3 Credits
Analyzes government responses to market power by examining antitrust policy and the regulation of natural monopoly. Focus in antitrust is on price-fixing, mergers, and dominant firms, and includes an introduction to the economics of platforms that highlights the new challenges they present. Analysis of regulation is focused on the problem of setting prices for a natural monopoly, on theories of regulation, and on the difficulties of deregulating.
Prerequisites: ECO 146
Attribute/Distribution: SS

ECO 338 International Economics 3 Credits
In trade (applied micro) graphical and mathematical analysis will be used to understand: why countries trade and the income-distributional effects; the gains from trade; the effects of government policies; and the reasons underlying the formation of trading blocs (e.g., TPP). In finance (applied macro) we will: examine the balance-of-payments accounts; develop international financial linkages (e.g., uncovered interest parity) and several exchange-rate models (e.g., the law of one price); and use models to understand macro policy-making in an open economy.
Prerequisites: (ECO 029 or ECO 119 or ECO 229) and ECO 146
Attribute/Distribution: SS

ECO 339 International Trade 3 Credits
The theory of international trade; the theory of tariffs; United States commercial policies; the impact of growth and development of the world economy.
Prerequisites: ECO 105 or ECO 146
Attribute/Distribution: SS
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
<th>Prerequisites</th>
<th>Attribute/Distribution</th>
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</thead>
<tbody>
<tr>
<td>ECO 340</td>
<td>International Finance 3 Credits</td>
<td>The monetary side of an open economy and the financial transactions that accompany trade in goods and services. Macroeconomic links among participants in the global economy; currency and financial crises illustrate how difficult it is for countries to remain insulated from external shocks. Topics include: balance-of-payments accounting, exchange-rate models, and macroeconomic policies under different exchange-rate regimes and capital-mobility assumptions.</td>
<td>ECO 119</td>
<td>SS</td>
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<tr>
<td>ECO 342</td>
<td>Economic Development in China 3 Credits</td>
<td>An examination of the economic, political and social forces at work in the development process in China since 1949. Special emphasis on post-1978 market reforms, the rural-urban divergence, the role of foreign trade and investment, the accumulation of human capital, and the deterioration of the physical environment. Concludes with a detailed discussion of possible futures of the Chinese economy.</td>
<td>ECO 303</td>
<td>SS</td>
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<tr>
<td>ECO 345</td>
<td>Political-Economy of Iraq 3 Credits</td>
<td>An examination of the economic, political and social forces at work in Iraq with emphasis on the post-2002 period. Major topics include recent history and culture, petroleum production and transport, corruption, agricultural transition, rural-urban divergence, unemployment, poverty, the economic and political role of the state owned enterprises, entrepreneurship and the informal economy, banking, and monetary exchange rate, and fiscal policies.</td>
<td>ECO 303 or IR 225</td>
<td>SS</td>
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<tr>
<td>ECO 353</td>
<td>Public Economics 3 Credits</td>
<td>A course on the economic analysis of government. Major topics include the theory of public goods, the economics of taxation, the design of tax structures, externalities, and social insurance.</td>
<td>ECO 146</td>
<td>ND</td>
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<tr>
<td>ECO 357</td>
<td>Econometrics 3 Credits</td>
<td>Problems in construction, evaluation and use of econometric models. Applications based on research and case studies.</td>
<td>ECO 119 or ECO 146 or MATH 012 or MATH 231 or ISE 111 and (ECO 245)</td>
<td>ND</td>
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<tr>
<td>ECO 358</td>
<td>Game Theory 3 Credits</td>
<td>A mathematical analysis of how people interact in strategic situations, which covers games of complete and asymmetric information and simultaneous moves and dynamic games. The course involves Nash equilibrium, backward induction, commitment, credibility, asymmetric information, adverse selection, and signaling, and is applied to the economics, politics, business, and everyday life.</td>
<td>ECO 146 and (MATH 021 or MATH 031 or MATH 051 or MATH 081)</td>
<td>ND</td>
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<tr>
<td>ECO 360</td>
<td>Time Series Analysis 3 Credits</td>
<td>This course provides an introduction to time series analysis as it is applied in macroeconomics and finance. The class will emphasize hands-on implementation of macroeconomic and time series models for macroeconomic, financial, and policy analysis. Topics include macroeconomic data, linear and nonlinear univariate time series models, practical issues with likelihood-based inference in time series models, forecasting, multivariate models, and structural identification in multivariate models.</td>
<td>ECO 245</td>
<td>ND</td>
</tr>
<tr>
<td>ECO 362</td>
<td>Martindale Research Seminar 1-3 Credits</td>
<td>This course prepares students to undertake research on various topics in business and/or economics. Admission to this course is limited to student associates of the Martindale Center for the Study of Private Enterprise. Consent of the instructor is required. This course does not count towards an Economics major or minor.</td>
<td>ECO 229 or ECO 119</td>
<td>ND</td>
</tr>
<tr>
<td>ECO 365</td>
<td>Business, Government, and Macroeconomic Policy 3 Credits</td>
<td>This course analyzes particular domestic and foreign macroeconomic policy episodes. Through the case study method, the provides both an historical and an international context for understanding current macroeconomic policy issues.</td>
<td>ECO 029 or ECO 119</td>
<td>ND</td>
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<tr>
<td>ECO 366</td>
<td>Quantitative Market Analysis 3 Credits</td>
<td>The course covers the application of empirical approaches to theoretical frameworks in the analysis of market structure, firm strategies, and consumer behavior. Students learn econometric methods to identify causal relationships, and the course emphasizes the role of theoretical models in developing hypotheses and interpreting data. The course covers methods of field experiments and causal inference using non-experimental data. Topics include pricing and market conduct, demand analysis, marketing, and online marketplaces. Basic knowledge of microeconomic theory and econometrics is required.</td>
<td>ECO 146 and (ECO 245 or ECO 357)</td>
<td>SS</td>
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<tr>
<td>ECO 367</td>
<td>Applied Microeconometrics 3 Credits</td>
<td>An empirical class with concentration in Applied Microeconometrics. Its goal is to give you knowledge (various econometrics methods) and a tool (Stata) to solve real-life problems.</td>
<td>ECO 245 or ECO 357</td>
<td>ND</td>
</tr>
<tr>
<td>ECO 368</td>
<td>Health Economics 3 Credits</td>
<td>Supply and demand in the health service markets for the U.S. and Canada. Unique features of health care which interfere with competitive market allocation and pricing. Overview of insurance systems and other payment methods.</td>
<td>ECO 145 or ECO 045 or MATH 012 or MATH 231 and (ECO 105 or ECO 146)</td>
<td>SS</td>
</tr>
<tr>
<td>ECO 371</td>
<td>Special Topics in Economics 1-3 Credits</td>
<td>Study in various fields of economics, designed for the student who has a special interest in a subject not included in the regular course schedule or for the student interested in pursuing a significant supervised research project in economics. Students interested in enrolling in this course must submit a written proposal to a member of the faculty with expertise in the proposed subject area and to the department chair prior to the registration period for the relevant semester. This course may count towards the ECO major only once; it does not count towards the ECO minor.</td>
<td>ECO 105 or ECO 146 or ECO 119</td>
<td>ND</td>
</tr>
<tr>
<td>ECO 389</td>
<td>Honors Project 1-6 Credits</td>
<td>Repeat Status: Course may be repeated.</td>
<td>ECO 146 or ECO 119</td>
<td>ND</td>
</tr>
<tr>
<td>ECO 401</td>
<td>Basic Statistics for Business and Economics 3 Credits</td>
<td>Descriptive statistics, probability and probability distributions, estimation, hypothesis testing, correlation and regression, chi-square analysis, and analysis of variance. Computer applications.</td>
<td>ECO 202 or MATH 096</td>
<td>ND</td>
</tr>
<tr>
<td>ECO 402</td>
<td>Managerial Economics 3 Credits</td>
<td>Application of economic and statistical analysis to managerial decision-making. Business and economic forecasting. Empirical estimation of demand, production, and cost functions. Resource allocation and pricing strategies in various market structures. Decisions under risk and uncertainty. Government regulation of business cases.</td>
<td>MATH 021 and (MATH 022 or MATH 081)</td>
<td>ND</td>
</tr>
<tr>
<td>ECO 403</td>
<td>Econometric Software 3 Credits</td>
<td>The fundamentals of data management and analysis using statistical software, such as Stata and/or SAS. Data management and programming skills using the Stata or SAS system will be developed. An introduction to R and basic programming in R will be included as well. Working with big data will provide hands-on, practical experience. Upon completion of this course students will be able to manage data to boost their research and analysis skills.</td>
<td>ECO 202 or MATH 096</td>
<td>ND</td>
</tr>
</tbody>
</table>
ECO 404 Applied Microeconometrics 3 Credits
The purpose of this course is to expose students to econometric techniques frequently used in applied microeconomic research. The course features critical reading of empirical research papers and the implementation of econometric methods on actual data sets.

ECO 409 Money, Banking and Macroeconomic Analysis 2 Credits
The role of financial intermediation in the U.S. economy, the process of money creation, impacts of fiscal and/or monetary policy on the goals of macroeconomic policy, inflation and unemployment.

ECO 412 Mathematical Economics 3 Credits
Applications of various mathematical techniques in the formation and development of economic concepts and theories. Consent of instructor required.

ECO 413 Advanced Microeconomics Analysis 3 Credits
A survey of methods of decision-making at the macroeconomic level; price theory and econometric applications.
Prerequisites: ECO 402

ECO 414 Advanced Topics in Microeconomics 3 Credits
Resource allocation and price determination. Theories of choice of consumers, firms, and resource owners under various market forms.
Prerequisites: ECO 413

ECO 415 Econometrics I 3 Credits

ECO 416 Econometrics II 3 Credits
Mathematical and statistical specification of economic models. Statistical estimation and tests of parameters in single and multiple equation models. Prediction and tests of structural change.
Prerequisites: ECO 415

ECO 417 Advanced Macroeconomic Analysis 3 Credits
Macroeconomic theory and policy. Emphasis on theoretical models and policy implications.

ECO 418 Advanced Topics in Macroeconomics 3 Credits
Prerequisites: ECO 417

ECO 423 Real Options 3 Credits
This is an introductory graduate level course in financial economics. It is intended for students with strong technical backgrounds who are comfortable with mathematical arguments. The course is divided into three major parts: deterministic finance, single-period uncertainty finance, and options theory and its applications.
Prerequisites: GBUS 420

ECO 425 Cost-Benefit Analysis 3 Credits
Theory and methods of cost-benefit analysis; efficiency and equity as criteria in program evaluation; proper measurement of market and non-market costs and benefits; consideration of risk, uncertainty, appropriate discounting techniques, and distributional consequences; applications to the evaluation of health care policies and therapies.
Prerequisites: ECO 402 and ECO 415

ECO 427 Statistical Analysis for Management 2 Credits
Descriptive statistical measures, probability and probability distributions, statistical inference (estimation and hypothesis testing), correlation and regression. EXCEL will be used for statistical computing.

ECO 428 Electricity Economics 3 Credits
The course will focus on the intersection between economics and electricity systems, and the market structures available in the electric energy industry. The course is intended to provide a background on basic economic theory applied to power systems, to understand operations objectives, pricing and incentives and non perfect competition situations that arise in the network. Different dispatch optimization problems used in the restructures electricity market will be discussed, approaches to solve these problems, and the existence of non-convex markets.
Prerequisites: ECO 001 and (ECO 146 or MATH 023)

ECO 429 Monetary Theory 3 Credits
The role of money in the economy from theoretical and empirical perspectives. The influence of money and prices, interest rates, output, and employment.

ECO 430 Public Finance 3 Credits
The economics of public spending and taxation; principles of government debt management; theories of budgeting and cost-benefit analysis and public choice.

ECO 431 Quantitative Market Analysis 3 Credits
The course covers the application of empirical approaches to theoretical frameworks in the analysis of market structure, firm strategies, and consumer behavior. Students learn econometric methods to identify causal relationships, and the course emphasizes the role of theoretical models in developing hypotheses and interpreting data. The course covers methods of field experiments and causal inference using non-experimental data. Topics include pricing and market conduct, demand analysis, marketing, and online marketplaces. Students cannot receive credit for both ECO 366 and ECO431.

ECO 440 Labor Economics I 3 Credits
The economics of labor markets and various labor-market institutions with emphasis on current theoretical and empirical research. Topics include labor supply and demand, human capital, the structure of labor markets, labor market regulation, information and job search, labor mobility, unionism, and labor market discrimination.
Prerequisites: ECO 402

ECO 441 Labor Economics II 3 Credits
An examination of empirical research in labor economics, focusing on topics such as human resource management and internal labor market outcomes, wage and income inequality and poverty, unemployment, and other issues current in the literature.
Prerequisites: ECO 402 and ECO 415

ECO 447 Economic Analysis of Market Competition 3 Credits
Mathematical models based on game theory and industrial organization. Cases are used to analyze the strategic interaction of firms and governments as competitors and partners.
Prerequisites: ECO 402

ECO 448 Business Economics 3 Credits
Applications of economic analysis to business decision-making; technology in economic systems; resource allocation and pricing strategies in various market structures; decisions under risk and uncertainty; and government regulation and support of business and innovation.

ECO 454 Economics of Environmental Management 3 Credits
Economic theory of natural resources. Optimal policies for the development of renewable and nonrenewable resources and environmental quality.

ECO 455 Health Economics I 3 Credits
Economic theory and empirical analysis of health production, the demand for health services, and health insurance. Implications for the current institutional structure of health care and health delivery systems will also be discussed. Additional topics and extensions will be selected based on developments in the literature.
Prerequisites: ECO 402 and ECO 415

ECO 456 Industrial Organization 3 Credits
The goal of the course is to review theoretical and empirical attempts by economists to understand market structures lying between the extremes of perfect competition and monopoly. The course will focus first on describing the current U.S. industrial structure and reviewing models of imperfect competition. The course then shifts to a closer study of individual firm behavior. The final segment of the course is an overview of two significant relationships between government and industry caused by the existence of imperfect.
Prerequisites: ECO 415 and ECO 447
**ECO 457 Bio-Pharmaceutical Economics 3 Credits**
Characteristics of the market for pharmaceuticals; barriers to entry, competition and innovation; pricing and regulation; physician prescribing behavior; commercialization and financing of biotech startups; international comparisons of public policy.
Prerequisites: ECO 401 and ECO 402

**ECO 460 Time Series Analysis 3 Credits**
Classical decomposition of time series, trend analysis, exponential smoothing, spectral analysis and Box-Jenkins autoregressive and moving average methods.

**ECO 461 Forecasting 3 Credits**
Methods of economic and business forecasting.

**ECO 463 Topics in Game Theory 3 Credits**
A mathematical analysis of how people interact in strategic situations. Topics include normal-form and extensive-form representations of games, various types of equilibrium requirements, the existence and characterization of equilibria, and mechanism design. The analysis is applied to micro-economic problems including industrial organization, inter-national trade, and finance. Must have completed two semesters of calculus.
Prerequisites: ECO 412 and ECO 413

**ECO 464 Applied Econometrics I 3 Credits**
This course focuses on the identification of causal relationships using cross-sectional and panel data. The objectives are to 1) familiarize students with identification assumptions for causal inference; and 2) enable students to select appropriate econometric tools for empirical economic problems and policy evaluation. Topics include robust inference and bootstrap; instrumental variables and generalized method of moments (GMM); quantile and nonparametric regression methods; treatment effect analysis, and models for discrete choices, panel data, and social interactions.
Prerequisites: ECO 416

**ECO 465 Applied Econometrics II 3 Credits**
Econometric analysis of skewed and truncated distributions, discrete outcomes, and missing or incomplete data. The first part of this course will involve the functional specification and testing of appropriate estimators in these situations, while the second part of the course will focus on conducting causal inference using non-linear models in the presence of unobserved heterogeneity. Emphasis will be given to common applications in health and labor economics.
Prerequisites: ECO 416

**ECO 466 Health Economics II 3 Credits**
Selected topics in the literature on health economics with an emphasis on the application and evaluation of econometric techniques and identification strategies. Both demand and supply side issues will be addressed. Examples of the former include the demand for health, health insurance and health care services, while examples of the latter include the regulation of supplier behavior and industrial organization issues.
Prerequisites: ECO 402 and ECO 416

**ECO 472 International Trade Theory 3 Credits**
Theories of comparative advantage, factor price equalization, trade and welfare, tariffs, trade and factor movements.
Prerequisites: ECO 413

**ECO 473 International Monetary Economics 3 Credits**
Theory of the balance of payments, the microeconomics of international finance, various approaches to balance-of-payments adjustments, theories of foreign exchange-rate determination, and macroeconomic policy under fixed and flexible exchange rates.
Prerequisites: ECO 417

**ECO 490 Dissertation 1-6 Credits**
Doctoral Pre-Dissertation Research Project - Independent Study 1-9 Credits
Independent study on a topic that is being pursued to fulfill the third year paper requirement, and has been approved by the student’s interim advisor.

**ECO 499 Dissertation 1-15 Credits**
Repeat Status: Course may be repeated.

**Entrepreneurship**
Entrepreneurship-related programs and activities are university-wide. Entrepreneurship curriculum is overseen by a joint committee of faculty from CBE, CAS and RCEAS.

**MINOR IN ENTREPRENEURSHIP**
Open to all undergraduate students, from any major.
The purpose is to enable students in any major to supplement their major with a creative entrepreneurial mindset and skills that increase their ability to identify opportunities for innovation, to challenge the status quo in any field, and to implement sustainable change, whether in emerging or established companies or non-profit enterprises. The program is designed to be accessible to students from all disciplines with an emphasis upon innovation, entrepreneurial thinking and creative processes, cross-functional integration, and hands-on experiential practice. The minor leverages the resources and support of the Baker Institute for Entrepreneurship, Creativity, and Innovation, as well as a broad array of related programs and infrastructure across the university.

We encourage participation by those interested in all types of entrepreneurship, including business and technical entrepreneurship but also not-for-profit contexts aiming for social, cultural and environmental change. Throughout the multi-disciplinary, team-based curriculum, students are encouraged to work either on their own entrepreneurial projects, projects related to Lehigh University intellectual property, or on ideas brought in by outside entrepreneurs.

**Recommended Tracks**
Students may select any set of courses that fulfill the minor requirements. However students are encouraged consult with the minor director to design a focused track, such as New Ventures Technology Entrepreneurship, Social & Non-profit Entrepreneurship, Arts Entrepreneurship, Service-sector Entrepreneurship, or others. The recommended approach for a focused track begins with the introductory ENTP 101 and closes with in-depth hands-on capstone entrepreneurial experiences, sandwiched around a flexible package of courses selected by each student as needed to foster their particular entrepreneurial interests and goals.

**Requirements**
Entrepreneurship-related programs and activities are university-wide. Entrepreneurship curriculum is overseen by a joint committee of faculty from CBE, CAS and RCEAS.

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RECOMMENDED TRACKS
Students may select any set of courses that fulfill the minor requirements. However students are encouraged consult with the minor director to design a focused track, such as New Venture, Technology Entrepreneurship, Social & Non-profit Entrepreneurship, Arts Entrepreneurship, Service-sector Entrepreneurship, or others. The recommended approach for a focused track begins with the introductory ENTP 101 and closes with in-depth hands-on capstone entrepreneurial experiences, sandwiched around a flexible package of courses selected by each student as needed to foster their particular entrepreneurial interests and goals.

REQUIREMENTS
The minor has a prerequisite of ECO 001 (4 credit hours) and then requires at least 12 credit hours of ENTP and capstone courses.

Prerequisite Course
ECO 001 Principles of Economics

Required Courses
- ENTP 101 Introduction to Entrepreneurship
- Select at least 6 additional credit hours in other ENTP courses
- Select at least one (minimum 3 credit hours) of the following experiential Capstone courses:
  - ENTP 311 The Garage: Launching Entrepreneurial Ventures I
  - ENTP 312 The Garage: Launching Entrepreneurial Ventures II
  - ENTP/CSB 304 Technology and Software Ventures
  - ENTP/SDEV 307 International Social Entrepreneurship
  - ENTP/POLS 310 Social Entrepreneurship: How to Change the World
  - ENTP 314/MGT 314 Business Consulting Practicum
  - IBE 380 Integrated Business and Engineering Capstone Project I
  - IBE 385 Integrated Business and Engineering Capstone Project II
  - CSB 312 Design of Integrated Business Applications I
  - CSB 313 Design of Integrated Business Applications II
  - TE 211 Capstone Design Projects-1 (formally BUS/ENGR 211)
  - TE 212 Capstone Design Projects-2 (formally BUS/ENGR 212)

Other independent experiential project approved by the minor director

Total Credits: 12

1 ECO 001 Principles of Economics (4 credit hours) must be completed prior to enrolling in the minor. Students may enroll in ENTP 101 without ECO 001, but may not sign up for the minor until completing ECO 001.
2 Or alternatives approved by the minor director in consultation with the student.
3 Or alternatives approved by the minor director.

Students must complete the minor with an average GPA of at least 2.0 in those courses to qualify.

One course may overlap with the student's major.

Courses cross-listed in CBE (e.g., ENTP/MGT 314) do not count as non-CBE courses.

Course descriptions for the Entrepreneurship graduate courses can be located under Master of Engineering in Technical Entrepreneurship.

(p. 453)
ENTP 250 (TE 250) Systematic Creativity Techniques 3 Credits
ENTP 250/TE 250 -- Systematic creativity methods including anthropological research, brainstorming, bisociation, the Kano model, trimmings technique, DeBono's Six Hats technique, biomimicry, lateral benchmarking, Blue Ocean Strategy, & the art of tinkering, along with other innovation methods. This course includes hands-on labs, individual & team projects, & the creation of a creativity portfolio. Open to students in any college and major. (ND).

Attribute/Distribution: ND

ENTP 304 (CSB 304, TE 304) Technology and Software Ventures 3 Credits
Designed from the perspective of functional leaders, course provides a holistic perspective of developing successful software ventures across various industries in an interdisciplinary and experiential environment. Students develop a software-oriented idea, concurrent with module delivery containing best practices, case studies, and subject-matter experts. Examines business model fundamentals, customer discovery, translating requirements to a minimum viable product, agile development, user acquisition, and traction. ENTP Capstone. Prior programming experience or technical background not required. Open to students in any college and major.

Prerequisites: ENTP 101 or CSB 002 or BIS 111

ENTP 306 (MG 306) Decision Making and Problem Solving in Business 3 Credits
The course will provide the foundational hard and soft-skills consulting firms employ to identify and diagnose business problems, generate data, formulate innovative solutions, and effectively communicate recommendations. The course will blend lecture with experiential learning.

ENTP 307 (SDEV 307) International Social Entrepreneurship 4 Credits
International social entrepreneurship aims to change the world through innovation in solving social problems. Focus on the nexus between social entrepreneurship and development practice, especially in relation to NGOs. Emphasis on acquiring tools and conceptual frameworks to launch new social ventures through real hands-on international fieldwork and team-oriented learning by doing. Exposure to best practices of how to affect meaningful social change in poor countries, to generate and evaluate innovative ideas, and to develop them into concrete on-the-ground start-ups.

Attribute/Distribution: SS

ENTP 308 Creating and Sustaining a Non-Profit 3 Credits
Non-profit organizations can be effective institutional agents of change, if you know what you are doing. This class will make sure you do. Students will learn the nuts and bolts of creating and sustaining a non-profit, including recruiting and managing a board of directors, fundraising, marketing, program planning and evaluation. We will also explore the ethics, values and drive necessary to be an effective leader of a non-profit (SS).

Attribute/Distribution: SS

ENTP 309 (POL 390) Nonprofit Administration 4 Credits
Key questions in nonprofit sector research, policy, & management and factors that make the nonprofit sector distinct. Scope & character of nonprofit activity in the U.S. & abroad. Current debates in nonprofit policy and critical challenges facing management.

Attribute/Distribution: SS

ENTP 310 (POL 310) Social Entrepreneurship: How to Change the World 4 Credits
The marketplace does not always have to be harsh. Social entrepreneurship uses market-based approaches to address needs and solve problems in our society. Students in this seminar-style course will learn how to identify community problems, convince the community that it is a problem worth solving, design the response, and implement it. Hands-on projects. Must have junior standing or higher.

Prerequisites: ENTP 001

Attribute/Distribution: SS

ENTP 311 The Garage: Launching Entrepreneurial Ventures I 3 Credits
Students work in cross-disciplinary teams with faculty advisors and alumni mentors on marketing, financial planning, and economic and technical feasibility of entrepreneurial product- or service-based new ventures, commercial or non-profit. Students may elect to work either on their own entrepreneurial projects, or on projects related to Lehigh University intellectual property, or on ideas brought in by outside entrepreneurs. Oral presentations, written new venture plans and discussions with guest speakers are integral parts of the course. Consent of minor director.

Prerequisites: ENTP 101

Attribute/Distribution: ND

ENTP 312 The Garage: Launching Entrepreneurial Ventures II 3 Credits
Continuation of ENTP 311. Investigates and pursues in detail the critical steps and activities necessary when entrepreneurs seriously pursue launching new ventures. Consent of minor director.

Prerequisites: ENTP 311

ENTP 314 (MG 314) Business Consulting Practicum 3 Credits
Students will build upon the skills acquired in MGT 306 and, working in student teams, will engage client organizations to diagnose and develop innovative solutions to address client needs.

Prerequisites: ENTP 306

Attribute/Distribution: ND

ENTP 315 Lehigh Silicon Valley 1-4 Credits
Immersion study-abroad-like program about the creation of venture capital-backed companies. Offered in the hub of entrepreneurship, Silicon Valley, where countless ventures emerge, particularly in disruptive technologies, nextgen software and Internet. "Live cases" draw on seasoned practitioners from all reaches of the venture community. Students encounter a highly charged learning environment focused on real companies, real players, and real situations in real time. Offered January winter term. Includes pre-trip sessions and pre-and post-trip assignments. Admission by competitive application. Program fees.

Attribute/Distribution: ND

ENTP 319 (MKT 319) Development and Marketing of New Products 3 Credits
This course adopts the marketing philosophy that new products and services will be profitable if the extended product provides customers with highly valued benefits. The goal is to help students learn how to use state-of-the-art management techniques to identify markets, develop new product ideas, measure customer benefits, and design profitable new products. The course provides techniques to interface the marketing function with the functions of R&D, design engineering, and manufacturing.

Prerequisites: MKT 111

ENTP 320 (BIOS 320) The Business of Life Science 3 Credits
An examination of business process in startup, early stage and developing bioscience companies. Technology assessment, business plan and proposal preparation, financial strategies, resource management, intellectual property, and legal as well as regulatory issues. Cannot be used to fulfill major requirements in BIOS.

Prerequisites: BIOS 121

Attribute/Distribution: NS

ENTP 366 (MKT 366) Services Marketing and Innovation 3 Credits
While manufacturing giants all consider themselves service-related companies, services are moving to the forefront of industry value proposition offerings. This course focuses on issues related to service design and marketing on a broad basis, and its implication to retailing in particular. The course enables students to gain an understanding of the special challenges evident in marketing services and to acquire a unique set of knowledge and skills beyond the traditional strategies designed for product goods. Illustrative topics include fundamental differences.

Prerequisites: MKT 111
**Finance**

In the era of a growing competitive global economy, finance has become increasingly important and complex. This has led to an expansion of career opportunities within corporations, investment firms, and financial institutions worldwide. These opportunities are varied and often overlap with other disciplines such as accounting, economics, marketing, and mathematics. It is also important that students engage in extracurricular activities that might complement their academic studies.

The domestic financial services industry has been at the forefront of global finance and will remain as one of our relative strengths within a global economy. Lehigh, in turn, enjoys a relative advantage in this regard as Lehigh alumni are well respected in all areas of finance. Our program has also been able to take advantage of our proximity to many financial institutions.

**Professors.** Paul Brockman, PHD (Louisiana State University); Kathleen W. Hanley, PHD (University of Florida); Richard J. Kish, PHD (University of Florida); Matthew A. Melone, JD (University of Pennsylvania); George A. Nation, JD, JD (Villanova University); Nandkumar Nayar, PhD (University of Iowa); Georgette C. Phillips, JD (Harvard Law School); XueMin Yan, PhD (University of Iowa)

**Associate Professors.** Donald E Bowen, PhD (University of Maryland); Steven McKay Price, PhD (Florida State University); Jesus M. Salas, PhD (University of Oklahoma); Ke Yang, PhD (University of Iowa)

**Assistant Professors.** Ke Shen, MS (Northern Illinois U); Qianqian Yu, PhD (Boston College); Haibei Zhao, PhD (Georgia State University)

**Professors Of Practice.** Loren Kenneth Keim, Jr., MBA (Lehigh University); Olena Nikolsko-Rzhevskaya, PhD (University of Memphis); Vijay Singh, PhD (Ohio State University); Samuel C. Weaver, PhD (Lehigh University); Patrick J. Zoro, MBA (St Johns University Queens)

**Emeriti.** Carl R. Beidleman, PhD (University of Pennsylvania); Stephen G. Buell, PhD (Lehigh University); Stephen F. Thode, DBA (Indiana University Bloomington)

The finance major offered by the Perella Department of Finance requires at least 18 credit hours beyond the core requirements. Each finance major must successfully complete the 2-course depth requirement; the 3-course depth requirement; and a minimum 2-course breadth requirement as outlined below.

### 2-Course Foundation Requirement

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIN 323</td>
<td>Investments</td>
<td>3</td>
</tr>
<tr>
<td>FIN 328</td>
<td>Corporate Financial Policy</td>
<td>3</td>
</tr>
</tbody>
</table>

### 3-Course Depth Requirement

Select three of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIN 324</td>
<td>Security Analysis and Portfolio Management</td>
</tr>
<tr>
<td>FIN 330</td>
<td>Financial Markets and Institutions</td>
</tr>
<tr>
<td>FIN 333</td>
<td>Global Finance</td>
</tr>
<tr>
<td>FIN 334</td>
<td>Derivatives and Management of Risk</td>
</tr>
<tr>
<td>FIN 335</td>
<td>Advanced Topics – Financial Management (Various Topics can be offered under this course listing)</td>
</tr>
<tr>
<td>FIN 336</td>
<td>Real Estate Finance (Cannot be used as a depth requirement when following the Real Estate Track)</td>
</tr>
<tr>
<td>FIN 337</td>
<td>Advanced Topics–Investments (Various topics can be offered under this course listing)</td>
</tr>
</tbody>
</table>

### 2-Course Breadth Requirement

Select 2 breadth electives within one of the following six breadth tracks.*

*3 breadth electives for the Real Estate track.

#### Track 1: Financial Analysis

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCT 315</td>
<td>Intermediate Accounting I</td>
</tr>
<tr>
<td>ACCT 316</td>
<td>Intermediate Accounting II</td>
</tr>
</tbody>
</table>

#### Track 2: Financial Marketing

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>MKT 312</td>
<td>Marketing Research</td>
</tr>
<tr>
<td>MKT 319</td>
<td>Development and Marketing of New Products</td>
</tr>
<tr>
<td>MKT 320</td>
<td>Global Marketing</td>
</tr>
<tr>
<td>MKT/ECO 325</td>
<td>Consumer Insights through Data Analysis</td>
</tr>
</tbody>
</table>

#### Track 3: Analytical Finance

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>MATH 205</td>
<td>Linear Methods</td>
</tr>
<tr>
<td>MATH 242</td>
<td>Linear Algebra</td>
</tr>
<tr>
<td>MATH 231</td>
<td>Probability and Statistics</td>
</tr>
<tr>
<td>MATH 263</td>
<td>Introduction to the Theory of Probability</td>
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</tbody>
</table>

#### Track 4: Financial Economics

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>ECO 209</td>
<td>Comparative Economic Systems</td>
</tr>
<tr>
<td>or ECO 322</td>
<td>Competitor and Market Analysis</td>
</tr>
<tr>
<td>or ECO 328</td>
<td>Electricity Economics</td>
</tr>
<tr>
<td>or ECO 333</td>
<td>The Economics of Business Decisions</td>
</tr>
<tr>
<td>or ECO 336</td>
<td>Antitrust, Regulation, and the New Economy</td>
</tr>
<tr>
<td>or ECO 353</td>
<td>Public Economics</td>
</tr>
<tr>
<td>ECO 203</td>
<td>Microfinance: Financial Inclusion for the Poor</td>
</tr>
<tr>
<td>or ECO 303</td>
<td>Economic Development</td>
</tr>
<tr>
<td>or ECO 339</td>
<td>International Trade</td>
</tr>
<tr>
<td>or ECO 340</td>
<td>International Finance</td>
</tr>
</tbody>
</table>

#### Track 5: Real Estate (Must take all 3 courses)*

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIN 336</td>
<td>Real Estate Finance</td>
</tr>
<tr>
<td>IPRE 347</td>
<td>Practicum in Real Estate I</td>
</tr>
<tr>
<td>IPRE 348</td>
<td>Practicum in Real Estate II</td>
</tr>
</tbody>
</table>

#### Track 6: Expanded Finance

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
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<tbody>
<tr>
<td>FIN 324</td>
<td>Security Analysis and Portfolio Management</td>
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<td>Financial Markets and Institutions</td>
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<tr>
<td>FIN 333</td>
<td>Global Finance</td>
</tr>
<tr>
<td>FIN 334</td>
<td>Derivatives and Management of Risk</td>
</tr>
<tr>
<td>FIN 335</td>
<td>Advanced Topics – Financial Management (various topics can be offered under this course listing)</td>
</tr>
<tr>
<td>FIN 336</td>
<td>Real Estate Finance</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
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<td>------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>FIN 125</td>
<td>Introduction to Finance 3 Credits</td>
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</tr>
<tr>
<td>FIN 273</td>
<td>Finance Internship I 1-3 Credits</td>
</tr>
<tr>
<td>FIN 323</td>
<td>Investments 3 Credits</td>
</tr>
<tr>
<td>FIN 324</td>
<td>Security Analysis and Portfolio Management 3 Credits</td>
</tr>
<tr>
<td>FIN 328</td>
<td>Corporate Financial Policy 3 Credits</td>
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<td>Advanced Topics – Financial Management 3 Credits</td>
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<td>FIN 336</td>
<td>Real Estate Finance 3 Credits</td>
</tr>
<tr>
<td>FIN 371</td>
<td>Directed Readings 1-3 Credits</td>
</tr>
<tr>
<td>FIN 372</td>
<td>Special Topics 1-3 Credits</td>
</tr>
<tr>
<td>FIN 373</td>
<td>Finance Internship II 1-3 Credits</td>
</tr>
<tr>
<td>FIN 374</td>
<td>Portfolio Management Practicum 1-3 Credits</td>
</tr>
<tr>
<td>FIN 377</td>
<td>Advanced Topics–Investments 3 Credits</td>
</tr>
</tbody>
</table>

Undergraduate Courses

For Advanced Undergraduates and Graduate Students

Courses numbered 200 and above in the College of Business are open to sophomores only on petition.

Graduate Courses

Course descriptions for the College of Business graduate courses can be found under the heading of Business Graduate Courses.

Courses

FIN 125 Introduction to Finance 3 Credits
An introductory finance course stressing the links between corporate finance and investments. Major topic areas will include financial statement analysis, time value of money, risk and return valuation of stocks and bonds, capital budgeting, and cost of capital.

Prerequisites: ACCT 151 and (ECO 145 or ECO 045 or MATH 231 or ISE 111 or IIE 111 or SR 111) and (MATH 021 or MATH 031 or MATH 076 or MATH 081)

FIN 273 Finance Internship I 1-3 Credits
Based on a student’s work experience, a sponsoring faculty member shall direct readings, projects, and other assignments—including a “capstone report.” It should be noted that the work experience (at least 80 hours), by itself, is not the basis for academic credit. The faculty directed activity must be provided concurrent with the work. Course registration and related arrangements must be made in advance of the work engagement. This course must be taken Pass/Fail and cannot be used to satisfy finance major requirements. Declaration of a finance major. Consent of department required.

Prerequisites: (ECO 129 or ECO 029 and ACCT 151) and (ECO 145 or ECO 045 or MATH 231 or ISE 111 or IIE 111 or SR 111) and (MATH 021 or MATH 031 or MATH 076 or MATH 097 or MATH 081)

FIN 300 Apprentice Teaching 1-3 Credits
Repeat Status: Course may be repeated.

FIN 323 Investments 3 Credits
The nature of risk and the form of returns on financial assets from the viewpoint of various constituents. Investor objectives, attitudes, and constraints are considered within the risk-return matrix within the context of valuation.

Prerequisites: FIN 125

FIN 324 Security Analysis and Portfolio Management 3 Credits
Valuation of equity and debt instruments factoring in the influence earnings forecasts and expectations, uncertainty, required returns, supply and demand for securities and funds, and investor attitudes. Portfolio management concepts include the implications of market factors, technical analysis, timing, and screening of securities.

Prerequisites: FIN 323 and FIN 328

FIN 328 Corporate Financial Policy 3 Credits
The study of management issues related to capital budgeting, working capital, leasing, mergers, and financing.

Prerequisites: FIN 125

FIN 330 Financial Markets and Institutions 3 Credits
Functions and portfolios of financial intermediaries. Sectional demand and supply of funds, nature and role of interest rates, term structure and forecasting, impact of inflation and regulation on financial intermediaries and markets, and current developments in the financial system. Management of assets and liabilities within the U.S. financial institution’s legal and economic constraints.

Prerequisites: (FIN 323 and FIN 328)

FIN 333 Global Finance 3 Credits
Issues that underlie the investment, financing, and dividend decisions of multinational firms from both the buyer’s and seller’s viewpoints. Current transactions in foreign currencies, direct and portfolio investment and associated risk management when dealing in foreign countries.

Prerequisites: (FIN 328 and FIN 323)
**FIN 382 Guest Speaker Seminar Series 1 Credit**
This course is designed to help prepare students for ‘real’ world problems by exposing them to a variety of career opportunities. The purpose of this seminar is to give students the opportunity to network with successful professionals in the Financial Services industry, connecting students and practitioners across places and generations to build community around shared work-as-service interests. For future professionals, this seminar advances co-curricular programming to the “pro-curricular” level – linking classroom study of finance to the dynamic world of the practicing financial professionals.

**Repeat Status:** Course may be repeated.

**FIN 388 (BIS 388) FinTech Capstone 3 Credits**
This course combines experiential learning via a semester long hands-on project with a series of lectures on relevant topics. Students will learn how to apply the information technologies and financial concepts they learned in the other courses to issues in the creation, distribution, servicing, or operations of financial products and services. These issues may include cybersecurity, payment processing, algorithmic trading, credit scoring, blockchain, cryptocurrency, artificial intelligence, machine learning, peer-to-peer lending, online banking, and mobile banking.

**Prerequisites:** (CSE 012 or CSE 017) and BIS 352 and (BIS 348 or CSE 347 or IS 364 or IS 365) and (BIS 324 or CSE 241 or IS 224) and FIN 330

**FIN 389 Honors Project 1-6 Credits**
**Repeat Status:** Course may be repeated.

**FIN 418 Principles of Corporate Finance and Investments 3 Credits**
This course provides students with a basic foundational knowledge of finance principles, working knowledge of various aspects of corporate finance, and the principles of investments. Short-term financial decisions will be discussed. Long-term capital investment will be explored starting with the basics of time value of money and capital investment techniques. Topics include the determination of the appropriate investment discount rate, the organization’s cost of capital and hurdle rates, the risk-reward tradeoff, and specific financial instruments.

**Financial Technology**
Financial Technology (FinTech) is a new emerging area composed of the intersection of information technology and financial services. Many disruptive technologies such as cryptocurrency, blockchain, mobile banking, machine learning, and mobile trading have been applied in the financial services sector to create new and improved products and to increase efficiency. This minor is ideal for students who have an interest in both IT and finance.

This minor provides advanced classes in both financial concepts and information technology, culminating in a capstone class that applies concepts in both areas. Students in this minor will be proficient in the information technologies that are applied in FinTech, such as computer programming, database, encryption, big data, and analytics. Additionally, students will be proficient in investments, corporate financial policy, and financial markets.

The FinTech minor is composed of 4 courses (12 credits), and is open to all College of Business students with a declared major, CSB, and IBE students. The courses in the minor have prerequisites that ensure that students have a strong BIS/FIN background before taking the advanced FinTech classes. College of Business majors and College of Business minors cannot overlap. BIS 352 and FIN 330 are not required courses in College of Business majors, and if taken for the minor, cannot count toward a College of Business major.

1. CSE 12: Survey of Computer Science or CSE 17: Programming and Data Structures
2. BIS 352: Advanced Topics in Business Analytics
3. FIN 330: Financial Markets and Institutions
4. BIS/FIN 388: FinTech Capstone

Many of the courses that apply to the minor have prerequisites. These prerequisites do not count toward the minor, and students attempting to complete the minor are not recused from these prerequisites.

**Law**
Every College of Business student is required to take Law 201 as part of the College of Business Core.

The following undergraduate law courses are offered through the Perella Department of Finance:

Course descriptions for the College of Business graduate courses can be found in the Courses tab. Prerequisite: consent of sponsoring instructor.

**Courses**

**LAW 101 Introduction to Law 3 Credits**
A study of the nature and function of law and the legal system, the study of legal reasoning through the use of the case method.

**LAW 102 Sports Law 3 Credits**
The study of legal relationships and legal topics of individuals, organizations, society, and the government as they relate to sports. The case method will be used to examine landmark cases and current day examples of legal principles and precedent.

**LAW 201 Legal Environment of Business 3 Credits**
This course examines the legal relationships between business and government, business and society, and the individual and society.

A significant focus of the course is on the structure of the U.S. legal system, the role of the courts in the legal system, and contract law as the principal mechanism for the private allocation of resources and risk allocation. The course also focuses on business ethics with particular emphasis on corporate social responsibility. Junior standing is required.

**Prerequisites:** (ECO 001)

**LAW 202 Business Law 3 Credits**
The law of agency, business organizations, secured transactions, bankruptcy and negotiable instruments.

**Prerequisites:** (LAW 201)

**LAW 300 Apprentice Teaching 1-3 Credits**
**Repeat Status:** Course may be repeated.

**LAW 371 Directed Readings 1-3 Credits**
Readings in various fields of law, designed for students who have a special interest in a field of law. Consent of sponsoring instructor required.

**LAW 372 Special Topics 1-3 Credits**
Special problems and issues in commercial law.

**LAW 417 Regulatory Environment of Business 2 Credits**
This course is designed to provide students with a basic understanding of the various legal, regulatory, and market constraints in which business operates. Students are introduced to the interplay between legislation, regulations, and court decisions in establishing the regulatory environment in which a business operates as well the allocation of power among federal and state authorities. Conflict of law issues will also be explored for businesses that operate internationally. Contract law, forms of business, and ethics are covered in depth.

**Management**

The Management major introduces management practices to students who wish to work in human resource management, management consulting, or in small business and non-profit organizations. There are two distinct tracks to the major.

- **Managing Human Resources:** This track prepares students to work as human resource professionals or in management consulting organizations or to broaden their interpersonal skills.
- **Management Consulting:** This track prepares students specifically to work in small businesses including family owned businesses, nonprofit organizations, startups, and in rapid growth environments.

**Professors.** Corinne A. Post, PhD (Rutgers University Newark); Michael D. Santoro, PhD (Rutgers University); Robert J. Trent, PhD (Michigan State University); Andrew J. Ward, PhD (University of Pennsylvania)
**Manage Human Resources**

**Required**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MGT 333</td>
<td>Human Resource Management</td>
<td>3</td>
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<tr>
<td>MGT/SCM 328</td>
<td>Negotiations and Conflict Management</td>
<td>3</td>
</tr>
<tr>
<td>MGT 342</td>
<td>Managing in the International Organization</td>
<td>3</td>
</tr>
<tr>
<td>MGT 363</td>
<td>Managing Diversity and Inclusion in the Workplace</td>
<td>3</td>
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**Plus 1 from the following courses:**

- MGT 314 Business Consulting Practicum
- ECO 235 Labor Economics

**Total Credits:** 15

**MANAGEMENT CONSULTING**

**Required**

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<thead>
<tr>
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<th>Credits</th>
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<tbody>
<tr>
<td>MGT 342</td>
<td>Managing in the International Organization</td>
<td>3</td>
</tr>
<tr>
<td>MGT 306</td>
<td>Decision Making and Problem Solving in Business</td>
<td>3</td>
</tr>
<tr>
<td>MGT 314</td>
<td>Business Consulting Practicum</td>
<td>3</td>
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**Plus 2 from the following courses:**

- MGT/SCM 328 Negotiations and Conflict Management
- MGT 333 Human Resource Management
- FIN 328 Corporate Financial Policy
- MKT 319 Development and Marketing of New Products
- MKT 326 Marketing Analytics in a Digital Space
- MGT 363 Managing Diversity and Inclusion in the Workplace
- BIS 348 Predictive Analytics in Business
- ACCT 330 Accounting Data and Analytics

**Total Credits:** 27

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**MANAGEMENT MINOR**

This minor provides an overview of management program. It is designed to expose students to the field of management and to provide them with an opportunity to build and enhance their professional and leadership skills through a formal course of study. This minor is open available only to students with a declared major in the College of Business and/or students enrolled in either the IBE or CSB programs. College of Business students cannot receive overlapping credit between College of Business major and minor courses or overlapping credit between College of Business minor courses.

**Program of Studies:** The Management Minor consists of 3 courses totaling 9 credit hours from the following courses:

- MGT 328 Negotiations
- MGT 333 Human Resource Management
- MGT 342 Managing in the International Organization
- MGT 363 Managing Diversity and Inclusion in the Workplace

Course descriptions for the College of Business graduate courses can be found under Business and Economics Graduate courses (p. 283).

**Courses**

- **MGT 043 Organizational Behavior 3 Credits**
  Managers are needed to make organizations run effectively. Management is the art and science of helping individuals achieve goals together, often in organizations. This course provides a broad overview of the principles of effective, ethical management at the individual, interpersonal, and group levels of analysis. Emphasis is on conceptual and applied organizational behavior topics such as: individual differences; decision making; perception and judgment; motivation; leadership; delivering effective feedback and performance appraisal; managing diversity; power, politics and influence; and organizational culture.

- **MGT 143 Managing and Leading People in Organizations 3 Credits**
  Introduction to human behavior in organizations. Emphasis on conceptual and applied organizational behavior and human resource topics such as: individual differences; perception and judgment; decision making; motivation; teams and groups; leadership; conflict; ethics; diversity; and culture. Must have sophomore or junior standing.

- **MGT 243 Leadership in Organizations 3 Credits**
  This course provides a deep dive into how to lead people, teams and organizations. Beyond intelligence and technical skills, what separates effective from less effective leaders is an understanding of the human side of business. This course offers an in-depth examination of leadership, and focuses on providing students with knowledge and abilities, increasing self-awareness, social-awareness, and organizational-awareness, thus facilitating their capacity for effective leadership. Students will learn to lead from within, and build and lead high impact and innovative teams.

- **MGT 300 Apprentice Teaching 1-3 Credits**

- **MGT 301 Strategic Management in a Global Environment 3 Credits**
  The capstone business class, integrating concepts and practices from core business classes, utilizing an organization-wide, strategic perspective and examining the relationship among firm strategy, structure and environment. Course emphasizes strategic analysis, strategy formulation, and strategy implementation to achieve sustainable competitive advantage. Corporate governance, corporate social responsibility and business ethics are incorporated into the strategic perspective. Case analyses and competitive simulation game are central learning components. Senior standing in the College of Business and completion of college core.

**Prerequisites:** (MKT 111) and (ECO 146 or ECO 119) and (LAW 201) and (FIN 125) and (MGT 186 or SCM 186) and MGT 043 and (MGT 143 or MGT 243 or CSB 312) and (BIS 111 or CSB 311) and ACCT 152 and (BUS 001 or BUS 002) and BUS 003 and BUS 203 and (BIS 244 or CSB 311)

- **MGT 306 (ENTP 306) Decision Making and Problem Solving in Business 3 Credits**
  The course will provide the foundational hard and soft-skills consulting firms employ to identify and diagnose business problems, generate data, formulate innovative solutions, and effectively communicate recommendations. The course will blend lecture with experiential learning.
MGT 314 (ENTP 314) Business Consulting Practicum 3 Credits
Students will build upon the skills acquired in MGT 306 and, working in student teams, will engage client organizations to diagnose and develop innovative solutions to address client needs.
Prerequisites: MGT 306

MGT 328 (SCM 328) Negotiations and Conflict Management 3 Credits
This course covers the theory and processes of negotiation in a variety of settings including faceto-face, virtual and crosscultural business environments. Students will learn negotiating skills by preparing and simulating a broad mixture of negotiations, ranging from oneonone, to threeperson, to multiparty and team negotiations. They will learn to analyze outcomes and strategies during the debriefing sessions and will have an opportunity to compare results of their negotiations to the results of other people in class.

MGT 333 Human Resource Management 3 Credits
Analysis and resolution of personnel problems in organizations. Human resource planning, recruitment, selection, orientation, training, appraisal, compensation, and development.
Prerequisites: MGT 043 or MGT 143

MGT 342 Managing in the International Organization 3 Credits
This course introduces students to the challenges of managing and leading organizations whose operations and activities span national boundaries. Particular attention will be given to the critical human resource issues confronting managers in the global marketplace. Topics discussed include: contemporary and emerging international organizational structures; fostering a global mindset; managing across cultures; developing global leaders; reward systems; performance management; and managing global careers. Junior standing is required.

MGT 346 International Business 3 Credits
This class provides an overview of international business, including the decisions, issues, and challenges faced by multinational enterprises and the environment in which they operate. This class will discuss why trade exists between nations and examine patterns in foreign direct investment. We will explore political, economic, cultural, and other differences between countries that are salient to international business. We will understand why businesses decide to create overseas subsidiaries, and the various choices available to them as they operate globally.

MGT 350 (BIS 350) Project Management 3 Credits
Key processes and tenets of project management including scope, time, cost, quality, human resources, communications, risk, procurement, and integration management. Both technical and behavioral aspects of project management are applied within the context of either IS management, HR management, Supply Chain Process Management, Small Business Management. Topics include: expectations management, change management and consulting engagement management. Introduces both software project monitoring tools and project team collaboration techniques and tools. Must have completion of all other courses in either BIS or Management major.
Prerequisites: (MGT 321 and MGT 333) or (MGT 321 and MGT 311 and MGT 306) or (MGT 321 and BIS 311 and BIS 324) or (MGT 321 and SCM 328 or SCM 340 or SCM 342 or SCM 309 or SCM 354),

MGT 363 Managing Diversity and Inclusion in the Workplace 3 Credits
This 3-credit course focuses on the complex dynamics that emerge in diverse groups and environments, explains how diversity and inclusion affect individual and organizational performance, relates diversity and inclusion to career development and success and to the management of human resources. This course also aims to develop skills and competencies for effectively managing diversity and its effects in the workplace. Diversity and Inclusion in the Workplace will be taught with a combination of lectures, self-assessments, class discussions, group exercises, self-reflections.

MGT 371 Directed Readings 1-3 Credits
Readings in various fields of management designed for the student who has a special interest in some field of management not covered by the regularly scheduled courses. Consent of department chair required.
Repeat Status: Course may be repeated.

MGT 372 Special Topics 1-3 Credits
Special problems and issues in management for which no regularly scheduled course work exists. Consent of department chair required.
Repeat Status: Course may be repeated.

MGT 373 Management Internship 1-3 Credits
A sponsoring faculty member shall direct readings, projects, and other assignments including a comprehensive final report in conjunction with an industry-sponsored internship. The work experience itself, whether paid or unpaid, is not the basis for academic credit. Intellectual development in the context of a field study learning experience will be the determining factor in awarding academic credit. This course cannot be used to satisfy requirements of the Management major. Consent of department chair required. Must have junior standing.

MGT 416 Managing Talent 3 Credits
The course is fundamentally about understanding and improving the behavior and performance of individuals in the workplace. As such, we will draw upon key theories in organizational behavior to address human resource issues arising from the employment relationship. Topics will address key areas in the talent pipeline from sourcing and selection, training and development, motivation and performance management, talent management metrics and analytics.

MGT 461 Strategic Management 1 Credit
Strategic Management covers overall organizational issues in determination, analysis, execution, and control within a global environment. This capstone course integrates theories and concepts from production, marketing, finance, and accounting and provides an opportunity to simulate the function of top level management as it relates to the total business environment through a team-based business simulation. Through readings, written assignments, presentations, in-depth group discussions, and a team-based simulation competition, students will broaden their understanding and practice the art of strategic decision making.

MGT 462 Experiential Learning Capstone 3 Credits
The Experiential Learning Capstone in the M2 curriculum immerses students in the study of how historical, iconic companies, under the guise of strategic management principles, created disruptive/game-changing industry innovation. Built on the foundational courses in the M2 curriculum, the capstone integrates classroom lectures with a combination of company visits and externship projects. Students apply their foundational learning in the study of how birth was given to a select set of companies.

Marketing
Marketing Department Web page: www.lehigh.edu/cbemarketing
Marketing is a critical success factor in any business. Marketing is more than just selling or advertising. It is understanding a product. It is focusing on the needs of the consumers. It encompasses new product development, pricing, promotion and distribution considerations. Marketing influences virtually all strategic business plans and decisions and its scope ranges from government and not-for-profit organizations to free enterprise. Marketing plays a major role in the management of any business.
Lehigh’s marketing major is a rigorous and highly relevant curriculum of instruction. Students are taught to recognize the strong linkage between theory and practice and to appreciate the need for teamwork, leadership, and communication skills. Activities that encourage students to acquire professional-level competency throughout the curriculum include: developing integrated advertising campaigns, designing and implementing marketing research projects, conducting customer analyses, as well as a wide variety of practice-based projects.
Students are encouraged to explore the potential enhancement of their educational experience through study abroad programs, internships with business, and research projects with faculty members.
Participation in the Marketing Club student organization is an extracurricular activity that offers a professional orientation program and the enjoyment of socializing with other students from across the campus.
Professor. K. Sivakumar, PGDRM (Institute of Rural Management)
GRADUATE COURSES

ECO 001 – Principles of Economics

Required prerequisite course:

Marketing Minor Program, marketing@lehigh.edu.

MKT 111 open to registration for all students in the Marketing Minor Program. Email inquiries should be directed to the Director of the program by the last Friday in January. Students will apply to the program will be made by students and submitted to the program director by the last Friday in January. Students will be notified of admissions decisions prior to registration for the Fall semester. MKT 111 open to registration for all students in the Marketing Minor Program. Email inquiries should be directed to the Director of the Marketing Minor Program, marketing@lehigh.edu.

Required prerequisite course:

ECO 001– Principles of Economics

MARKETING MAJOR

The marketing major offered by the Department of Marketing consists of 18 credit hours from the following courses:

Required courses

- MKT 311 Consumer Behavior 3
- MKT 312 Marketing Research 3
- MKT 387 Marketing Strategy 3

Elective courses

Select three of the following: 9

- MKT 313 Advertising & Sales Promotion Strategy
- MKT 314 Digital and Social Media
- MKT 319 Development and Marketing of New Products
- MKT 320 Global Marketing
- MKT 325 Consumer Insights through Data Analysis
- MKT 326 Marketing Analytics in a Digital Space
- MKT 327 Retail Marketing
- MKT 347 Strategic Brand Management
- MKT 330 Professional Selling
- MKT 332 Sales Management
- MKT 366 Services Retailing and Marketing
- MKT 371 Directed Readings
- MKT 372 Special Topics

Total Credits 18

MARKETING MINOR

The purpose of the marketing minor program is to enable non-CBE students to pursue a course of marketing studies that will enable them to supplement their major studies and make them more marketable. The overall learning objective of the program is to provide non-CBE students with the knowledge and skills with which to make more informed marketing decisions.

Program of Studies:

A Marketing Minor consists of 12 credits. Students wishing to earn a Marketing Minor must take MKT 111, and then select three other marketing courses from the marketing curriculum.

Program Admission Requirements:

Each Spring semester, a limited number of students will be accepted into the Marketing Minor Program for the following Fall semester. Applications to the program will be made by students and submitted to the program director by the last Friday in January. Students will be notified of admissions decisions prior to registration for the Fall semester. MKT 111 open to registration for all students in the Marketing Minor Program. Email inquiries should be directed to the Director of the Marketing Minor Program, marketing@lehigh.edu.

Required prerequisite course:

ECO 001– Principles of Economics

GRADUATE COURSES

Course descriptions for the College of Business graduate courses can be found in this section under the heading of Business and Economics Graduate Courses.
MKT 319 (ENTP 319) Development and Marketing of New Products 3 Credits
This course adopts the marketing philosophy that new products and services will be profitable if the extended product provides customers with highly valued benefits. The goal is to help students learn how to use state-of-the-art management techniques to identify markets, develop new product ideas, measure customer benefits, and design profitable new products. The course provides techniques to interface the marketing function with the functions of R&D, design engineering, and manufacturing.
Prerequisites: MKT 111

MKT 320 Global Marketing 3 Credits
Understanding the process of globalization and its impact on the firm’s marketing activities. Whether an organization operates in the domestic market or in the global market place, it cannot ignore competitive pressures and market opportunities at the global level. This course will focus on topics such as the changes in global environment and their impact on marketing activities, development of global marketing strategies based on sound marketing research, and the role of technology in global marketing strategies.
Prerequisites: MKT 111

MKT 325 (ECO 325) Consumer Insights through Data Analysis 3 Credits
Explores marketing analytic approaches aimed to improve the understanding of customer and customer perceptions thereby enhancing the effectiveness of marketing decision making and implementation. Foundational data analysis techniques are examined in such areas as advertising, customer acquisition and retention (customer relationship management), segmentation, customer loyalty, lifetime-value analysis of the customer, pricing, sales force management, sales promotions and new products. The development, implementation, and utilization of quantitative models on customer data are emphasized. Prerequisites as noted below.
Prerequisites: MKT 111 and ECO 146

MKT 326 Marketing Analytics in a Digital Space 3 Credits
This course provides a quantitative approach to understanding and harnessing marketing data (e.g., online advertising, social media) to meet marketing objectives. Students will learn how to design, run, evaluate and improve online marketing efforts to meet specific business objective like customer acquisition, increased brand awareness, etc. This course will cover basic marketing and statistical concepts, provide an introduction to different online marketing tools (e.g., inbound marketing, SEO/SEM and social media analytics), and techniques pertaining to visual representation of marketing data.
Prerequisites: MKT 111
Attribute/Distribution: ND

MKT 327 Retail Marketing 3 Credits
This course provides an overview of the retailing industry. Primary focus will be on the customer-facing activities of retailers, such as assortment planning, private-label development and the management of in-store operations, and the back-door activities that support customer interaction. In addition, current issues facing retailers, such as customer relationship management, industry consolidation and supplier relations, will be examined.
Prerequisites: MKT 111

MKT 330 Professional Selling 3 Credits
The course provides students with basic preparation for business-to-business personal selling and careers in sales. The course utilizes role-playing, experiential exercises, lectures and projects designed to teach the latest strategies and tactics in lead generation and prospecting, qualifying leads for high potentials, seeding, cold-calling, making formal presentations, handling objections, negotiating for final proposal, closing techniques and service after the sale.
Prerequisites: MKT 111

MKT 332 Sales Management 3 Credits
This course is an integrative approach to sales management including formulation of strategically sound sales programs, implementation of sales programs, and evaluation and control of the organization’s sales activities. Illustrative topics include the role of the sales manager in the divergent demands of multiple constituencies; the development of effective sales organizations; salesperson’s motivations and the development of flexible motivational plans; the variety of financial and non-financial rewards used by sales managers; forecasting sales costs and evaluating performance by person, territory, customer, market, and industry; and coordination of the sales activities with other elements in a firm’s marketing program.
Prerequisites: MKT 211 or MKT 111

MKT 347 Strategic Brand Management 3 Credits
In this class you will be introduced to concepts pertaining to brand development and its relationship with technology, design, emotions and the financial performance of firms. Our goal is to help you learn how to use state-of-the-art branding techniques. Our focus is brand equity and its contributions to shareholder wealth. The course will be relevant to students who expect to work directly in brand or product management.
Prerequisites: MKT 111

MKT 360 Marketing Practicum 3 Credits
The marketing practicum combines formal class work on marketing problem formulation and business communications with an intensive internship or consulting engagement with a business. Students work with client firms to develop individual or team projects, which focus on marketing activities such as market research, strategy development, sales management, and promotion management. Upon completion of the project, students submit a written report and make a formal presentation to clients. This course cannot be used to satisfy marketing major requirements. Summer only.
Prerequisites: MKT 111 and MKT 312 and MKT 311

MKT 366 (ENTP 366) Services Marketing and Innovation 3 Credits
While manufacturing giants all consider themselves service-related companies, services are moving to the forefront of industry value proposition offerings. This course focuses on issues related to service design and marketing on a broad basis, and its implication to retailing in particular. The course enables students to gain an understanding of the special challenges evident in marketing services and to acquire a unique set of knowledge and skills beyond the traditional strategies designed for product goods. Illustrative topics include fundamental differences.
Prerequisites: MKT 111

MKT 371 Directed Readings 1-3 Credits
Readings in various fields of marketing designed for the student who has a special interest in some field of marketing not covered in regularly scheduled course work. Consent of department chair required.
Repeat Status: Course may be repeated.

MKT 372 Special Topics 1-3 Credits
Special problems and issues in marketing for which no regularly scheduled course work exists. When offered as group study or internship, coverage will vary according to the interests of the instructor and students. Consent of department chair required.
Repeat Status: Course may be repeated.

MKT 373 Marketing Internship 1 Credit
Based on a student’s work experience, a sponsoring faculty member shall direct readings, projects, and other assignments—including a “capstone report.” It should be noted that the work experience (at least 80 hours), by itself, is not the basis for academic credit. The faculty directed activity must be provided concurrent with the work. Course registration and related arrangements must be made in advance of the work engagement. This course must be taken Pass/Fail and cannot be used to satisfy marketing major requirements. Must have junior standing. Consent of department chair required. Declaration of a marketing major.
Repeat Status: Course may be repeated.
Prerequisites: MKT 111
MKT 387 Marketing Strategy 3 Credits
The objective of this capstone course is to synthesize the marketing principles introduced in other marketing courses and thus provide students an integrative framework to marketing decision-making. Our review indicates that this integrative closure for the marketing coursework is a common practice at some of the better business schools. It will focus on how marketing strategy supports the overall corporate strategy. The course will emphasize that Marketing does not operate in a vacuum. What is done in other functional areas will impact marketing strategy profoundly, and vice versa. The will address traditional strategic issues such as identification of organizational strengths, weaknesses and environmental opportunities in the context of developing marketing strategies, but will also emphasize the importance of embracing a customer-centric orientation throughout the organization. Incorporating a customer-centric orientation is an essential component of marketing strategy today as it captures the dynamic and evolving nature of marketing. Every company employee is important to the marketing function, every employee contact with a customer is a form of marketing communication, the increasing number of customer-initiated contacts with the firm are as important as firm-initiated contacts, and customer relationships now take precedence over sales transactions. Specific emphasis will be placed on applying theoretical principles in realistic scenarios by means of case studies of how marketing strategy is impacted by the overall corporate strategy and other functional strategies. Student performance will be evaluated by his/her ability to prepare and present case analyses. Senior Standing.
Prerequisites: MKT 311 and MKT 312

MKT 389 Honors Project 1-6 Credits

MKT 415 Marketing Foundations 3 Credits
This course is designed to provide students with a comprehensive analytical framework to develop, implement and evaluate competitive marketing strategies that achieve organizational goals and objectives. It explores the functional marketing operations of organizations and examines the key elements of a marketing manager's decision-making process. Examples of learning modules include: customer and market analysis, segmentation, targeting and positioning, marketing mix decisions (product, price, place and promotion).

MKT 425 Contemporary Topics in Marketing 2 Credits
The objective of this course is to build on the principles learned in Marketing Foundations and study a series of contemporary topics relevant for the marketing function in organizations. The focus is on key factors that are driving changes in the marketplace and the implications to the organization when devising strategies. Students will obtain an understanding of how to identify emerging trends, explore the underlying antecedents and consequences of these trends, and learn how organizations can proactively manage these trends.
Prerequisites: MKT 415

Real Estate
Real Estate is, by far, the most significant store of global wealth; and most people spend the majority of their lives in the built environment. Closer to home, real estate-related businesses typically generate over 25% of U.S. economic activity. Consequently, real estate presents a wide array of career opportunities in areas including (but not limited to) accounting, banking, brokerage, construction, consulting, design, development, engineering, finance, government, insurance, investment, law, management, marketing, planning, and valuation. The Real Estate Minor is, therefore, designed to complement a wide range of majors.

REAL ESTATE MINOR
Real Estate is, by far, the most significant store of global wealth; and most people spend the majority of their lives in the built environment. Closer to home, real estate-related businesses typically generate over 25% of U.S. economic activity. Consequently, real estate presents a wide array of career opportunities in areas including (but not limited to) accounting, banking, brokerage, construction, consulting, design, development, engineering, finance, government, insurance, investment, law, management, marketing, planning, and valuation. The Real Estate Minor is, therefore, designed to complement a wide range of majors. Students must take five courses comprised of both required and elective components which draw from several academic disciplines across campus. The program is housed in the Goodman Center for Real Estate and open to undergraduate students of all majors.

Required Courses
- REAL 301 Real Estate Development 3
- REAL 347 Real Estate Investment 3
- REAL 348 Real Estate Practicum 3

Elective Courses
Choose Two of the Following 6-8
- REAL 305 Real Estate Law
- FIN 336 Real Estate Finance
- MGT 328 Negotiations and Conflict Management
- POLS 312 Urban Environmental Policy Workshop
- CEE 266 Construction Management
- ARCH 002 Architectural History II
- or ARCH 034 Digital Drawing and 3D Modeling
- or ARCH 157 Architectural Technology I

Total Credits 15-17

Courses
- REAL 300 Apprentice Teaching 1-3 Credits
Repeat Status: Course may be repeated.

REAL 301 Real Estate Development 3 Credits
This course examines "ground-up" real estate development as well as re-hab/re-development across various property types (office, retail, industrial/warehousing, multi-family, mixed use, hospitality, etc.) Emphasis is on concise analysis and decision making. The main topics covered may include the following: the development process, market analysis, site selection, due diligence, zoning, entitlements/approvals, site planning, building design, and the similarities and differences of traditional real estate product types.

REAL 302 Real Estate Internship 1 Credit
Students are not required to obtain academic credit for an internship. However, if academic credit is desired, or made a condition of employment by an employer, students may register for REAL 302. The work experience itself is not the basis for academic credit. Course registration and related arrangements must be made in advance of the work experience. This course must be taken Pass/Fail and cannot be used to satisfy minor requirements. Consent of program director/manager required.
Repeat Status: Course may be repeated.

REAL 305 Real Estate Law 3 Credits
An examination of real estate investment, finance, and development from a legal perspective in a transactional setting. The course will be of interest to students contemplating careers in accounting, real estate brokerage, real estate investment, real estate finance, real estate development, city planning, or banking. The main topics covered may include the following: land acquisition, finance; choice of entity; tax aspects; management (leasing, environmental); disposition of real property (sale of mortgaged property, foreclosures, sale-leasebacks); and recent legal developments.

REAL 347 Real Estate Investment 3 Credits
An exploration of real estate investment value from the perspective of the equity investor in existing commercial real estate assets. The main topics covered may include the following: drivers of value, modeling in spreadsheets and specialized software applications, taxation, investment structuring, asset management, and sources of equity capital.
REAL 348 Real Estate Practicum 3 Credits
This capstone course provides a deep dive into the valuation of a “real world” asset. Students are formed into teams and conduct an in-depth market analysis including rents, vacancy rates, and absorption rates; and, a refined financial analysis of the subject property including historical results and pro forma estimates of revenues, expenses, cash flow and residual value. Each team also studies the financial characteristics of comparable properties. Note: This course cannot be taken concurrently with REAL 301 and/or REAL 347.
Prerequisites: REAL 301 and REAL 347
REAL 371 Directed Readings 1-3 Credits
Readings in various fields of real estate designed for the student with a special interest in some field of real estate not covered in scheduled courses. Consent of sponsoring instructor required.
Repeat Status: Course may be repeated.

Supply Chain Management

Success in today's business environment is driven by competitive advantage and profitability. Customer-focus, value added product differentiation and cost management are the elements associated with industry leaders. The Supply Chain Management undergraduate major at Lehigh University, housed in the Department of Decision and Technology Analytics (DATA), prepares students to understand and manage the processes that distinguish the successful company from its competitors.

The Supply Chain Management major equips students with the knowledge, skills and abilities necessary for success in the complex business environment of the 21st Century. This program:

- Provides solid exposure to supply management, logistics, business-to-business, and operations management topics.
- Emphasizes advanced cost analysis, negotiation, quality and financial management and improvement, logistics network modeling, risk management, and e-business.
- Integrates core business courses with supply chain major courses.
- Provides field study and experiential learning opportunities.

Supply Chain Management graduates will be prepared to enter industry at a level that accelerates their on-the-job learning and development. Supply Chain Management graduates typically work within five areas, each with its own set of positions and career paths:

- purchasing and supply management
- transportation and logistics
- operations management
- inventory management and control
- supply chain planning

Professor: Yuliang Yao, PhD (University of Maryland, College Park)
Associate Professor: Catherine M. Ridings, PhD (Drexel University)
Assistant Professors: Jing Gong, PhD (Carnegie Mellon University); Haoyan Sun, MBA (University of Washington); Dawei Zhang, PhD (University of Calgary)
Lecturer: Chitra S. Nayar, MBA (University of Iowa)
Professor Of Practice: Troy Adair, PhD (Indiana University Bloomington)
Emeritus: Susan A. Sherer, PhD (University of Pennsylvania)

SUPPLY CHAIN MANAGEMENT PROGRAM

Required Major Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCM 309</td>
<td>Supply, Cost, and Risk Management</td>
<td>3</td>
</tr>
<tr>
<td>SCM 354</td>
<td>Integrated Logistics and Transportation Management</td>
<td>3</td>
</tr>
<tr>
<td>SCM 328</td>
<td>Negotiations and Conflict Management</td>
<td>3</td>
</tr>
<tr>
<td>TE 211</td>
<td>Capstone Design Projects-1</td>
<td>3</td>
</tr>
<tr>
<td>SCM 340</td>
<td>Demand and Supply Chain Planning</td>
<td>3</td>
</tr>
<tr>
<td>SCM 342</td>
<td>e-Business Enterprise Applications</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits 18

SUPPLY CHAIN MANAGEMENT MINOR

The Supply Chain Management minor is designed to offer students in other disciplines an opportunity to learn about supply chain topics and issues. The College of Business offers a Supply Chain Management minor to any student that has completed the following:

Required

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCM 309</td>
<td>Supply, Cost, and Risk Management</td>
<td>3</td>
</tr>
<tr>
<td>SCM 354</td>
<td>Integrated Logistics and Transportation Management</td>
<td>3</td>
</tr>
</tbody>
</table>

Select one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCM 328</td>
<td>Negotiations and Conflict Management</td>
<td>3</td>
</tr>
<tr>
<td>SCM 342</td>
<td>e-Business Enterprise Applications</td>
<td></td>
</tr>
<tr>
<td>SCM 340</td>
<td>Demand and Supply Chain Planning</td>
<td></td>
</tr>
</tbody>
</table>

Total Credits 9

Courses

SCM 186 Supply Chain Operations Management 3 Credits
Introduction to managing global supply chains and operations within the context of an integrated value chain. Topics include supply chain management, total quality management, project management, demand forecasting, supply management, lean operations, aggregate planning, capacity planning, inventory management, distribution and transportation management, and performance measurement.
Prerequisites: (MATH 021 or MATH 076 or MATH 097 or MATH 081) and (ECO 045 or ECO 145 or MATH 231)
Attribute/Distribution: ND

SCM 300 Apprentice Teaching 1-3 Credits

SCM 309 Supply, Cost, and Risk Management 3 Credits
This class presents a framework for achieving sustainable competitive advantage through progressive supply management leadership and approaches. It presents the need for supply leadership, the organizational enablers that must be in place, and the strategies and approaches that leading organizations pursue to achieve competitive advantage in price and cost, quality, delivery, cycle time, technology, flexibility, and end customer responsiveness. Special attention is given to a wide range of price, cost and risk management techniques.
Prerequisites: SCM 186 or MGT 186

SCM 328 (MGT 328) Negotiations and Conflict Management 3 Credits
This course covers the theory and processes of negotiation in a variety of settings including face-to-face, virtual and cross-cultural business environments. Students will learn negotiating skills by preparing and simulating a broad mixture of negotiations, ranging from one-on-one, to three-person, to multiparty and team negotiations. They will learn to analyze outcomes and strategies during the debriefing sessions and will have an opportunity to compare results of their negotiations to the results of other people in class.

SCM 340 Demand and Supply Chain Planning 3 Credits
Students will learn how businesses work with other businesses to build relationships and integrate demand and supply planning activities across the supply chain to deliver value to customers. They will learn about tools and technologies enabling integration, and the critical drivers and key metrics of supply chain performance. Current readings, case studies, simulations and written assignments will be used.
Prerequisites: MGT 186 or SCM 186

SCM 342 (BIS 342) e-Business Enterprise Applications 3 Credits
Introduction to the implications of key information technologies used within and across businesses to conduct e-business. The course covers the functionality of various enterprise applications and their integration: customer relationship management, enterprise resource planning, supply chain management, supplier relationship management, data warehousing and mining, business intelligence, and product lifecycle management.
Prerequisites: BIS 111
SCM 354 Integrated Logistics and Transportation Management 3 Credits
A combined lecture, discussion, and experiential course designed to provide students (1) exposure to the fundamentals of logistics and transportation and (2) the opportunity to work in teams to manage a company's supply chain within a strategic supply chain simulation. Students will gain hands-on-experience integrating supply chain management concepts to optimize business performance outcomes. Topics addressed include integrated logistics, transportation, warehouse management and global logistics.

SCM 371 Directed Readings 1-3 Credits
Readings in various fields of supply chain management designed for the student who has a special interest in some field of supply chain management not covered by the regularly scheduled courses. Consent of the department chair.
Repeat Status: Course may be repeated.

SCM 372 Special Topics 1-3 Credits
Special problems and issues in supply chain management for which no regularly scheduled course work exists. When offered as group study, coverage varies according to interests of instructor and students. Consent of the department chair.
Repeat Status: Course may be repeated.

SCM 373 Supply Chain Management Internship 1-3 Credits
A sponsoring faculty member shall direct readings, projects and other assignments including a comprehensive final report in conjunction with an industry sponsored internship. The work experience itself, whether paid or unpaid, is not the basis for academic credit. Intellectual development in the context of a field study learning experience comparable to BUS 211 (ENGR 211), Integrated Product Development Projects, and SCM 372, Special Topics, will be the determining factor in awarding academic credit. This course cannot be used to satisfy requirements of the Supply Chain Management major. Consent of the department chair. Must have junior standing in the College of Business and Supply Chain Management declaration.
Repeat Status: Course may be repeated.

SCM 423 Supply Chain Operations Management 2 Credits
This course provides an essential understanding of managing global supply chains and operations within the context of an integrated value chain. Topics addressed include the fundamentals of supply chain management; supply chain risk management; quality management; demand and supply chain planning, including forecasting, capacity planning, aggregate planning, and scheduling; the components of a lean supply chain; inventory and working capital management; distribution and transportation management; and performance measurement. Special emphasis is given to managing supply chains from a financial perspective.

College of Education

The university's College of Education offers opportunities for advanced study in the field of education.

GRADUATE DEGREES IN EDUCATION
Lehigh's College of Education offers primarily graduate degree programs. Additionally, undergraduates may apply to the college's 5-year Bachelor's plus Master of Education (p. 53) and Pennsylvania Teacher Certification program or they can minor in education (p. 53). The five-year program is designed to allow students to earn both a bachelor's degree and a master's degree in elementary or secondary education in five years instead of the traditional six years. The Education minor allows upper level undergraduates to take selected coursework that combines practicum activities with theoretical work and is designed to provide a foundation for further educational studies at the graduate level. Students enrolled in the College of Education should check with their advisers for a list of regulations and requirements governing degree programs.

Financial assistance. Graduate assistantships and research assistantships are available in the college and in various administrative offices on campus. In addition, graduate students may be recommended for a limited number of fellowships and endowed scholarships that are awarded by the college.

Lehigh’s Centennial School, a laboratory school for children with emotional/behavior disorders, provides employment for some Lehigh education students. Graduate students may apply for teaching internships, which cover tuition and pay salaries.

MASTER OF EDUCATION (M.ED.)
This degree is offered in the following professional specializations: elementary education, secondary education, special education, educational leadership, counseling and human services, globalization and educational change, international counseling, school counseling and teaching and learning. Degree requirements vary from program to program.

MASTER OF ARTS (M.A.)
The master of arts is available in either teacher education (secondary education or the teaching and learning degree programs) or comparative and international education. The teacher education M.A. focuses on enhancing both pedagogical skill and subject matter expertise of teachers. The comparative and international education student pursuing an M.A. must take graduate work in education plus 12 credits in one of four specific academic disciplines (sociology and anthropology, political science and international relations, economics, or history).

MASTER OF SCIENCE (M.S.)
The master of science degree is awarded in instructional technology or teaching, learning and technology. The M.S. in instructional technology focuses on the planning and use of instructional technology in preK-12 and post secondary settings and non-formal learning environments (such as museums and science centers). The program is targeted toward individuals from varied backgrounds who wish to help educators or learn themselves to design, develop, and incorporate technology applications more effectively in diverse educational settings including preK-12, post secondary education, and informal learning environments. This is an appropriate degree for those who teach in the classroom and online, technology specialists, informal educators, and others interested in effectively using information and communications technologies to enhance instruction. The program is designed to help develop skills that can be used to create new curriculum and learning activities to meet the demands of a changing technological society and the needs of new generations of students. As such, graduates may be designing online courses, enhance existing curriculum with emerging technologies, or may work as technology specialists, assisting with the integration of technology in academic and informal learning environments. The Instructional Technology graduate program is intended for both current professionals in the education field as well as those who are seeking an advanced degree to uprade their skills and knowledge base related to technology. The M.S. in teaching, learning and technology is available only to students previously admitted to the TLT Ph.D. program and is a "fallback" for those who have completed the core coursework but are unable to progress through the culminating research projects.

MASTER IN BUSINESS ADMINISTRATION/MASTER OF EDUCATION (MBA/M.ED.)
The MBA and master’s of education joint degree program offers students the opportunity to acquire a solid foundation in both business and education. Designed to increase the administrative skill required in today’s educational systems, the MBA/M.Ed. provides a framework in which excellent education and sound business practices can flourish. The MBA/M.Ed. will provide an additional option for students for business and studentists of educational leadership. The program should enhance the student’s marketability in private and public sector education while providing students with an understanding of the cultures of both business and education.
EDUCATIONAL SPECIALIST (ED.S.)
Specialized post-master’s degree programs for practitioners are available in school psychology.

CERTIFICATION PROGRAMS
The college offers programs of study leading to eligibility for Pennsylvania state certifications in various professional specialties including elementary and secondary teacher education, including certification in special education; supervisor of special education, pupil services, or curriculum and instruction; superintendent; and K-12 principal. Certification programs vary in the number of credits required.

POST-BACCALAUREATE CERTIFICATES
The college also offers post-baccalaureate certificate programs in international counseling, international development in education, project management (jointly offered through the College of Business and the College of Education), behavior analysis, teacher leadership, teaching English as a second language, and technology use in the schools. Post-baccalaureate certificate programs differ from the above-described certifications issued by agencies external to Lehigh (such as the Pennsylvania Department of Education). Lehigh’s post-baccalaureate certificate programs are, instead, focused concentrations of 12 to 18 credits that students complete to enhance their professional credentials. Where appropriate, post-baccalaureate certificate programs may be included as part of the coursework of a degree program. http://ed.lehigh.edu/academics/certificates

DOCTOR OF PHILOSOPHY (PH.D.)
The College of Education also offers the Ph.D. degree to students enrolled in the fields of comparative and international education, counseling psychology, school psychology, special education, and teaching, learning and technology. The requirements for this degree are the same as those for the Ph.D. in the other colleges and as described in previous sections.

DOCTOR OF EDUCATION (ED.D.)
The doctor of education degree program provides specialized study in educational leadership. Successful professional experience is required for admission to candidacy. The requirements for the Ed.D. degree parallel those already stated for the Ph.D. degree.

NON-DEGREE OPTIONS
The non-degree options are designed for those individuals interested in taking a few courses in the College but not interested in pursuing a graduate degree. For information on the non-degree program, contact Donna Johnson at 610-758-3231 or email education@lehigh.edu. There are two non-degree options as well:
1. Regular non-degree and
2. Non-degree for external certification.

Regular non-degree admission is for students who wish to take up to 12 credits of graduate coursework at Lehigh University without seeking a degree. Any transcript or other record from the University will clearly indicate the student status as non-degree. Non-degree students are not permitted to audit courses. University admissions criteria for non-degree graduate students are (a) a bachelor’s degree from an accredited institution with an overall grade point average of at least 2.75 on a four-point scale (Applicants with undergraduate GPAs slightly below 3.0 may be admitted with approval from the department of Education and Human Services) or (b) to have achieved a GPA of 3.0 or higher on a four-point scale for a minimum of 12 graduate credits at another accredited institution. If English is not your first language, you must submit TOEFL scores.

Non-degree for external certification students are admitted to pursue coursework for the purpose of obtaining certification through an external accrediting agency. Applicants are expected to have an undergraduate GPA of 3.0 or higher on a four-point scale or to have achieved a GPA of 3.0 or higher on a four-point scale for a minimum of 12 graduate credits at another accredited institution. Applicants are assigned certification advisers on admissions and must work with the adviser to assure that they complete all requirements for certification satisfactorily. Students complete the coursework and any other required field experiences for the appropriate certification, with the number of credits and field experiences being dictated by the external accrediting agency. Given this external control of credit requirements, the number of credits will vary and will typically exceed the 12 credit limit for regular non-degree students. Certification involves qualitative components as well as credits; a non-degree student seeking such certification must meet the quality standards of the certification program, as well as completing the necessary coursework and field experiences.

CHANGING FROM NON-DEGREE TO DEGREE STATUS
Non-degree students of either type may seek admission to a degree program. Non-degree students who seek admission to a degree program must meet all regular admissions criteria, complete all regular application procedures, and present all documents normally required of degree-seeking applicants to that program. Courses taken by a non-degree student who later enters a degree program will count towards the completion of the program to the extent that those courses fall within the normal requirements of the program and to the extent that the student’s performance in the course(s) is acceptable for degree program purposes. Any course that is counted towards the completion of a degree must be completed within the established time limits for that degree, whether taken initially as a degree or non-degree course.

Professor. William Gaudelli, EDD (Rutgers University)
Assistant Professor. Kaitlin P Anderson, PHD (University of Arkansas)
Professors Of Practice. Jon Drescher, MS (Community College of NY, Brooklyn College); Qiong Fu, PHD (University of Illinois at Chicago)
Emeriti. Raymond Bell, EDD (Lehigh University); Joseph P. Kender, EDD (University of Pennsylvania); Robert L. Leight, EDD (Lehigh University); J. Gary Lutz, EDD (Lehigh University); Alden J. Moe, PHD (University of Minnesota Minneapolis); Gary M. Sasso, PHD (University of Kansas); Roland K. Yoshida, PHD (University Southern Calif)

Comparative and International Education
The Comparative and International Education (CIE) Program offers three degrees: An M.Ed. in Globalization and Educational Change, a M.A. in Comparative and International Education, and a Ph.D. in Comparative and International Education. The CIE program also offers a Lehigh graduate certificate program in International Education for Development.

Grades completing their degree in the CIE program may move into positions in international education, as government officials and education policy makers, research/policy institute scientists, development program officers, or work in various non-governmental and educational organizations either in the United States or in countries around the world.

The Comparative and International Education (CIE) program provides a unique blend of global community, content, interaction, context, perspective and purpose. Highlights of these innovative qualities include:

• An international learning community. The CIE Program is a vibrant learning community where internationalization thrives in formal classroom instruction, as well as in daily socialization of students and faculty in personal and professional realms. CIE students have a unique opportunity to engage in a myriad of international experiences as a part of their graduate education experience, including conducting education research and evaluation worldwide, engaging in international education development consultancy, internships at the United Nations, and assisting in journal/book editing in comparative and international education.

• Multiple opportunities for student/faculty interaction. CIE faculty have extensive experience in the field as teachers and leaders, as well as a theoretical and methodological grounding in a discipline, which is relevant to global research and comparative educational issues. We recognize that students bring a wealth of expertise and knowledge that complements the faculty’s expertise and knowledge. Therefore, the CIE program provides a framework through which students and faculty can build professional relationships that extend beyond the classroom, including collaborative projects, directed study, and intellectual discourse.

• Interdisciplinary perspectives. Given that education is the product of many converging forces from politics to society to economics to history to business and philosophy, education and schooling issues are too complex to be addressed by just one disciplinary perspective. Unless we understand the various factors impacting decisions, we cannot understand why schools in countries
around the world are structured the way they are, or why educational policies in our own communities deal with the topics they do. Working closely with the graduate programs in the College of Education and across the university, the CIE degree programs breach the boundaries of disciplines, thus creating an opportunity for students to examine education-related issues from multiple perspectives.

There are several projects that exemplify the CIE Program’s signature and distinctive properties. They are,

- **International Education and Research.** CIE faculty and students participate in research and academic exchange with colleagues around the world. One example is through the CIE Program-based Tübingen-Lehigh International Partnership (TüLIP). Through TüLIP, Lehigh students have the option to take either full-term or short schedule courses taught in English at the University of Tübingen (Germany). Research or field-work may also be taken for Lehigh academic credit and is collaboratively supervised by both Lehigh and Tübingen professors. One recent project connected to TüLIP through the CIE Program is the Mountaintop Experience called “Transitions for Refugees through Empowerment and Education” (TREE). The TREE project unites Lehigh students, refugee advocates and education experts in both the U.S. and Germany to investigate the dynamic factors facing resettled refugee youth.

- **Scholarly Publication and Editing.** The CIE Program is home to two professional academic publications in the field: The *Annual Review of Comparative and International Education* (ARCIE) and the *Forum for International Research in Education*. ARCIE is the flagship academic review in the field of comparative and international education, and is published annually. FIRE is an international, peer-reviewed, open-source, online journal promoting interdisciplinary scholarship on the use of internationally comparative data for evidence-based and innovative change in education worldwide. CIE faculty serve as senior editor for both publications and CIE students serve as both editorial assistants and frequent co-authors for these prestigious publications.

- **International Development and Consulting.** CIE Program faculty and students engage in short-term development and program-related consultancy projects on a regular basis. For example, a CIE faculty and student team has worked with a youth village for orphaned and vulnerable youth in post-genocide Rwanda to develop a village-wide monitoring and evaluation system. This consultancy project, developed with the support of a CIE degree program graduate working with the Rwandan village, involved both Lehigh-based and Rwanda-based planning, research, workshops, and other consultancy-related activities, and complemented graduate-level coursework in the CIE program.

For additional information about the program, please visit: [http://coe.lehigh.edu/academics/disciplines/cie](http://coe.lehigh.edu/academics/disciplines/cie)

**Assistant Professor.** Peggy A Kong, PHD (Harvard University)

**Professor Of Practice.** Lisa Damaschke-Deitrick, PHD (University of Tübingen)

**Doctor of Philosophy in Comparative and International Education**

The Ph.D. degree program in Comparative and International Education (Ph.D. CIE) prepares students for research, scholarly inquiry, and advanced professional careers in the field of comparative and international education. A hallmark of this program is the bridge between educational theory, research, and practice. The Ph.D. degree program will build on and continue the strengths of the M.A. in Comparative and International Education program by being practical, research-oriented, and policy-focused, while adding a robust theory-oriented and research-driven component. The Ph.D. in CIE degree offers a combination of rigorous training in comparative education; key skills in policy analysis, monitoring and evaluation and advocacy; as well as provides students with the flexibility to pursue in-depth research in a variety of areas critical to comparative and international education.

Graduates are prepared to work in higher education institutions, educational research and policy organizations, government offices, ministries of education, and international development organizations.

**Comparative & International Education Core (15 credits)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIE 400</td>
<td>Comparative and International Education</td>
<td>3</td>
</tr>
<tr>
<td>CIE 401</td>
<td>Globalization &amp; Contextualization</td>
<td>3</td>
</tr>
<tr>
<td>CIE 471</td>
<td>Globalization and Education Equity</td>
<td>3</td>
</tr>
<tr>
<td>CIE 450</td>
<td>Doctoral Seminar in Comparative and International Education I</td>
<td>3</td>
</tr>
<tr>
<td>CIE 451</td>
<td>Doctoral Seminar in Comparative and International Education II</td>
<td>3</td>
</tr>
</tbody>
</table>

**Research Methods Core (21 credits)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIE 410</td>
<td>Research in Comparative and International Education I</td>
<td>3</td>
</tr>
<tr>
<td>CIE 411</td>
<td>Research in Comparative and International Education II</td>
<td>3</td>
</tr>
<tr>
<td>CIE 460</td>
<td>Advanced Research Practicum in Comparative and International Education</td>
<td>3</td>
</tr>
<tr>
<td>CIE 402</td>
<td>Development and Evaluation of International Educational Projects</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 405</td>
<td>Qualitative Research Methods</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 410</td>
<td>Univariate Statistical Models</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 411</td>
<td>Multivariate Statistical Models</td>
<td>3</td>
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</tbody>
</table>

**Interdisciplinary Core (27 credits)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIE 404</td>
<td>Issues and Institutions in International Educational Development</td>
<td>3</td>
</tr>
<tr>
<td>CIE 406</td>
<td>International Education Policy</td>
<td>3</td>
</tr>
</tbody>
</table>

In addition, students are required to complete at least 21 credits across three interdisciplinary program areas with at least two courses in each of the interdisciplinary areas. This includes one CIE required course in each area and electives depending on students’ research needs and interests: 1) Society and Culture, 2) Politics and Policy, and 3) Sustainable Development.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIE 405</td>
<td>Experiencing the United Nations: Gender and Education in International Development</td>
<td>3</td>
</tr>
<tr>
<td>CIE 412</td>
<td>Sociocultural Issues in Comparative and International Education</td>
<td>3</td>
</tr>
<tr>
<td>CIE 414</td>
<td>Globalization and Post-Colonialism in Education</td>
<td>3</td>
</tr>
</tbody>
</table>

Other elective courses in sociology, anthropology, political science, environmental initiative, and other programs with the approval of CIE and relevant program faculty.

In addition to coursework, the Ph.D. program in Comparative and International Education requires successful completion of both the doctoral qualifying project and the comprehensive examination. Students then must complete the dissertation proposal seminar.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIE 470</td>
<td>Doctoral Proposal Seminar in Comparative and International Education</td>
<td>3</td>
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</tbody>
</table>

**Concentrated Learning Requirement:** All students must complete a concentrated learning requirement in accordance with COE rules and regulations. The concentrated learning requirement is intended to ensure that doctoral students spend a period of concentrated study and intellectual association with other scholars. In order to fulfill this requirement, students must be accepted into the doctoral program.

**Master of Arts In Comparative and International Education**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIE 400</td>
<td>Comparative and International Education (REQUIRED COURSES (15 CREDITS))</td>
<td>3</td>
</tr>
<tr>
<td>CIE 401</td>
<td>Globalization &amp; Contextualization</td>
<td>3</td>
</tr>
<tr>
<td>CIE 408</td>
<td>Master'SThesis/Capstone</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 471</td>
<td>Diversity and Multicultural Perspectives</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 403</td>
<td>Research</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 408</td>
<td>Introduction to Statistics</td>
<td>3</td>
</tr>
</tbody>
</table>
ELECTIVE COURSES (6 CREDITS, select 2 courses from below)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIE 402</td>
<td>Development and Evaluation of International Educational Projects</td>
<td>3</td>
</tr>
<tr>
<td>CIE 403</td>
<td>Globalization and Curriculum Implications</td>
<td>3</td>
</tr>
<tr>
<td>CIE 404</td>
<td>Issues and Institutions in International Educational Development</td>
<td>3</td>
</tr>
<tr>
<td>CIE 405</td>
<td>Experiencing the United Nations: Gender and Education in International Development</td>
<td>3</td>
</tr>
<tr>
<td>CIE 406</td>
<td>International Education Policy</td>
<td>3</td>
</tr>
<tr>
<td>CIE 407</td>
<td>Grant Writing and Fund Raising in International Education Development</td>
<td>3</td>
</tr>
</tbody>
</table>

SELECT A DISCIPLINARY FOCUS:

Focus 1: SOCIOLOGY & ANTHROPOLOGY (12 CREDITS, select 4 courses from below)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTH 325</td>
<td>Economic Anthropology</td>
<td>4</td>
</tr>
<tr>
<td>AAS 313</td>
<td>Keep the Change: Social Movements in Society</td>
<td>4</td>
</tr>
<tr>
<td>GS 322</td>
<td>Global Health Issues</td>
<td>4</td>
</tr>
<tr>
<td>SOC 323</td>
<td>The Child In Family and Society</td>
<td>4</td>
</tr>
<tr>
<td>SOC 329</td>
<td>Global Migration</td>
<td>4</td>
</tr>
<tr>
<td>SOC 341</td>
<td>Gender and Health</td>
<td>4</td>
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<tr>
<td>SOC 345</td>
<td>Colonialism and the Black Radical Tradition</td>
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</tr>
<tr>
<td>SOC 351</td>
<td>Gender and Social Change</td>
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<tr>
<td>SOC 355</td>
<td>Sociology Of Education</td>
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<tr>
<td>SOC 364</td>
<td>Sociology of the Family</td>
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<tr>
<td>SOC 402</td>
<td>Sociology of Cyberspace</td>
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<tr>
<td>SOC 415</td>
<td>Case Studies Of Social Control</td>
<td>3</td>
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<tr>
<td>SOC 418</td>
<td>Gendered Experience of Globalization</td>
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<td>SOC 419</td>
<td>Global Food Systems</td>
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<tr>
<td>SOC 420</td>
<td>Global Migration</td>
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<tr>
<td>SOC 441</td>
<td>Gender and Health</td>
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<tr>
<td>SOC 454</td>
<td>Urban Education: Inequality and Public Policy</td>
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<tr>
<td>SOC 465</td>
<td>Inequalities at Work</td>
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<tr>
<td>SOC 473</td>
<td>Social Basis Of Human Behavior</td>
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<tr>
<td>SOC 476</td>
<td>Issues In Health Policy Analysis</td>
<td>3</td>
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</table>

OTHER SSP 400+ AND ANTH 400+ courses with advisor approval

Focus 2: POLITICAL SCIENCE & INTERNATIONAL RELATIONS (12 CREDITS, select 4 courses from below)

<table>
<thead>
<tr>
<th>Course</th>
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<tr>
<td>POLS 413</td>
<td>Modern Political Philosophy</td>
<td>3</td>
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<tr>
<td>POLS 451</td>
<td>Comparative Politics Core</td>
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<tr>
<td>POLS 425</td>
<td>Nationalism,Regionalism, and Populism</td>
<td>3</td>
</tr>
<tr>
<td>IR 322</td>
<td>Poverty and Development</td>
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<tr>
<td>IR 323</td>
<td>Political Economy of Industrialization and Development</td>
<td>4</td>
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<tr>
<td>IR 340</td>
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<td>4</td>
</tr>
<tr>
<td>IR 344</td>
<td>International Politics of Oil</td>
<td>4</td>
</tr>
<tr>
<td>IR 345</td>
<td>Democratization</td>
<td>4</td>
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<tr>
<td>IR 346</td>
<td>Contemporary Ethical Dilemmas in World Politics</td>
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<tr>
<td>IR 347</td>
<td>Non-State Actors in a Globalized World</td>
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OTHER POL 400+ and IR 300+ courses with advisor approval

Focus 3: ECONOMICS (12 CREDITS, select 4 courses from below)

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<thead>
<tr>
<th>Course</th>
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<tr>
<td>ECO 303</td>
<td>Economic Development</td>
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</tr>
<tr>
<td>ECO 339</td>
<td>International Trade</td>
<td>3</td>
</tr>
<tr>
<td>ECO 340</td>
<td>International Finance</td>
<td>3</td>
</tr>
<tr>
<td>ECO 342</td>
<td>Economic Development in China</td>
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<tr>
<td>ECO 343</td>
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<td>ECO 472</td>
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OTHER ECO 400+ with advisor approval

Focus 4: HISTORY (12 CREDITS, select 4 courses from below)

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<thead>
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<tbody>
<tr>
<td>HIST 401</td>
<td>Historical Research</td>
<td>3</td>
</tr>
<tr>
<td>HIST 404</td>
<td>Readings in the History of the Atlantic World, 1500-1900</td>
<td>3</td>
</tr>
<tr>
<td>HIST 443</td>
<td>Readings in English History</td>
<td>3</td>
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<tr>
<td>HIST 444</td>
<td>Readings in Latin American History</td>
<td>3</td>
</tr>
<tr>
<td>HIST 447</td>
<td>Readings in European History</td>
<td>3</td>
</tr>
<tr>
<td>HIST 453</td>
<td>Research in English History</td>
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<tr>
<td>HIST 454</td>
<td>Research in Latin American History</td>
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</tr>
<tr>
<td>HIST 457</td>
<td>Research in European History</td>
<td>3</td>
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</table>

OTHER HIST 400+ courses with advisor approval

The M.A. in Comparative and International Education (CIE) guides students in the examination of educational policy and theory on an international level, taking into consideration the impact of global economic, political, sociological, and historical factors on educational systems. A focus on interdisciplinary approaches to comparative and international education provides students a foundation for examining both educational research and policy. Graduates are prepared to work in educational research and policy organizations, government offices, ministries of education, and international development organizations.

The M.A. in CIE is a 36 credit hour program comprised of 18 credit hours of required (core) courses, 6 credit hours of electives, 12 credit hours of disciplinary-focused courses, and 3 capstone research credit hours.

**Master of Education in Globalization and Educational Change**

CIE 400 Comparative and International Education

CIE 401 Globalization & Contextualization

CIE 402 Development and Evaluation of International Educational Projects

CIE 403 Globalization and Curriculum Implications

CIE 471 Globalization and Education Equity

EDUC 403 Research

In addition, students take a minimum of 12 credits in a Concentration area. Concentration coursework is designed by each student and faculty advisor in close collaboration to fit the interests and situation of the student's current and/or potential needs. In addition, students may choose to concentrate in one of the following areas exclusively, which then leads to concurrent receipt of the M.Ed. in Globalization and Educational Change plus a Post-Baccalaureate Certificate in the specified area: 1) International Counseling (12 credit minimum), 2) International Development in Education (12 credit minimum), 3) Special Education (12 credit minimum), 4) Teaching English to Second Language Learners (12 credit minimum), 5) Technology Use in the Schools (12 credit minimum), 6) Women, Gender, and Sexuality Studies (12 credit minimum)

The M.Ed. is a 30-credit-hour program, which is designed to equip graduates to understand, participate in, and make data-driven decisions in and about schools and education institutions — both in the U.S. and internationally. It is a practitioner-oriented program with concentrations in education-related areas (e.g., international counseling, international education development, TESOL, special education, and technology use in schools). Program curriculum explores how education is related to economic, political, and social globalization, as well as examines how education policies, structures, and practices are contextualized in different geopolitical contexts.

**International Development in Education Certificate**

The post-baccalaureate certificate program in International Development in Education (IDE) provides a foundation in the theoretical concepts of, and practical skills in, education and international development. Certificate
and comparative education. Discussions are framed by current debates in the fields of international settings (e.g., United Nations, World Bank, NGOs, and state agencies). Involved in international educational development in diverse global in international development by introducing students to institutions and developing capitalist, socialist and “transitional” societies. At the end of this course, students should be able to think about their school or educational system within a global context, and have some idea how to make meaningful comparisons.

Courses
CIE 400 Comparative and International Education 3 Credits
The goal of this course is to introduce students to the origins and development of the field of international and comparative education and to explore how both scholars and educational policymakers have engaged some of the debates that characterize the field of education around the world. Special attention is devoted to similarities and differences in educational policy and practice between advanced and developing capitalist, socialist and “transitional” societies. At the end of this course, students should be able to think about their school or educational system within a global context, and have some idea how to make meaningful comparisons.

CIE 401 Globalization & Contextualization 3 Credits
The goal of the course is to clarify what globalization is and to consider the impact of globalizing ideas, structures, and cultures on education, and how educators and other stakeholders respond given their school’s or system’s unique global context. Through case studies and discussions with real-world school leaders, students explore ways that policies are “borrowed” and both educational cultures and structures are “institutionalized.”

CIE 402 Development and Evaluation of International Educational Projects 3 Credits
This course is an introductory exercise for students new to educational research, program evaluation and related areas (e.g., quality improvement, enhancing organizational performance, methods of social change, management training). Students will develop and conduct a professional on-site project evaluation of existing national and international projects, including initiatives undertaken by different international organizations (e.g., UNICEF, UNESCO, USAID), educational institutions, and schools (both public and private). Students will be accompanied and supervised throughout all stages of the research and evaluation process. No previous experience with evaluation research and empirical or qualitative data analysis is required.

CIE 403 Globalization and Curriculum Implications 3 Credits
This course investigates the impact of globalization on curriculum. In particular, it discusses how curriculum has historically been utilized in nation building; how tensions between the global and the local are inherent in curriculum; and how curriculum is a site of construction of national as well as global/cosmopolitan identities. Global citizenship is one of the major curricula themes spanning this dynamic intersection between the global and the local. This course will present several theoretical perspectives on this phenomenon and compare curricula across nations to understand how globalizing the curricula differs according to culture and language.

CIE 404 Issues and Institutions in International Educational Development 3 Credits
Explores theoretical approaches to understanding the role of education in international development by introducing students to institutions involved in international educational development in diverse global settings (e.g., United Nations, World Bank, NGOs, and state agencies). Discussions are framed by current debates in the fields of international and comparative education.

CIE 405 (WGSS 405) Experiencing the United Nations: Gender and Education in International Development 3 Credits
Building on the Lehigh University/United Nations partnership initiative, this course provides a structured practical experience for students to learn about the dynamics of UN and civil society relationships, focusing on the issues of gender and education in international development. Course activities include trips to the UN to attend NGO briefings and other events. Students develop experiences and skills in international development such as policy blogging, brief writing, and education sector analysis.

CIE 406 International Education Policy 3 Credits
Focuses on how policy is created, implemented, and evaluated in schools and educational systems from a comparative and international perspective. Provides a framework for a comprehensive analysis of the education “sector” in order to inform regional, national, or multinational educational policymaking. Students will apply this understanding to an analysis of education policy in a specific region or district (e.g., Pennsylvania) from a global policymaking perspective.

CIE 407 Grant Writing and Fund Raising in International Education Development 3 Credits
Addresses NGO issues and needs and will develop leadership, problem solving, and practical grant writing skills focused on international education development. The course is designed for individuals working in international NGOs and schools and is designed to work in conjunction with a local or international NGO. Teams of students will develop a project proposal related to the agency’s primary service mission, articulate a fund-raising strategy, and raise capital on the basis of proposals developed in class.

CIE 410 Research in Comparative and International Education I 3 Credits
(Two-semester-course taught in consecutive semesters with CIE 411.) This course provides an overview of research methodologies used in comparative and international education research. The course will introduce doctoral students to both qualitative and quantitative research methodologies, including participant observation, interviews, ethnography, narrative analysis, survey data collection, and large-scale, cross-national data analysis. The relationship between each methodology and the field of comparative and international education will be discussed using both research and policy examples from a variety of developed and developing country contexts.

CIE 411 Research in Comparative and International Education II 3 Credits
(Two-semester-course taught in consecutive semesters with CIE 410) This course provides an overview of research methodologies used in comparative and international education research. The course will introduce doctoral students to both qualitative and quantitative research methodologies, including participant observation, interviews, ethnography, narrative analysis, survey data collection, and large-scale, cross-national data analysis. The relationship between each methodology and the field of comparative and international education will be discussed using both research and policy examples from a variety of developed and developing country contexts.

CIE 412 Sociocultural Issues in Comparative and International Education 3 Credits
This course examines social and cultural contexts of teaching and learning in developed and developing country contexts. The course combines theoretical and empirical readings to highlight the dynamic factors that shape the lives of learners inside and outside the classroom. The course is divided into two modules. The first module presents theoretical readings on the social and cultural context of schooling. The second module draws from empirical studies of social and cultural issues in developed and developing country contexts.
CIE 414 Globalization and Post-Colonialism in Education 3 Credits
This course focuses on some of the central discussions in the field of comparative and international education and addresses the specific questions about the meaning of education and post-colonialism. Readings examine specific instances of the intersection of European colonialism, global capitalism, and international development in a variety of geographic settings, including Eastern/Central Europe, Africa, and Asia. Assignments focus on post-colonialism in specific countries to develop a historical perspective on the topic and to provide the basis for international comparison.

CIE 450 Doctoral Seminar in Comparative and International Education I 3 Credits
[Two-semester sequence] This seminar is a year-long course divided into several modules, each taught by different faculty within the comparative and international education program. The goal is to provide new doctoral students with a strong foundation in comparative education theory and initiate them into the professional and academic field. Students will study a variety of established and evolving theoretical frameworks and explore major research areas in comparative and international education and its sub-disciplines, with an emphasis on Lehigh-specific expertise in the field.

CIE 451 Doctoral Seminar in Comparative and International Education II 3 Credits
[Two-semester sequence] This seminar is a year-long course divided into several modules, each taught by different faculty within the comparative and international education program. The goal is to provide new doctoral students with a strong foundation in comparative education theory and initiate them into the professional and academic field. Students will study a variety of established and evolving theoretical frameworks and explore major research areas in comparative and international education and its sub-disciplines, with an emphasis on Lehigh-specific expertise in the field.

CIE 460 Advanced Research Practicum in Comparative and International Education 3 Credits
The goal of this course is to provide an opportunity for doctoral students to learn advanced techniques of comparative education research or measurement applied to international and/or cross-national comparative study of education phenomena. Advanced Research Practicum will be closely supervised by a CIE faculty member and will involve elements of collaborative academic research and professional mentoring.

CIE 470 Doctoral Proposal Seminar in Comparative and International Education 3 Credits
This course guides students through the initial stages of the dissertation proposal writing. Must have official standing as a doctoral student in comparative and international education.

CIE 471 Globalization and Education Equity 3 Credits
This course investigates how globalization affects education equity by examining group differences that result from race, ethnicity, culture, language, class, and gender. It critically analyzes existing systems of power and privilege that maintain the social constructions of cultural differences in the United States and globally. Through readings and class discussion, students are empowered to clarify and ground their own beliefs about education equity, while articulating a vision for equitable educational development as thoughtful, critical, and humane education researchers and practitioners.

CIE 482 Practicum in University Teaching: Comparative & International Ed 1-4 Credits
Mentored and guided co-teaching focused on the design, organization, pedagogy and assessment of university courses in Comparative and International Education. Students in this course will work with a faculty member to apply best practices in university teaching with feedback while co-teaching students in a course in the College of Education. Students taking the course must meet the college standards for participation and be approved by the program director and department chair.

Repeat Status: Course may be repeated.

CIE 491 Special Topics in Comparative and International Education 3 Credits
Intensive study and discussion of a specialized area in comparative and international education. Subtitle will vary.

Repeat Status: Course may be repeated.

CIE 499 Dissertation 1-15 Credits

Counseling Psychology

The Counseling Psychology program offers 4 degrees: M.Ed. (and certification) in School Counseling (48 credits); M.Ed. in Counseling and Human Services (60 credits); M.Ed. in International School Counseling (36 credits); and Ph.D. in Counseling Psychology. The program also offers a Lehigh graduate certificate in International School Counseling.

The M.Ed. in School Counseling is approved for certification (pre-K-12) by the Pennsylvania Department of Education (PDE); the M.Ed. program in Counseling and Human Services is accredited by the Master's in Psychology and Counseling Accreditation Council (MPCAC), and the Ph.D. program is accredited by the American Psychological Association (APA).

Our counseling psychology programs (Ph.D. and M.Ed. in Counseling and Human Services) adhere to The Benchmark Competencies for Professional Psychology (Campbell, Fouad, Grus, Hatcher, Leahy, & McCutcheon, 2013). The M.Ed. Program in School Counseling adheres to the PDE competencies for pre-K-12 School Counselors.

Counseling Psychology prepares students as competent and effective scientist-practitioners who demonstrate and strive for self-awareness, knowledge, and skills, undergirded by an attentiveness and responsiveness to multiculturalism and social justice.

Students who complete the M.Ed. in School or International School Counseling typically seek positions in public, private, and international educational settings as school counselors. Students who complete the M.Ed. in Counseling and Human Services seek a variety of positions, including community and agency counseling, independent practice, doctoral-level work, business and industry, and they often seek LPC licensure. Students completing the Ph.D. in Counseling Psychology typically seek positions as professional psychologists in hospitals and mental health centers, university counseling centers, independent practice, government positions (for example, Veterans Administration, public health) or as university professors.

Students and faculty are active in local communities, doing research in gender-based violence, maternal attachment and emotional regulation, and NIH-funded projects on Latino health behaviors, and with inner city adolescents in the Lehigh Valley. The Counseling Psychology program also runs a summer institute on international counseling and conducts training of counsellors globally. In addition, the Community Voices Clinic (CVC) (https://ed.lehigh.edu/cvc) is a school-based integrated mental health clinic, located at Broughal Middle and Donegan Elementary Schools, that provides mental health services to uninsured and underinsured families and communities in Southside Bethlehem. Many of our students co-publish and co-present nationally with faculty members.

For additional information about the program, please visit:
http://ed.lehigh.edu/acadamics/disciplines/cp

Questions regarding APA Accreditation may be addressed to the APA Office of Accreditation at:
Office of Program Consultation and Accreditation
750 First St. NE, Washington, DC 20002-4242
Telephone: (202) 336-5979 TDD/TTY: (202) 336-6123 Fax: (202) 336-5978
Email (apaaccred@apa.org) (General Questions) (apaaccred@apa.org)
Email (aro@apa.org) (Annual Report Online only)

Professor. ArpanaGovindan Inman, PhD (Temple University)
Associate Professors. Grace Caskie, PhD (University of North Carolina at Chapel Hill); Christopher T H Liang, PhD (University of Maryland, College Park); Susan S. Woodhouse, PhD (University of Maryland, College Park)
**Assistant Professors.** Germán Cadenas, PHD (Arizona State University); Nicole L. Johnson, PHD (University of Akron)

**Professor Of Practice.** Jerome A Farrell, PHD (University at Albany)

**Emeritus.** Arnold R. Spokane, PHD (Ohio State University)

**Doctor of Philosophy in Counseling Psychology**

Currently, the doctoral program requires a total of 103 credits, which are composed of 30 master’s level credits plus 70 doctoral level credits. A student who enters the counseling psychology doctoral program already holding a master’s degree, regardless of where the degree was obtained, may be exempted by her or his advisor from taking up to a total of the 30 credits of required master’s level coursework, with the exemption granted based on a review of the student’s transcript and/or course syllabi to ensure that the course or courses were of similar content to the course offered by Lehigh. These exempted credits do not count toward the total needed for the doctoral degree (currently 103), but will not appear on the student’s Lehigh transcript. After conferring with his or her advisor, the student will complete an internal petition to have these credits exempted, and this petition must be approved by the program director.

**Required Master's Level Coursework**

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<tr>
<th>Course Code</th>
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<th>Credits</th>
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<tbody>
<tr>
<td>EDUC 403</td>
<td>Research</td>
<td>3</td>
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<tr>
<td>EDUC 408</td>
<td>Introduction to Statistics</td>
<td>3</td>
</tr>
<tr>
<td>CPSY 427</td>
<td>Assessment and Appraisal in Counseling</td>
<td>3</td>
</tr>
<tr>
<td>CPSY 439</td>
<td>Theory and Practice of Group Counseling</td>
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</tr>
<tr>
<td>CPSY 440</td>
<td>Introduction to Family Counseling</td>
<td>3</td>
</tr>
<tr>
<td>CPSY 442</td>
<td>Counseling and Therapeutic Approaches</td>
<td>3</td>
</tr>
<tr>
<td>CPSY 430</td>
<td>Professional Seminar</td>
<td>3</td>
</tr>
<tr>
<td>CPSY 451</td>
<td>Helping Skills</td>
<td>3</td>
</tr>
<tr>
<td>CPSY 455</td>
<td>Counseling Issues and Skills: Advanced Techniques in Counseling</td>
<td>3</td>
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<tr>
<td>CPSY 471</td>
<td>Diversity and Multicultural Perspectives</td>
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**Doctoral Coursework**

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<tr>
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<tbody>
<tr>
<td>CPSY 461</td>
<td>Assessment of Adult Intellectual Functioning</td>
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<tr>
<td>or SCHP 422</td>
<td>Assessment of Intelligence</td>
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</tr>
<tr>
<td>CPSY 462</td>
<td>Assessment of Personality</td>
<td>3</td>
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<tr>
<td>CPSY 466</td>
<td>Current Issues in Counseling and Therapy (Projective Techniques - Optional)</td>
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<table>
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<tr>
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<tbody>
<tr>
<td>CPSY 476</td>
<td>Supervision and Consultation in Counseling</td>
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<td>EDL 488</td>
<td>Program Evaluation</td>
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**Advanced Seminar**

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<tr>
<td>CPSY 466</td>
<td>Current Issues in Counseling and Therapy</td>
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<tr>
<td>or CPSY 467</td>
<td>Doctoral Seminar In Counseling Psychology</td>
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**Apprenticeship**

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<tbody>
<tr>
<td>CPSY 470</td>
<td>Independent Study and Research (College Teaching Apprenticeship)</td>
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<tr>
<td>CPSY 470</td>
<td>Independent Study and Research (Research Apprenticeship)</td>
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<tr>
<td>CPSY 477</td>
<td>Supervision Apprenticeship</td>
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**Research Methods**

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<tbody>
<tr>
<td>EDUC 410</td>
<td>Univariate Statistical Models</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 411</td>
<td>Multivariate Statistical Models</td>
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**Practicum**

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<tbody>
<tr>
<td>CPSY 487</td>
<td>Advanced Doctoral Practicum I</td>
<td>3</td>
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<tr>
<td>CPSY 488</td>
<td>Advanced Doctoral Practicum II</td>
<td>3</td>
</tr>
<tr>
<td>CPSY 489</td>
<td>Advanced Doctoral Practicum III</td>
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<td>CPSY 491</td>
<td>Advanced Doctoral Practicum IV</td>
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<tr>
<td>CPSY 492</td>
<td>Advanced Field Placement (if not taken as part of master’s [course can be repeated])</td>
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**Internship**

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<tbody>
<tr>
<td>CPSY 498</td>
<td>Counseling Psychology Doctoral Internship (2 semesters full-time, or four semesters half-time)</td>
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**Qualifying Project**

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<tr>
<td>EDUC 486</td>
<td>Doctoral Qualifying Research Project</td>
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**Dissertation**

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<th>Course Title</th>
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<tbody>
<tr>
<td>CPSY 499</td>
<td>Dissertation (Note credit requirement explained in dissertation section)</td>
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</tbody>
</table>

**Total Credits** 103

* After the student has completed the first 15 hours of graduate work, the student is specifically reviewed for full admission. This review is completed during the annual review process for any student who has completed 15 hours. The student's coursework and performance and progress in the doctoral program are reviewed by the faculty. Any questions about the student's progress and plans are raised and discussed, and a vote is then taken to admit the student. The College of Education then writes a letter of admittance to the student specifying the time line for completion of all degree requirements. Students entering with a bachelor's degree have 10 years to complete all degree requirements. Students entering with a master's degree have 7 years to complete all degree requirements.

1. The purpose of the doctoral qualifying research project is to demonstrate research competence and to lay the groundwork for the student's dissertation. The doctoral qualifying project must be completed before application for the pre-doctoral internship can be approved. The project is research undertaken by the student in consultation with the research advisor and is presented in two forms:

   1. A written manuscript in APA (6th edition) format in a condition suitable for submission in a professional journal (with one variance; see below). Acceptance for publication is not required to meet this requirement, but it is expected that research projects will be submitted for publication in a timely fashion following completion.

   2. Presentation of the project at a public colloquium.

2. (with one variance; see below). Acceptance for publication is not required to meet this requirement, but it is expected that research projects will be submitted for publication in a timely fashion following completion.

3. Acceptance for publication is not required to meet this requirement, but it is expected that research projects will be submitted for publication in a timely fashion following completion.

4. Acceptance for publication is not required to meet this requirement, but it is expected that research projects will be submitted for publication in a timely fashion following completion.
prior to, and including the semester in which a proposal is approved, students must register for 3 dissertation credits each fall and spring semester. Similarly, for the semester(s) following the approval of the dissertation proposal, students must take 1 maintenance of candidacy credit until, and including, the semester in which the dissertation is defended. The only exception to this policy is during the time the student is on internship, during which only internship credits need to be taken. The matter of taking these dissertation credits should be taken seriously. Students who do not follow this procedure, and take fewer credits than required, will find that they will not be able to graduate until back-credits are paid for.

Master of Education in Counseling and Human Services
This professional preparation program reflects the increasing level of skills and competencies required for certification as a counselor in the Commonwealth of Pennsylvania, as well as new regulations governing Professional Counselor Licensure in Pennsylvania. The M.Ed. program is designed to provide the basic coursework as well as the specialized counseling "common core" coursework, and practical experience and professional concentration for certification as a school counselor in the Commonwealth of Pennsylvania; as preparation for further graduate study (i.e., doctoral study [see Ph.D. program manual]).

Shared Core Courses
CPSY 427 Assessment and Appraisal in Counseling 3
CPSY 436 Culture-Centered Career Intervention 3
CPSY 442 Counseling and Therapeutic Approaches 3
CPSY 471 Diversity and Multicultural Perspectives 3
CPSY 451 Helping Skills 3
CPSY 472 Human Development Across the Lifespan 3
EDUC 403 Research 3

Counseling and Human Services Track
CPSY 430 Professional Seminar 3
CPSY 439 Theory and Practice of Group Counseling 3
CPSY 440 Introduction to Family Counseling 3
CPSY 455 Counseling Issues and Skills: Advanced Techniques in Counseling 3
EDUC 408 Introduction to Statistics 3

Clinical Training
CPSY 479 Master's Counseling Practicum 3
CPSY 480 Master's Internship I 3
CPSY 483 Master's Internship II 3

Specialty
At least one advisor approved 3 credit elective from each of three areas (9)
  - Biological and Neuropsychological bases of behavior (3)
  - Social Justice, Diversity, Trauma and Loss (3)
  - Abnormal Behavior and Psychopathology (3)
Six additional credits of advisor approved electives (6)

Total Credits 60

Prepared to adapt to changing societal condition and demands placed upon Third Culture Kids.

Summer Institute I - Summer Session I
CPSY 452 Helping Skills in International Settings 3
CPSY 453 International School Counseling I 3
CPSY 456 International School Counseling II: Trauma & Resilience in Schools 3

Year I
Fall Semester
CPSY 436 Culture-Centered Career Intervention (online) 3
CPSY 457 International School Counseling III: Issues & Practicum 3

January Intersession
CPSY 472 Human Development Across the Lifespan 3

Spring Semester
CPSY 442 Counseling and Therapeutic Approaches (online) 3
SPED 332 Education and Inclusion of Individuals with Special Needs in K-12 3

Summer Institute II - Summer Session II
CPSY 471 Diversity and Multicultural Perspectives 3
CPSY 430 Professional Seminar 3
CPSY 438 School-Based Small-Group Counseling 3

Year 2
Fall Semester
CPSY 480 Master's Internship I (online) 3
SPED 465 Advanced Inclusionary Practices in K-12 3

January Intersession
EDUC 403 Research 3

Spring Semester
CPSY 483 Master's Internship II (online) 3
CPSY 427 Assessment and Appraisal in Counseling 3

Total Credits 45-48

Electronic Portfolio Completion Form Signed Off
Technology Requirement (An Electronic Portfolio submission is required), complete online registration each semester, receive orientation from LTS staff on use of the portal, use Course Site for at least one course, and take at least one Information Resources Mini Course as well as participate in the LU CP Listserv.

NOTE: Ten of the above courses will be offered online. Online courses may be offered in a variety of formats, including synchronous (i.e., everyone online at the same time), asynchronous (i.e., each student goes online at different times based on his/her schedule), or a combination of these formats.

* In Bethlehem or International Location
* All courses must be completed with a grade of B or better prior to the internship application being submitted.
  - Prerequisites for Master's Internship I & II
  - SPED 332 is a prerequisite for CPSY 438: Small-group school-based counseling and SPED 465

International SCHOOL Counseling Certificate
The Post-Baccalaureate Certificate in International Counseling is a joint venture between the Counseling Psychology Program and the College of Education’s Office of International Programs at Lehigh University.
Career, academic, cultural transition, and mental health issues have become a main focus in international schools. This certificate emphasizes counseling in community, school, and family settings within international communities. The certificate program at Lehigh University consists of a concentration of 4 courses (12 credit hours) in the area

Lehigh University 2019-2020
of International Counseling. **Students must complete the 4 courses over the span of one year. Typically students sequence courses in following manner: Summer (host country site), Fall (on-line), Spring (on-line), Summer (host country site). However, students may take courses off-sequence to fit their program of study.**

**CPSY 436**  
Culture-Centered Career Intervention  3

**CPSY 442**  
Counseling and Therapeutic Approaches  3

**CPSY 452**  
Helping Skills in International Settings  3

**CPSY 453**  
International School Counseling  3

**Total Credits**  12

**Master of Education in School Counseling & Pennsylvania State Certification**

The curricula and PDE standards for our school counseling program are detailed in this section.

### M.Ed. in School Counseling Curriculum

#### Shared Core Courses (21 cr.)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CPSY 427</td>
<td>Assessment and Appraisal in Counseling</td>
<td>3</td>
</tr>
<tr>
<td>CPSY 436</td>
<td>Culture-Centered Career Intervention</td>
<td>3</td>
</tr>
<tr>
<td>CPSY 442</td>
<td>Counseling and Therapeutic Approaches (*)</td>
<td>3</td>
</tr>
<tr>
<td>CPSY 471</td>
<td>Diversity and Multicultural Perspectives (**)</td>
<td>3</td>
</tr>
<tr>
<td>CPSY 472</td>
<td>Human Development Across the Lifespan</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 403</td>
<td>Research (***</td>
<td>3</td>
</tr>
<tr>
<td>CPSY 451</td>
<td>Helping Skills (*)</td>
<td>3</td>
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#### School Counseling Track (17 cr.)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>CPSY 445</td>
<td>School Counseling I (*)</td>
<td>4</td>
</tr>
<tr>
<td>CPSY 448</td>
<td>School Counseling II (*)</td>
<td>3</td>
</tr>
<tr>
<td>CPSY 449</td>
<td>School Counseling III (*)</td>
<td>4</td>
</tr>
<tr>
<td>SPED 332</td>
<td>Education and Inclusion of Individuals with Special Needs in K-12</td>
<td>3</td>
</tr>
<tr>
<td>SPED 465</td>
<td>Advanced Inclusionary Practices in K-12 (****)</td>
<td>3</td>
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#### Clinical Training (7 cr.)

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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CPSY 479</td>
<td>Master's Counseling Practicum</td>
<td>1</td>
</tr>
<tr>
<td>CPSY 480</td>
<td>Master's Internship I</td>
<td>3</td>
</tr>
<tr>
<td>CPSY 483</td>
<td>Master's Internship II</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Specialty and Technology Requirement

1 Advisor Approved Elective  3

Technology Requirement (An Electronic Portfolio is required, student must post it to Web space), complete online registration each semester, receive orientation from LTS staff on use of the portal, use Course Site for at least one course, and take at least one Information Resources Mini Course as well as participate in the LU CP Listserv)

NOTE: Students seeking LPC status should also register for CPSY 439 and CPSY 430 as two of their additional courses for licensure beyond the 48 credits required for the degree.

* This course must be taken and passed with a grade of B or better before student can start the internship sequence. ** This course must be taken and passed with a grade of B or better and satisfactory levels of counseling-related and professional competencies before the student can take CPSY 483. *** EDUC 403 and CPSY 471 are generally offered every semester and in the summer. CPSY 471 must be taken before CPSY 483 and must be passed with a B or better. **** SPED465 must be taken in a fall semester (other semester offerings are limited to SPED students). Note that SPED332 is a prerequisite course to SPED465.

**Total Credits**  48

### Courses

**CPSY 407 (SCHP 407) Crisis Management in the Schools 3 Credits**

This course is designed to provide students with knowledge and skills related to crisis preparedness and intervention in the schools. Relevant theories and research literature will be explored as well as practical elements of crisis response that are applicable to all school systems. In addition, intervention strategies and protocols will be examined and discussed.

**CPSY 427 (SCHP 427) Assessment and Appraisal in Counseling 3 Credits**

Principles of psychological measurement (e.g., tests construction, technology, validity, reliability, functional utility). Ethical, legal, and cultural issues in the administration and interpretation of psychological tests. Case conceptualization, reporting and presentation.

**CPSY 430 Professional Seminar 3 Credits**

Professional, ethical, and legal issues in counseling. Management and delivery of counseling services in a culturally diverse society. Professional development, certification, licensure, and role identification.

**CPSY 431 Latino Health 3 Credits**

The course is designed to provide a rich understanding of the factors at the individual, health care provider, institution, and policy level that affect Latino health and health seeking-behaviors in the United States. Research in the disciplines of social and behavioral sciences, epidemiology, health promotion, environmental health, minority health and health disparities, and public policy will be reviewed and discussed.

**CPSY 436 Culture-Centered Career Intervention 3 Credits**

Examination of the career development process and interventions for children, adolescents, and adults with a culture-centered perspective. Study of theorists, vocational assessment process, and occupational and psychological information systems.

**CPSY 438 School-Based Small-Group Counseling 3 Credits**

Introduction to small group counseling in school settings. Selection of group members; group rules; evidence-based practice with children and adolescents; ethical and cultural considerations with groups.

**Prerequisites:** SPED 332

**CPSY 439 Theory and Practice of Group Counseling 3 Credits**

Introduction to the process of group counseling and therapy. Selection of group members; group rules; group procedures with children, adolescents and adults; ethical considerations with groups. Study of research on group processes, group theory, and group leadership. Consent of program director required.

**CPSY 440 Introduction to Family Counseling 3 Credits**

Research and current trends in the practice of family counseling. Overview and analysis of major theoretical approaches of family therapy.

**CPSY 442 Counseling and Therapeutic Approaches 3 Credits**

Theory, research, and technique of counseling within a cultural context. Must have admission to CPSY master’s program or consent of counseling psychology program director.

**CPSY 445 School Counseling I 4 Credits**

Overview of the history, philosophy and current trends in school counseling. Emphasis is placed on (a) professional, ethical, and legal issues in counseling; (b) management and delivery of counseling services in a school setting and culturally diverse society; (c) professional development, certification and role identification; (d) collaboration and consultation with teachers, parents, and administrators. Students will be involved in a pre-practicum observation of school counselors in a K-12 setting.

**CPSY 448 School Counseling II 3 Credits**

Emphasis on the social and cultural context of school counseling. Includes ethical, legal, and cultural issues in the administration and interpretation of psychological tests used in K-12 settings. Focus on a special topic such as school violence or substance abuse prevention, school and community interaction, and the social and cultural context of school counseling, etc. The course will also include observations in schools.

**Prerequisites:** CPSY 445
CPSY 449 School Counseling III 4 Credits
Theory and methods of consultation; development and implementation of student assistance programs; intra- and inter-agency collaborations. The course will also include observations in schools.

CPSY 451 Helping Skills 3 Credits
Helping Skills is a course designed to provide counselor trainees with didactic and experiential learning opportunities to facilitate and enhance beginning counseling skills. Counselor trainees will begin to develop an understanding of the counselor’s role in assisting or inhibiting client change. This course utilizes such techniques as modeling, role-playing, audiotape feedback, as well as other learning modalities. Particular emphasis is given to theoretical frameworks, cultural competency, and self-understanding.

CPSY 452 Helping Skills in International Settings 3 Credits
This course assists counselors in developing proficiency in helping skills and an understanding of the counselor’s role in facilitating or inhibiting client change. Focus is on acquiring basic helping and therapeutic skills applicable across cultures using empirically based models.

CPSY 453 International School Counseling I 3 Credits
The objectives of this course are for students to gain knowledge related to constructing school-based prevention programs in international settings. Special focus will be paid to designing healthy school communities, understanding the components of an effective school counseling program, and working with children and adolescent students from third cultures and home countries.

CPSY 455 Advanced Techniques in Counseling 3 Credits
This course introduces students to advanced counseling techniques including risk management and empirically supported treatment (EST) approaches. In addition, students will develop knowledge in treatment planning and outcome evaluation and applying EST in a multi-culturally sensitive manner. The course will utilize readings, discussion, film/video clips and presentations to help therapists-in-training develop awareness, skills, and confidence needed to manage complex therapeutic processes. Emphasis will be placed on student’s professional identity development and the ability to engage in counseling relationships.

CPSY 456 International School Counseling II: Trauma & Resilience in Schools 3 Credits
This course is designed to provide counseling trainees with a comprehensive exploration of the psychological trauma field; including the history and current theories in the field, the nature of trauma (e.g., sexual abuse, combat, natural disasters); how trauma and loss affects individuals and systems, grief reactions, and traumatic stress; and the diagnosis and treatment (including evidence-based practices) of trauma in diverse children and adult populations. Students will have the opportunity to exercise leadership, clinical, assessment, and consultation skills.
Prerequisites: CPSY 453

CPSY 457 International School Counseling III: Issues & Practicum 3 Credits
Emphasis is on the social and cultural context of international school counseling. Content includes ethical, legal, and cultural issues in the administration and interpretation of psychological tests used in K-12 settings. The focus is on special topics such as school violence, substance abuse prevention, school and community interaction, and the social and cultural context of school counseling, etc. The course will also include a practicum in schools.
Prerequisites: CPSY 456

CPSY 460 Foundations of Counseling Psychology 3 Credits
Knowledge in the core foundations of Counseling Psychology, including the history of Counseling Psychology, multicultural issues, career and vocational counseling, counseling/psychotherapy process and outcome, ethics, prevention and health promotion, social justice and disaster intervention. Must have admission to the Ph.D. program in counseling psychology or consent of the counseling psychology program director required.

CPSY 461 Assessment of Adult Intellectual Functioning 3 Credits
Administration and interpretation of individual tests/batteries of adult intelligence and neuropsychological functioning. Consideration of psychological and cross-cultural issues in intellectual assessment. Preparation of psychological reports. Consent of instructor required.
Prerequisites: CPSY 427

CPSY 462 Assessment of Personality 3 Credits
Consideration of issues and methods of personality assessment, including ethical and legal issues, and cross-cultural issues. Practice in the administration of instruments used for personality assessment. Supervised experience and report writing. Must have admission to the Ph.D. program in counseling psychology.
Prerequisites: CPSY 427

CPSY 464 Gender and Sexuality 3 Credits
In this course, students are introduced to the psychology of gender and sexuality from a variety of theoretical perspectives (e.g., positivist-empirical, postmodern), with attention to how both quantitative and qualitative methodologies are used to inform knowledge. The course examines the ways in which mainstream psychology is gendered and sexed, as well as how various feminist approaches are used to study issues in psychology, the intersection of race/ethnicity, sexual orientation, and social class are also addressed.

CPSY 465 Addictions: Assessment, Treatment, & Prevention Strategies 3 Credits
Through class discussions, lectures and experiential exercises, as well as guest lecturers, videos, and co-curricular activities, this course explores the issues pertaining to the assessment, treatment, and prevention of addictions with the overall purpose of increasing our scientific and clinical expertise in working with individuals in counseling.

CPSY 466 Current Issues in Counseling and Therapy 1-6 Credits
Examination of an area of counseling or therapy that is of topical interest to students and faculty.
Repeat Status: Course may be repeated.

CPSY 467 Doctoral Seminar in Counseling Psychology 1-6 Credits
Research and writing-intensive seminar on current issues and topics in professional psychology directed to doctoral students in counseling psychology. Permission of CP Training Director.
Repeat Status: Course may be repeated.

CPSY 468 Trauma and Loss 3 Credits
This course aims to train students to address trauma and loss in their clinical work. Topics will include the history and diagnosis of trauma, the neurobiology of trauma, and the trauma experience of survivors of war, disaster, and childhood sexual abuse. Theories and treatment of loss and bereavement are also addressed.

CPSY 470 Independent Study and Research 1-6 Credits
Individual or small group study in the field of counseling. Approved and supervised by the major adviser.
Repeat Status: Course may be repeated.

CPSY 471 (EDUC 471) Diversity and Multicultural Perspectives 3 Credits
Examination of the influence of culture, gender, and disabilities on behavior and attitudes. Historical and current perspectives on race, culture, gender, and Lehigh minority group issues in education and psychology. Lecture/small group discussion. is restricted to graduate students in the College of Education only.

CPSY 472 Human Development Across the Lifespan 3 Credits
An examination of prevailing theories of human growth and development across the lifespan. Examination of the interactive effect of various age groups upon one another. Particular emphasis on the helping relationships.

CPSY 473 (SCHP 473) Advanced Research Methods in Applied Psychology 3 Credits
For doctoral students in applied psychology. Issues and methods of research design, data collection and data analysis. Advanced discussion of quantitative, qualitative and single-case research design. Admission to the Ph.D. program in counseling psychology or school psychology or permission of the instructor.
CPSY 476 Supervision and Consultation in Counseling 3 Credits
Examination of supervision and consultation theory, research and practice within a multicultural framework. Observation and supervision of counseling practicum students. Consultation in clinical settings. For candidates for supervisor’s certificate or doctorate in counseling. Consent of instructor required.
Prerequisites: CPSY 488

CPSY 477 Supervision Apprenticeship 3 Credits
The Supervision Apprenticeship normally follows completion of the supervision course CPSY 476 and ensures a full academic year of supervision experience working with master’s level trainees under the supervision of a faculty member. Doctoral standing and permission of training director required.
Repeat Status: Course may be repeated.

CPSY 479 Master's Counseling Practicum 1-3 Credits
CPSY 479 Master's Counseling Practicum 1-3 Credits Practicum field experience in professional practice settings with accompanying seminar meetings. Minimum of 100 documented hours on site.
Repeat Status: Course may be repeated.

CPSY 480 Master's Internship I 3 Credits
Twenty hours of weekly supervised practicum training for advanced graduate students in individual, group, and family counseling and therapy.
Repeat Status: Course may be repeated.
Prerequisites: CPSY 442 or CPSY 451 or CPSY 479

CPSY 481 Advanced Multicultural Counseling 3 Credits
This seminar covers models and theories of multicultural counseling and intervention. Students should be actively engaging in practice with multicultural clients in a practicum or field site, and these cases will form part of the basis of course discussions. Must have admission to the doctoral program in counseling psychology. Consent of counseling psychology program director required.
Prerequisites: CPSY 471

CPSY 482 Practicum in University Teaching: Counseling Psychology 1-4 Credits
Mentored and guided co-teaching focused on the design, organization, pedagogy and assessment of university courses in Counseling Psychology. Students in this course will work with a faculty member to apply best practices in university teaching with feedback while co-teaching students in a course in the College of Education. Students taking the course must meet the college standards for participation and be approved by the program director and department chair.
Repeat Status: Course may be repeated.

CPSY 483 Master's Internship II 3-6 Credits
Twenty hours of weekly supervised professional practice in a school or agency setting as an extension of CPSY 480, Practicum. Onsite supervision, audio and/or video recordings and case presentations required. Consent of counseling psychology practicum coordinator required.
Prerequisites: CPSY 480

CPSY 484 (SCHP 484) History and Systems of Psychology 3 Credits
This doctoral level course is designed as an overview of the history of psychology in the Western world. The historical approaches to this task will include a historical developmental approach to the origins and changes of ideas over time, the study of great persons and schools of thought, and a look at the Zeitgeist of each. This course will examine the nature of psychology as a whole, and the influence of philosophical worldviews in areas such as epistemology, ontology, teleology, and axiology. Part of this study regards the nature of science, and its power and limitations as applied to the understanding of human beings.

CPSY 485 Advanced Psychopathology 3 Credits
This class will cover etiology, assessment, interviewing techniques, establishing a therapeutic alliance, and treatment planning in adult mental disorders. In depth coverage will be given to Axis II disorders. The diagnosis and classification of abnormal behavior using DSM-IV-R medical model will be emphasized. Alternate theories of abnormal psychology will also be discussed.
minor, as well as a five-year program leading to a master’s degree and certification in a teaching field. Across the six academic programs, the department offers a variety of master’s degrees (M.Ed., M.S., and M.A.) and doctoral degrees (Ph.D. and Ed.D.), as well as an Educational Specialist degree (Ed.S.). In addition, in cooperation with the College of Business, the department offers a combination MBA/M.Ed. degree.

Further, programs in the college offer coursework-only study toward Pennsylvania state certification, without having to earn a degree. Lastly, there are numerous non-degree programs of study in the college leading to a Lehigh University post-bachelor’s certificate.

Programs of study vary in the number of credits required for completion. Please consult the appropriate academic program to learn more about those requirements.

Agencies accrediting our programs include the Pennsylvania Department of Education, the American Psychological Association, the National Association of School Psychologists, and the Masters in Psychology and Counseling Accreditation Council.

Graduates of our programs may work in schools or other educational settings, in health settings and agencies, in government agencies and non-governmental organizations focused on education, in industry, in private practice, or as consultants. While many graduates work in the United States, others work in countries around the world. For more information on what our graduates do after graduation, please consult the appropriate academic program.

The College of Education subscribes to a research-to-practice model, and all academic programs in the department train their graduates in research-based and evidence-based practices and policies that seek to create inclusive environments in which all individuals are able to work to their potential and social justice is well served.

The department is home to projects funded by the National Science Foundation, the National Institutes of Health, and the Department of Education.

Additional information about the department for current students, faculty, and staff is available at ed.lehigh.edu/insidecoe.

**Professor.** William Gaudelli, EDD (Rutgers University)

**Assistant Professor.** Kaitlin P Anderson, PHD (University of Arkansas)

**Professors Of Practice.** Jon Drescher, MS (Community College of NY, Brooklyn College); Qiong Fu, PHD (University of Illinois at Chicago)

**Emeriti.** Raymond Bell, EDD (Lehigh University); Joseph P. Kender, EDD (University of Pennsylvania); Robert L. Leight, EDD (Lehigh University); J. Gary Lutz, EDD (Lehigh University); Alden J. Moe, PHD (University of Minnesota Minneapolis); Gary M. Sasso, PHD (University of Pennsylvania); Alden J. Moe, PHD (University of Pennsylvania); Robert L. Leight, EDD (Lehigh University); J. Gary Lutz, EDD (Lehigh University); Alden J. Moe, PHD (University of Minnesota Minneapolis); Gary M. Sasso, PHD (University of Pennsylvania); J. Gary Lutz, EDD (Lehigh University); Alden J. Moe, PHD (University of Minnesota Minneapolis); Gary M. Sasso, PHD (University of Pennsylvania); Alden J. Moe, PHD (University of Minnesota Minneapolis); Gary M. Sasso, PHD (University of Pennsylvania);

**Courses**

**EDUC 375 (HMS 375) Community Based Participatory Research Methodology 3-4 Credits**
The course provides an introduction to the core concepts of community based participatory research (CBPR) methodology applied to social science research to address public health issues. The course will equip students with strategies for developing community academic partnerships as well as to strengthen skills in research methods.

**Attribute/Distribution:** SS

**EDUC 383 Supervised Research in Applied Psychology 1-3 Credits**
Provides undergraduate junior and senior psychology majors a formal supervised research experience in applied psychology. Students are assigned for the semester to a research team led by a participating faculty member in the counseling psychology or school psychology programs in the College of Education.

**Repeat Status:** Course may be repeated.

**EDUC 388 Statistical Computing 3 Credits**
Use of one or more major statistical software packages. Principles of data coding, editing, integrity checking, and management. Emphasis on link between personal computers, mainframes, and other software.

**Prerequisites:** EDUC 408

**EDUC 391 Educational Linguistics 3 Credits**
Study of language form, language function, and language varieties, among other topics. By collecting and analyzing learner language, students will develop a solid foundation of the system of English, both as it exists and as it is used. Applying this linguistic knowledge to practice, students will learn how to identify learners’ linguistic needs; to set priorities and to establish goals for ELLs; and to embed target language forms in authentic tasks.

**EDUC 394 Special Topics In Education 3 Credits**

**Repeat Status:** Course may be repeated.

**EDUC 402 Developmental Psychology 3 Credits**
Survey of theories and research concerning perceptual, cognitive, social, and personality development through infancy and childhood. Must have graduate standing.

**EDUC 403 Research 3 Credits**
Basic principles of research; techniques of gathering and analyzing data; design of studies in education. Emphasis on critical reviews of research reports representing various methodologies. Research report required.

**EDUC 405 Qualitative Research Methods 3 Credits**
Foundations of qualitative design as research methodology for answering questions in education. Topics include history, philosophy, types, methods, applications, and critical reading of qualitative research reports. Emphasis on developing key researcher skills of gaining entrance, collecting, analyzing and interpreting data, establishing credibility, and writing and publishing results.

**EDUC 408 Introduction to Statistics 3 Credits**
Organization and description of data. Principles of statistical inference including hypothesis testing, interval estimation, and inferential error control. Emphasis on application.

**EDUC 409 Analysis of Experimental Data 3 Credits**
Emphasis on analysis of variance designs including one-way, factorial, nested, and repeated measures designs. Introduction to multiple regression and the analysis of covariance.

**Prerequisites:** EDUC 408

**EDUC 410 Univariate Statistical Models 3 Credits**
The univariate general linear model. Principles of expressing models and hypotheses about those models. Emphasis on similarity among the analysis of variance, multiple regression, and the analysis of covariance. Examples of nonstandard models and generalization to complex designs.

**Prerequisites:** EDUC 409

**EDUC 411 Multivariate Statistical Models 3 Credits**
The multivariate general linear model. Principles of expressing multivariate models and hypotheses about those models. Emphasis on similarity among the multivariate analysis of variance, multiple regression, and the analysis of covariance. Examples of non-standard models and generalization to complex designs.

**Prerequisites:** EDUC 410

**EDUC 412 Advanced Applications of Psychometric Principles 3 Credits**
Conceptual examination of exploratory and confirmatory factor analysis, cluster analysis, latent-trait modeling, and other advanced psychometric topics.

**Prerequisites:** EDUC 409 or SCHP 427 or CPSY 427

**EDUC 413 Hierarchical Linear Modeling 3 Credits**
This course is designed to introduce students to the theoretical underpinnings and basic applications of hierarchical linear modeling (HLM). At the end of the course, students will understand when HLM is the appropriate analysis of choice as well as be able to analyze multilevel data. Both cross-sectional and longitudinal nestedness will be considered. An understanding of regression analyses is essential for success in this course and is a prerequisite to this class.

**Prerequisites:** EDUC 410 or EDUC 411
EDUC 414 Structural Equation Modeling 3 Credits
Analysis and interpretation of a variety of structural equation modeling (SEM) procedures including path analysis, confirmatory factor analysis, factorial invariance, full structural equation models, and latent growth models. Understanding and criticizing both theoretical and applied literature relevant to SEM.
Prerequisites: EDUC 410 or EDUC 411

EDUC 419 Second Language Acquisition 3 Credits
Introduces theories of second language acquisition (SLA) and explores current research that addresses the psycholinguistic, affective, and sociocultural dimensions of learning a second language (L2), specifically as they relate to English Language Learners (ELLs). SLA theory is fundamental to ESL practitioners’ training in teaching and supporting ELLs effectively. Although this course has a theoretical focus, practical understanding of how to apply these theories in teaching will also be emphasized.

EDUC 420 Contemporary Issues in English Language Learner Education 3 Credits
Current educational, political, and social conditions that make learning English as a second language a matter of educational equity and social justice. Through a synthesis of the latest research and current educational trends, this course takes a critical look at the complexities of contemporary policies, school practices, and prevalent ideologies that both create and reinforce limited educational opportunities for ELLs.

EDUC 422 Pedagogy for Second Language Learning 3 Credits
Introduction to research-based principles and strategies that will promote second language acquisition (SLA) for ELLs. Knowing that schools cannot delay or water down content-learning until ELLs have acquired English, this course emphasizes infusing content and language learning both in and outside the general education classroom.

EDUC 423 Curriculum and Materials Design for English Language Learners 3 Credits
Design of curricula and materials to meet the needs of English language learners (ELLs). This course will guide students through the process of creating, adapting, and differentiating materials used in everyday teaching, while also giving students tools to develop curricula for their districts and schools. Students will engage in design and adaptation at many levels from curricula and courses, to assessments, lesson plans, and tasks.

EDUC 424 Practicum in Second Language Teaching 1-3 Credits
Culminating course for students pursuing the ESL Program Specialist Certificate. Throughout the practicum, students will apply the knowledge they have gained about ELL education, theory, and practice to teaching and supporting ELLs in K-12 classrooms. As they teach, students will enhance their professional expertise by evaluating, problematizing and reflecting on their praxis. In doing so, this practicum emphasizes teacher agency and the professional skills needed for self-directed, on-going growth as an ESL practitioner.

EDUC 451 Applied Principles of Cognitive Psychology 3 Credits
Basic principles and contemporary theories of cognitive psychology will be covered, especially regarding the application of these principles to education. Experimental research relevant to contemporary theories of cognitive psychology and the application of these theories in educational settings will be reviewed.

EDUC 461 Single-Subject Research Design 3 Credits
Experimental designs for use with small N’s. Topics include design theory and application, experimental validity (internal, external, statistical conclusions and construct validity) and an overview of data analysis procedures.

EDUC 471 (CPSY 471) Diversity and Multicultural Perspectives 3 Credits
Examination of the influence of culture, gender, and disabilities on behavior and attitudes. Historical and current perspectives on race, culture, gender, and minority group issues in education and psychology. Lecture/small group discussion. is restricted to graduate students in the College of Education only.

EDUC 473 Social Basis of Human Behavior 3 Credits
Development of human behavior from a social psychological perspective. Emphasis placed on the impact of society upon school-age children and adolescents.

EDUC 474 Behavioral Neuroscience 3 Credits
Humans are biological creatures, and our behaviors and thoughts are influenced and constrained by our physiology. This course will describe how the function of the working brain contributes to our thoughts, feelings, and actions. We will also discuss the implications of a brain-based approach to issues of free will, responsibility, and identity.

EDUC 475 Clinical Psychopharmacology 3 Credits
This course will examine the principle concepts in pharmacology such as pharmacokinetics and pharmacodynamics, different neurotransmitter systems and our current understanding of their relationship to behavior, as well as pharmacological treatment of various psychological or psychiatric disorders. Additionally, we will explore the ethical issues and concerns associated with taking a bioreductive view of psychology, as well as issues relating to advance in new drug development.

EDUC 482 Practicum in University Teaching: Education 1-4 Credits
Mentored and guided co-teaching focused on the design, organization, pedagogy and assessment of university courses in Education. Students in this course will work with a faculty member to apply best practices in university teaching with feedback while co-teaching students in a course in the College of Education. Students taking the course must meet the college standards for participation and be approved by the program director and department chair. May be repeated for credit.
Repeat Status: Course may be repeated.

EDUC 486 Doctoral Qualifying Research Project 1-3 Credits
Design and implement research project under faculty supervision to meet requirements for doctoral programs.
Repeat Status: Course may be repeated.

EDUC 490 Thesis 1-6 Credits

EDUC 491 Advanced Seminars: (with subtitle) 1-6 Credits
Intensive study and discussion of a specialized area. Title will vary.
Repeat Status: Course may be repeated.

EDUC 493 Internship in: (with subtitle) 1-6 Credits
Opportunity for students to apply theory to practice in a variety of educational settings. Students will be supervised in the field and participate in seminars dedicated to addressing specific concerns and issues encountered during their experience. Consent of program director required.

EDUC 494 Field Work in: (with subtitle) 3 Credits
Identification of significant problems in an educational environment, review of the literature, and development of appropriate research plans.

EDUC 495 Independent Study in: (with subtitle) 1-6 Credits
Individual or small group study in the field of specialization. Approved and supervised by the major adviser.
Repeat Status: Course may be repeated.

EDUC 496 Doctoral Research Seminar 3 Credits
For doctoral students. Research design and application to various kinds of educational problems; data collection and analysis. Criticism and evaluation of student proposals.
Repeat Status: Course may be repeated.

EDUC 499 Dissertation 1-15 Credits

Educational Leadership

The Educational Leadership program offers a master’s (M.Ed.) and a doctoral degree (Ed.D.), both in Educational Leadership. The program also offers K-12 Principal, Supervisor of Curriculum and Instruction, and Superintendent (Pennsylvania Letter of Eligibility) certification through the state of Pennsylvania.

The Educational Leadership program is approved by the Pennsylvania Department of Education (PDE). Thus, graduates of our approved preparation programs are eligible for state certification.

Our graduates typically assume positions as superintendents, principals, assistant principals, and directors of curriculum and instruction. Some of our graduates are now faculty members in universities where they
teach and conduct research. Internationally, our graduates lead schools around the world (for example, in China, Columbia, Italy, and The Middle East).

The Educational Leadership program has a unique blend of both theory and practice, and a long history of excellence and high quality. In addition, through Lehigh’s partnerships and programming, students may have the opportunity to take coursework with peers who work in international schools, bringing a different perspective to their classes. Further, this program has a history of strong commitment to improving educational opportunities for all students. This is evident in the practices of our many graduates who now hold leadership positions in schools and districts in the local area, region, nation and throughout the world.

The Global Online Educational Leadership Program offers educational opportunities at the master’s and doctoral level to people interested in leadership in the international school community.

The Urban Principals Academy at Lehigh (U*PAL) program is designed to develop urban school leaders who will think and act in ways that disrupt the stagnation and mediocrity that exists in too many of our nation’s schools. This cohort-based program utilizes the underlying themes of creativity and imagination in leadership to address issues of diversity and organizational culture.

For additional information about the program, please visit: http://ed.lehigh.edu/academics/disciplines/edl

Professor: George P. White, EDD (Vanderbilt University, Peabody College)
Associate Professors: Floyd D. Beachum, PHD (Bowling Green State University); Craig Hochbein, PHD (University of Virginia)
Assistant Professor: Jihyun Kim, PHD (Michigan State University)
Emeriti: Jill Sperandio, PHD (University of Chicago); Perry A. Zirkel, JD (University of Connecticut)

Doctor of Education in Educational Leadership

This program is designed to develop the leadership abilities of administrators in educational institutions and agencies that support significant educational programs. Through a combination of regular coursework and special seminars, the program stresses the integration of the theoretical and applied aspects of educational leadership. This planning sheet provides direction for the sequencing of courses but allows flexibility to meet the unique needs of students with different backgrounds and career goals. The program requires a minimum of 60 credit hours (post Master’s) earned at Lehigh and the completion and defense of a dissertation in a maximum of seven years.

**AREA I - ADMINISTRATION AND LEADERSHIP**

**Section A - Organization and Leadership (9 cr.)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>EDL 400</td>
<td>Organizational Leadership and Change Management</td>
<td>3</td>
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<tr>
<td>EDL 405</td>
<td>The Principalship II (or advisor-approved organizational leadership course)</td>
<td>3</td>
</tr>
<tr>
<td>EDL 485</td>
<td>The Superintendentcy (or advisor-approved organizational leadership course)</td>
<td>3</td>
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**Section B - Leadership Functions (21 cr. minimum)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>EDL 476</td>
<td>School Resources Management</td>
<td>3</td>
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<tr>
<td>EDL 477</td>
<td>Seminar in School-Community Relations</td>
<td>3</td>
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<tr>
<td>EDL 479</td>
<td>School Law and Ethics</td>
<td>3</td>
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<tr>
<td>EDL 432</td>
<td>Special Education Law</td>
<td>3</td>
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<tr>
<td>EDL 481</td>
<td>Policy and Politics in Public Education</td>
<td>3</td>
</tr>
<tr>
<td>EDL 488</td>
<td>Program Evaluation</td>
<td>3</td>
</tr>
<tr>
<td>EDL 470</td>
<td>Special Topics in Educational Leadership (management focus)</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 495</td>
<td>Independent Study in: (with subtitle) (leadership-functions focus)</td>
<td>3</td>
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OR other advisor-approved leadership functions course

**Section C - Curriculum and Instruction (12 cr. minimum)**

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>EDL 467</td>
<td>Supervision and Professional Development</td>
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<tr>
<td>EDL 468</td>
<td>Applied Learning Theory for School Leadership</td>
<td></td>
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<tr>
<td>EDL 420</td>
<td>Data Based Decision Making</td>
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<tr>
<td>EDL 422</td>
<td>Curriculum Management for the School Executive</td>
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<tr>
<td>EDL 470</td>
<td>Special Topics in Educational Leadership (curriculum focus)</td>
<td>3</td>
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<tr>
<td>EDL 450</td>
<td>Curriculum Design in a Global Society</td>
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</table>

**Section D - Addressing the Needs of Diverse Learners (6 cr. minimum)**

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>EDUC 471</td>
<td>Diversity and Multicultural Perspectives</td>
<td>3</td>
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<tr>
<td>SPED 332</td>
<td>Education and Inclusion of Individuals with Special Needs in K-12</td>
<td>3</td>
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<tr>
<td>EDL 430</td>
<td>Development and Administration of Special Education Programs</td>
<td>3</td>
</tr>
<tr>
<td>EDL 434</td>
<td>Leadership and Management of Special Education Programs</td>
<td>3</td>
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**Section E - Research and Measurement (6 cr.)**

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<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>EDUC 408</td>
<td>Introduction to Statistics</td>
<td>3</td>
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<tr>
<td>EDUC 409</td>
<td>Analysis of Experimental Data</td>
<td>3</td>
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<tr>
<td>or EDUC 405</td>
<td>Qualitative Research Methods</td>
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**AREA II - RESIDENT STUDIES (12 CREDIT HOURS)**

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<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>EDL 470</td>
<td>Special Topics in Educational Leadership (Introduction to Doctoral Research I)</td>
<td>3</td>
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<tr>
<td>EDL 470</td>
<td>Special Topics in Educational Leadership (Introduction to Doctoral Research I)</td>
<td>3</td>
</tr>
<tr>
<td>EDL 489</td>
<td>Doctoral Seminar in School Administration</td>
<td>3</td>
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<tr>
<td>EDUC 496</td>
<td>Doctoral Research Seminar</td>
<td>3</td>
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**AREA III - SPECIALIZATION ELECTIVES**

May be selected from courses offered in the College of Education, as well as other related disciplines. (Approval of Advisor required.)

**AREA IV - DISSERTATION AND CONCENTRATED LEARNING EXPERIENCE**

**Dissertation:** Candidates for the Ed.D. are required to present a dissertation prepared under the direction of a professor.

**Concentrated Learning Requirement:** This requirement is intended to ensure that doctoral students spend a period of concentrated study and intellectual association with other scholars. Two semesters of full-time Lehigh Graduate study or 18 credit hours of study, either on or off campus, must be completed within a 15-month period.


**Comprehensive examination**

The comprehensive examination for Educational Leadership consists of a take-home exam requiring students to conduct a comprehensive review of the literature on a critical issue facing school leaders and policy makers. With three months to respond, students will submit a paper no longer than 12 pages excluding references. The exam will be offered twice a year, Fall and Spring semesters.

In order to qualify to sit for the exam, students must have no open incompletes other than for EDL 489 or Educ 496, and must also have passed EDL 470 with grades of B- or better.

**Master of Education in Educational Leadership**

The Masters degree is designed to provide a core foundation of understanding in the areas of leadership, organizational development and change management. Students are required to complete the Core Requirements prior to taking other courses in the program. The student and the academic advisor should design the elective portion of the
program jointly. A minimum of 30 credits are required to complete the Masters degree in Educational Leadership.

### Core Requirements (15 credits)

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<thead>
<tr>
<th>Course</th>
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<td>EDL 420</td>
<td>Data Based Decision Making</td>
<td>3</td>
</tr>
<tr>
<td>EDL 424</td>
<td>Leadership: Self and Groups</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 403</td>
<td>Research</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 471</td>
<td>Diversity and Multicultural Perspectives</td>
<td>3</td>
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</tbody>
</table>

#### Leadership & Management Skills (15 credits; must be approved by Advisor)

Total Credits 30

### K-12 Principal Certification

***You currently have no program requirements listed in the catalog.***

### Superintendent of Schools Certification: Pennsylvania Letter of Eligibility

***You currently have no program requirements listed in the catalog.***

### Supervisor of Curriculum and Instruction Certification

Program Requirements: All candidates must have an earned Master’s degree in an educationally related area (e.g., Elementary/Secondary Education, Educational Leadership, Curriculum and Instruction, or Teaching, Learning & Technology). In addition, the candidate must have a minimum of four years of elementary or secondary school teaching experience. Students will be admitted as a cohort group. Each cohort will begin course work during the summer. Prior to receiving endorsement from the College of Education for certification the student must submit passing scores on the PRAXIS Supervision and Administration examination (#0410) and shall have demonstrated a minimum of five years of certificated teaching experience.

#### Summer 1 (6 cr.)

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<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>EDL 421</td>
<td>Instructional Leadership</td>
<td>3</td>
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<tr>
<td>EDL 422</td>
<td>Curriculum Management for the School Executive</td>
<td>3</td>
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#### Fall (5 cr.)

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<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>EDL 400</td>
<td>Organizational Leadership and Change Management</td>
<td>3</td>
</tr>
<tr>
<td>EDL 428</td>
<td>Practicum in Supervision of Curriculum and Instruction I</td>
<td>2</td>
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#### Spring (5 cr.)

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<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>EDL 467</td>
<td>Supervision and Professional Development</td>
<td>3</td>
</tr>
<tr>
<td>EDL 429</td>
<td>Practicum in Supervision of Curriculum and Instruction II</td>
<td>2</td>
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#### Summer 2 (3 cr.)

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<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>EDL 420</td>
<td>Data Based Decision Making</td>
<td>3</td>
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</tbody>
</table>

Total Credits 19

### Courses

#### EDL 400 Organizational Leadership and Change Management 3 Credits

Theory development relating to individuals and organizations emphasizing leadership, decision-making, motivation, and change. Analysis of existing leadership approaches focusing on demonstrating the application theories to administrative practice.

#### EDL 404 The Principalship I 3 Credits

Roles, responsibilities, and operational tasks of principals in the first half of the school year; engagement in practical application of the knowledge, theories, systems, and processes with an emphasis on fall semester responsibilities. Focus on applying the skills and knowledge of the course using problem based learning experiences drawn directly from internship. Must be completed during Principal Internship I (EDL 414).

#### EDL 405 The Principalship II 3 Credits

Roles, responsibilities, and operational tasks of principals in the second half of the school year; engagement in practical application of the knowledge, theories, systems, and processes with an emphasis on budgeting, state testing requirements and closing the school down in the summer. Focus on applying the skills and knowledge of the course using problem-based learning experiences drawn directly from internship. Must be completed during Principal Internship II (EDL 415).

**Prerequisites:** EDL 400

#### EDL 408 Central Office Internship I 2 Credits

Practical experiences in meeting the challenges inherent in the Superintendent and associated central office positions. Emphasis on the five basic functional office roles of the superintendent: CEO to the school board, human resource manager, instructional leader, financial manager, and director of community relations.

#### EDL 409 Central Office Internship II 2 Credits

Practical experiences in meeting the challenges inherent in the Superintendent and associated central office positions. Emphasis on the budgeting process, state testing requirements and other priorities in the second half of a school year. Must have completed Central Office Internship I.

**Prerequisites:** EDL 408

#### EDL 414 Principal Internship I 2 Credits

Practical experiences in meeting the challenges inherent in the principal positions during the first half of the school year. Emphasis on data based decision making, instructional leadership, and day to day operations. Must be completed with EDL 404.

**Corequisites:** EDL 404

#### EDL 415 Principal Internship II 2 Credits

Practical experiences in meeting the challenges inherent in the principal positions during the second half of the school year. Emphasis on data based decision making, instructional leadership, and day to day operations. Must be completed with EDL 405.

**Corequisites:** EDL 405

#### EDL 420 Data Based Decision Making 3 Credits

Theory, research, and processes associated with the design and management of school curriculum; implementation of effective instructional and assessment practices enhancing student learning. School leader’s role in designing and implementing a comprehensive school improvement process, and using data to guide curriculum, instruction and assessment program.

#### EDL 421 Instructional Leadership 3 Credits

Skills, competencies, and best practices of instructional leadership and student achievement. Includes framing and communicating school goals dealing with student learning, supervising and evaluating instructional practices, coordinating the curriculum to student outcomes, monitoring student progress, creating a professional learning community, and engaging in reflective practice as a school leader.

#### EDL 422 Curriculum Management for the School Executive 3 Credits

A survey of the methods used to facilitate a curriculum development process based on the theories and findings from research and practice. Application of concepts to practical problems in curriculum leadership to acquire skills in the change process for instruction innovation. Emphasis on current theory and research in standards, technology, and curriculum integration.

#### EDL 423 Leading Inclusive Learning Systems 3 Credits

Issues facing school administrators as they develop and implement plans to address the needs of all students in their schools and districts. Addresses administrators’ obligations for the development and monitoring of Individualized Education Programs for children and youth with disabilities as well as other duties encumbered by administrators.

#### EDL 424 Leadership: Self and Groups 3 Credits

Exploration of the development and practice of leadership with experiential opportunities for application. Formal and informal authority, the practice of leadership, and individual and organizational dynamics are explored to improve the understanding of adaptive work in organizations.
EDL 425 Leading and Managing Change 3 Credits
Practices and theories about reform, change, and decision making look at who you need to communicate with and why each entity needs to be managed differently. Identify the educational stakeholders, the current trends that effect change, and what precipitates the need for change in the educational system. Addresses the process of change as it relates to individuals, the school board, teachers, students, and the administration with special emphasis on leadership, decision-making, motivation, and the dimensions of change.

EDL 426 Introduction to Relational Leadership: Theory and Practice 3 Credits
Theory development relating to individuals and organizations with special emphasis on the superintendents prolonged effective working relationship with the board of education, the administration, the professional and support staffs and the community. Implementation, follow through, and maintenance are emphasized relating to the interpersonal savvy a superintendent needs to effectively establish trust, build and mend relationships, guide decision-making, instill motivation, lead stakeholders and manage change.

EDL 428 Practicum in Supervision of Curriculum and Instruction I 2 Credits
Supervised field experience in all aspects of district-wide curriculum and instructional activities. Requires monthly seminar meetings.

EDL 429 Practicum in Supervision of Curriculum and Instruction II 2 Credits
Advanced supervised field experience in all aspects of district-wide curriculum and instructional activities. Requires monthly seminar meetings.

Prerequisites: EDL 428

EDL 430 Development and Administration of Special Education Programs 3 Credits
Exploration of the research and practice of an effective special education program. Emphasis on curriculum development, field-based research, and data-based decision making program design and evaluation, and the relationship of the special education program to the regular curriculum.

EDL 432 Special Education Law 3 Credits
An overview of the relevant legislation, regulations, and case law concerning the education of students with disabilities in pre-k through secondary school.

EDL 434 Leadership and Management of Special Education Programs 3 Credits
Introduction to the management practices related to effective leadership of special education programs including budget development and management, staffing, instructional practices, student assessment practices, and parent involvement.

EDL 436 School District Governance: Planning Policy, Ethics and Law 3 Credits
Examines federal and state Department of Education policies, laws, and regulations governing educational practice, policy, ethics and programming at the district level. Topics include a study of policy-making and related policies in a district, the role of the educational community in developing a collaborative decision-making organization, equality of educational opportunity for all students, and how policy efforts are reshaped by federal, state and local systemic reform efforts.

EDL 437 School District Resource Management 3 Credits
Theoretical and practical foundation in school resource allocation from the superintendent district wide perspective. Trends in revenue and expenditures, staffing, and operations, including school board issues, are explored. The economics of education and school business administration are discussed in terms of the policies they affect and create.

EDL 438 Practicum in Supervision of Special Education and Pupil Services Programs I 2 Credits
Supervised field experience in all aspects of district-wide special education programs. Requires monthly seminar meetings.

EDL 439 Practicum in Supervision of Special Education and Pupil Services Programs II 2 Credits
Supervised field experience in all aspects of district-wide special education programs. Requires monthly seminar meetings.

Prerequisites: EDL 438

EDL 440 Development and Administration of Pupil Services Programs 3 Credits
Exploration of the research and practice of an effective comprehensive pupil services program. Emphasis on involvement of community agencies, field-based research, and data-based decision-making, program design and evaluation, and the relationship of the pupil services program to the regular and special education curriculum.

EDL 442 Leadership and Management of Pupil Services Programs 3 Credits
Overview of the management practices related to effective leadership of pupil services programs, including budget development and management, staffing, instructional practices, community agency partnerships, student assessment, legal issues, and parent involvement.

EDL 450 Curriculum Design in a Global Society 3 Credits
Exploration of global issues and their effects on what is taught in schools, specifically in international schools. Emphasis on the analysis of curriculum and the influence that culture plays in decision making.

EDL 452 Comparative Education 3 Credits
Survey of education practices abroad. Systems of articulation, social and legal foundations, and structure in government. Emphasis on the nature and purpose schools in various cultural contexts and the major problems and trends occurring throughout the world.

EDL 461 Facilitating Organizational Inquiry 2 Credits
Exploration into the use of reflective practice and inquiry for professional development and school improvement. Development of group facilitation skills for collective inquiry. Reflection and inquiry will serve as the foundation for development of an action research project.

EDL 462 Transforming the Learner 2 Credits
Exploration of the integration of social, personal, cognitive, and knowledge-building dimensions to support learning and literacy. Focusing on the metacognitive conversations with self and others essential for developing learning and leadership.

EDL 463 Designing Systems of Action 3 Credits
Implementation of action research project. Building understanding of how the project impacts and is influenced by school and community systems. Explores the application of learning theory as related to leadership. Continued development of leadership concept and tools.

EDL 464 Sustaining Learning Communities 2 Credits
Completion of action research. Design and facilitation of a symposium of inquiry results. Review the behaviors of leadership that sustain learning in the classroom, school, and community.

EDL 467 Supervision and Professional Development 3 Credits
Emphasis on establishing skills in human resource management and supervision, including staff selection, supervision models, assessment and feedback methods, managing a diverse workforce, and adult development related to professional growth options. This course is designed specifically for individuals enrolled in a supervisory certification program.

EDL 468 Applied Learning Theory for School Leadership 3 Credits
Overview of the foundations, principles, and theories of curriculum, teaching, and learning. Emphasis on historical perspectives, teaching and learning for understanding, and schools as professional organizations. The purpose is to provide prospective administrators with the background for developing a balanced and challenging school-wide curriculum, for supervising instruction, and for supporting school improvement.

EDL 470 Special Topics in Educational Leadership 1-3 Credits
Intensive study and discussion of a specialized area. Title will vary. Repeat Status: Course may be repeated.
EDL 476 School Resources Management 3 Credits
Theoretical and practical foundation in school resource allocation. Trends in revenue and expenditures, staffing, and operations are explored. The economics of education and school business administration are discussed in terms of the policies they affect and create.

EDL 477 Seminar in School-Community Relations 3 Credits
Analysis and development of the communication and public relations skills needed by educators in dealing with the public.

EDL 479 School Law and Ethics 3 Credits
Examination of legal and ethical issues in effective leadership in the public schools, including awareness, analysis and applications of judicial interpretations of the constitutions, statutes, regulations, and common law relating to educational issues.

EDL 481 Policy and Politics in Public Education 3 Credits
Analysis of the forces, factors, agencies, formal governmental systems and informal subsystems that influence educational policy in local districts and state and national governments.

EDL 482 Practicum in University Teaching: Educational Leadership 1-4 Credits
Mentored and guided co-teaching focused on the design, organization, pedagogy and assessment of university courses in Educational Leadership. Students in this course will work with a faculty member to apply best practices in university teaching with feedback while co-teaching students in a course in the College of Education. Students taking the course must meet the college standards for participation and be approved by the program director and department chair.

Repeat Status: Course may be repeated.

EDL 485 The Superintendency 3 Credits
A theoretical and historical examination of superintendents’ leadership, school board/superintendent relations, and the array of duties and demands upon the superintendency.

EDL 488 Program Evaluation 3 Credits
The historical background, theory, methodology, and current practices of program evaluation in the human services area. Emphasis on conducting evaluations of educational programs and gathering data to make effective program decisions. Participants are required to design a program evaluation research plan.

EDL 489 Doctoral Seminar in School Administration 3 Credits
Analysis of the theoretical, empirical, and conceptual aspects of contemporary issues in educational administration and their implications for policy formulation and implementation in educational institutions. Must have official standing as a doctoral student in educational leadership.

EDL 499 Dissertation 1-15 Credits

School Psychology

The School Psychology Program offers two degree programs: An Educational Specialist (Ed.S.) degree and a doctoral degree (Ph.D.). Certification as a school psychologist in the state of Pennsylvania is associated with both degree programs.

Both degree programs are approved by the National Association of School Psychologists (NASP), while the Ph.D. program is additionally accredited by the American Psychological Association (APA). The Pennsylvania Department of Education has approved our program’s certification in school psychology.

Graduates of the Ed.S. program are prepared to serve as school psychologists in school districts. Graduates of the Ph.D. program have a broader range of employment options, including practitioner positions in school district, clinical, and hospital settings, as well as positions as researchers and professors in academic settings.

Fundamental to the School Psychology program is a commitment to a scientist-practitioner model. Students in our degree programs complete coursework and field-based experiences that prepare them to apply critical skills for delivering evidenced-based practices to children and youth. Moreover, our programs operate from an ecological perspective.

Students are well prepared to address the contextual influences on children’s educational achievement and health.

The School Psychology program continues to develop concentrated training opportunities, including coursework and practicum, in unique areas consistent with faculty expertise. For example, in the Ed.S. program, students have had the opportunity to seek specialized training in facilitating inclusion for students with autism and leading Response-to-Intervention initiatives. The Ph.D. program is distinguished by offering concentrations in School-Based Prevention and Pediatric School Psychology, currently.

For additional information about the School Psychology program, please visit:
http://coe.lehigh.edu/academics/disciplines/sp

Questions regarding APA Accreditation may be addressed to the APA Office of Accreditation at:
Office of Program Consultation and Accreditation
750 First St, NE, Washington, DC 20002-4242
Telephone: (202) 336-5979
TDD/TTY: (202) 336-6123
Fax: (202) 336-5978
Email (apaaccred@apa.org) (General Questions) (apaaccred@apa.org)
Email (aro@apa.org) (Annual Report Online only)

Professors. Christine L. Cole, PHD (University Wisconsin-Madison); George J. DuPaul, PHD (University of Rhode Island); Patricia H. Manz, PHD (University of Pennsylvania)

Associate Professors. Bridget V. Dever, PHD (University of Michigan); Robin L. Hojnoski, PHD (University of Massachusetts Amherst)

Assistant Professor. Ethan R. Van Norman, PHD (University of Minnesota Twin Cities)

Emeritus. Christine Novak, PHD (University of Iowa)

Doctor of Philosophy in School Psychology

DOCTORAL CORE (3 HOURS)
SCHP 496 Doctoral Seminar in School Psychology 3
or SPED 490 Doctoral Seminar in Special Education

PSYCHOLOGICAL FOUNDATION CORE COURSES (18 HOURS)
EDUC 402 Developmental Psychology 3
EDUC 451 Applied Principles of Cognitive Psychology 3
PSYC 404 Behavioral Neuroscience 3
EDUC 473 Social Basis of Human Behavior 3
SCHP 429 Special Topics in School Psychology 1-3
SCHP 484 History and Systems of Psychology 3

RESEARCH CORE (24 HOURS) Required Courses
EDUC 410 Univariate Statistical Models 3
EDUC 411 Multivariate Statistical Models 3
EDUC 461 Single-Subject Research Design 3
SCHP 406 Research Methods and Design 3
SCHP 408 Dissertation Proposal Seminar 3
EDUC 491 Advanced Seminars: (with subtitle) 1-6
EDUC 412 Advanced Applications of Psychometric Principles 3
EDUC 486 Doctoral Qualifying Research Project 1-3
Electives:
EDUC 409 Analysis of Experimental Data 3
CPSY 460 Foundations of Counseling Psychology 3
EDUC 495 Independent Study: (with subtitle) 1-6
SCHP 434 Applied Research Practicum 1-3

PROFESSIONAL SCHOOL PSYCHOLOGY CORE (39 HOURS):
EDL 400 Organizational Leadership and Change Management 3
SCHP 402 Applied Behavior Analysis 3
In this program, students have the opportunity to choose one of the two options for developing specialized expertise. These two core options are: 1) School-Based Prevention subspecialization (additional 18 hours, total of 99), 2) Pediatric/Health subspecialization (additional 18 hours, total of 99). DISSERTATION HOURS as necessary - minimum of 2

SCHP 404 Historical and Contemporary Issues in School Psychology 3
SCHP 407 Crisis Management in the Schools 3
SCHP 412 Consultation Procedures 2
SCHP 422 Assessment of Intelligence 3
SCHP 423 Behavioral Assessment 3
SCHP 425 Assessment and Intervention in Educational Consultation 3
SCHP 426 Advanced School and Family Interventions 3
SCHP 431 Practicum in Consultation Procedures 1-3
SCHP 432 Practicum in Assessment of Intelligence 1-3
SCHP 433 Practicum in Behavioral Assessment 1-3
SCHP 435 Practicum in Assessment & Intervention in Educational Consultation 1-3
SCHP 437 Advanced Child Psychopathology 3
SCHP 442 Doctoral Practicum in School Psychology 1-6
SCHP 436 Specialized Practicum in School Psychology 1-3
SCHP 444 Doctoral Internship 1-6

In this program, students have the opportunity to choose one of the two options for developing specialized expertise. These two core options are: 1) School-Based Prevention subspecialization (additional 18 hours, total of 99), 2) Pediatric/Health subspecialization (additional 18 hours, total of 99). DISSERTATION HOURS as necessary - minimum of 2

SCHP 404 Historical and Contemporary Issues in School Psychology 3
SCHP 407 Crisis Management in the Schools 3
SCHP 412 Consultation Procedures 2
SCHP 422 Assessment of Intelligence 3
SCHP 423 Behavioral Assessment 3
SCHP 425 Assessment and Intervention in Educational Consultation 3
SCHP 426 Advanced School and Family Interventions 3
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SCHP 433 Practicum in Behavioral Assessment 1-3
SCHP 435 Practicum in Assessment & Intervention in Educational Consultation 1-3
SCHP 437 Advanced Child Psychopathology 3
SCHP 442 Doctoral Practicum in School Psychology 1-6
SCHP 436 Specialized Practicum in School Psychology 1-3
SCHP 444 Doctoral Internship 1-6

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SCHP 442 Doctoral Practicum in School Psychology 1-6
SCHP 436 Specialized Practicum in School Psychology 1-3
SCHP 444 Doctoral Internship 1-6

Courses
SCHP 402 (SPED 402) Applied Behavior Analysis 3 Credits
Theory and application of behavior modification methods in classroom and clinical settings. Topics include behavior analysis, outcome research, task utilization, and single case research.

SCHP 404 Historical and Contemporary Issues in School Psychology 3 Credits
History of psychology, education, and school psychology. Roles and function of school psychologist; legal and ethical aspects of school psychology.

SCHP 406 Research Methods and Design 3 Credits
This course is designed to provide skills in the use and application of research methodologies and in the conceptualizing and writing of research proposals. Specifically, the course is focused on developing conceptual knowledge of specific research methods, interpreting data using specific methods of analysis, and developing independent research skills focused around one’s own research project. The course is primarily designed for doctoral students in School Psychology and Special Education. Permission of instructor is required.

SCHP 407 (CPSY 407) Crisis Management in the Schools 3 Credits
This course is designed to provide students with knowledge and skills related to crisis preparedness and intervention in the schools. Relevant theories and research literature will be explored as well as practical elements of crisis response that are applicable to all school systems. In addition, intervention strategies and protocols will be examined and discussed. Permission of instructor is required.
SCHP 408 Dissertation Proposal Seminar 3 Credits
The primary purpose of this course is to guide students in their independent research endeavors. Students will learn about the complexities of planning and initiating independent research, focusing on the writing process, methodological issues, and the management of time and data. Knowledge and competencies obtained in this seminar will be applied as students prepare their dissertation proposals.

SCHP 412 Consultation Procedures 3 Credits
Observational methodology utilized in consultation; rationale, theory and methods of consultation; individual, group and parent consulting. Study of research on the consultation process.

SCHP 418 Children in Context: Family, School, and Community 3 Credits
This course provides an advanced, theoretical basis for understanding various contextual influences on children's health, development, and learning. Fundamental to the course is application of ecological systems theory. A specific objective of this course is to develop students' cultural competence for implementing psychological and educational services to children of all ages and backgrounds.

SCHP 422 Assessment of Intelligence 3 Credits
Administration and interpretation of individual tests of intelligence used in school evaluation and preparation of psychological reports. Consent of instructor required.

SCHP 423 Behavioral Assessment 3 Credits
Techniques of behavioral assessment including direct observation, interviews, checklists, rating scales, self-monitoring and role-play tests. Consent of instructor required.

SCHP 425 Assessment and Intervention in Educational Consultation 3 Credits
Collection and use of data in designing classroom interventions. Curriculum based assessment, direct behavioral assessment, and structured interviews, and the interrelationship with diagnoses are emphasized within the behavioral consultation model. Utilization of data from actual case studies.

SCHP 426 Advanced School and Family Interventions 3 Credits
Overview of school-based and family-based intervention strategies for children and adolescents presenting interpersonal, emotional, developmental or behavioral challenges. Examples of topics covered include crisis intervention, peer-mediated interventions, self-management interventions, behavioral parent training, interventions for child abuse/neglect and computer-assisted instruction. Prerequisites: SCHP 402

SCHP 427 (CPSY 427) Assessment and Appraisal in Counseling 3 Credits
Principles of psychological measurement (e.g., tests construction, technology, validity, reliability, functional utility). Ethical, legal, and cultural issues in the administration and interpretation of psychological tests. Case conceptualization, reporting and presentation.

SCHP 429 Special Topics in School Psychology 1-3 Credits
Repeat Status: Course may be repeated.

SCHP 432 Practicum in Assessment of Intelligence 1-3 Credits
Supervised experience in the administration and interpretation of intelligence test.

SCHP 433 Practicum in Behavioral Assessment 1-3 Credits
Supervised experience in conducting behavioral assessments in school settings.

SCHP 434 Applied Research Practicum 1-3 Credits
Designing and conducting research projects in applied settings.

SCHP 435 Practicum in Assessment & Intervention in Educational Consultation 1-3 Credits
Supervised experience in conducting curriculum-based assessments and designing intervention strategies for educational problems.

SCHP 436 Specialized Practicum in School Psychology 1-3 Credits
Supervised field experience in school psychology with a specific population or setting. Permission of instructor required. Repeat Status: Course may be repeated.

SCHP 437 Advanced Child Psychopathology 3 Credits
Advanced training in the definition, classification, etiology, long-term outcome, and treatment of children and adolescents with various psychopathological disorders. Emphasis is placed upon the assessment and treatment of child and adolescent psychopathology in school settings. Must have admission to doctoral program or consent of instructor.

SCHP 438 Health/Pediatric Psychology 3 Credits
Introduction to training in the definition, etiology and behavioral/academic characteristics of children and adolescents with medical disorders. Emphasis is placed on the assessment and treatment of educational and behavioral sequelae of medical disorders in both school and health settings. Must have admission to doctoral program in school psychology or consent of instructor.

SCHP 439 Comprehensive School Health Programs 3 Credits
Examination of school-wide programs designed to address health care needs of children and adolescents in school settings. Focus is on development of primary prevention and integration of educational, medical, social and community resources. Permission of instructor required.

SCHP 440 Applications of Pediatric School Psychology 3 Credits
Focus on further development of students' knowledge and application of pediatric school psychology. The etiology and developmental course of pediatric medical conditions will be examined, emphasizing the impact on school, family and community environments. Prerequisites: SCHP 438 or SCHP 439

SCHP 442 Doctoral Practicum in School Psychology 1-6 Credits
Field-based experience in providing psychological services in school and/or clinical settings. Must have admission to doctoral program. Repeat Status: Course may be repeated.

SCHP 443 Certification Internship 1-6 Credits
Full-time experience in clinical/educational settings. Student must complete a minimum of 1,200 clock hours under joint supervision of faculty and field supervisor. Repeat Status: Course may be repeated.

SCHP 444 Doctoral Internship 1-6 Credits
Full-time experience in clinical/educational settings. Student must complete a minimum of 1,500 clock hours under joint supervision of faculty and field supervisor. Repeat Status: Course may be repeated.

SCHP 473 (CPSY 473) Advanced Research Methods in Applied Psychology 3 Credits
For doctoral students in applied psychology. Issues and methods of research design, data collection and data analysis. Advanced discussion of quantitative, qualitative and single-case research design. Admission to the Ph.D. program in counseling psychology or school psychology or permission of the instructor.

SCHP 482 Practicum in University Teaching: School Psychology 1-4 Credits
Mentored and guided co-teaching focused on the design, organization, pedagogy and assessment of university courses in School Psychology. Students in this course will work with a faculty member to apply best practices in university teaching with feedback while co-teaching students in a course in the College of Education. Students taking the course must meet the college standards for participation and be approved by the program director and department chair. May be repeated for credit. Repeat Status: Course may be repeated.

SCHP 484 (CPSY 484) History and Systems of Psychology 3 Credits
This doctoral level course is designed as an overview of the history of psychology in the Western world. The historical approaches to this task will include a historical developmental approach to the origins and changes of ideas over time, the study of great persons and schools of thought, and a look at the Zeitgeist of each. This course will examine the nature of psychology as a whole, and the influence of philosophical worldviews in areas such as epistemology, ontology, teleology, and axiology. Part of this study regards the nature of science, and its power and limitations as applied to the understanding of human beings.
The Special Education program offers two degrees, a Master's Degree in Education in Special Education (M.Ed.) and a Doctor of Philosophy Degree in Special Education (Ph.D.). Students have options within the master's degree program to pursue Pennsylvania state teacher certification. All teacher certification programs are fully accredited by the Pennsylvania Department of Education. These options include:

- Dual certification in special education PreK-8 and PreK-4,
- Dual certification in special education 7-12 and secondary education 7-12,
- Certification in elementary/middle level special education PreK-8, and
- Certification in secondary special education 7-12.

The special education program also offers options for Pennsylvania state teacher certification in special education without earning a master's degree.

For individuals already certified, students may enroll in a post-certification Master's in Special Education degree program to build upon their professional expertise. Students may pursue course work focused on intensive academic/behavioral interventions, low incidence disabilities or work toward the Board Certification Behavioral Analyst (BCBA) Examination within the post-certification master's degree program.

Students who complete the master's degree and/or certification programs are fully qualified to teach special education in school settings within the grade band of their certification. Teacher graduates may assume a variety of roles as teachers in self-contained classrooms, co-teachers in inclusive classrooms, itinerant support or consultants, and transition coordinators. Some graduates choose to work in community settings, providing behavioral support or services to non-school age individuals with disabilities.

Students who complete the Ph.D. program are fully prepared to conduct research and teach in college or university settings. Alternatively, some graduates assume leadership positions, directing school, district, or state-level programs or participating in state or national educational policy or teacher training initiatives.

The Special Education program emphasizes the use and development of evidence-based and other innovative practices that make meaningful differences in the lives of individuals with disabilities. Working collaboratively the Teaching, Learning, and Technology program, our master's students learn a variety of effective practices to prevent disabilities and to support students with disabilities in inclusive settings. Students are also trained in intensive academic and behavioral interventions. The Ph.D. program is individualized and emphasizes the development of professional competencies in research, teacher training, and dissemination. Two unique features of our program are our small Ph.D. cohorts, which allow for personalized faculty-student mentoring, and cross-collaboration with other programs within the college (for example, School Psychology; Educational Leadership; and Teaching, Learning and Technology).

Special Education faculty members are continuously immersed in research and service projects that bring nationally recognized innovations to schools and community settings that support individuals with disabilities. Students may have the opportunity to work with faculty on projects supported by competitive university, state, foundation and federal grants and contracts. Recent projects/programs include:

- Developing comprehensive intervention packages for high school students with emotional and behavioral problems,
- Evaluating the effectiveness of Tier 2 and Tier 3 math interventions for primary grade students,
- Providing behavioral and academic interventions for young children with or at risk for disabilities in preschool classrooms,
- Evaluating peer-mediated interventions to improve the social-communication skills of high school students with autism, and
- Demonstrating an individualized transition program of support for adolescents with intensive learning and behavioral needs.

For additional information about the program, please visit: http://coe.lehigh.edu/academics/disciplines/sped

**Professors.** Linda M. Bambara, EDD (Vanderbilt University); Lee Kern, PHD (University of South Florida)

**Associate Professor.** Minyi Shih Dennis, PHD (University of Texas at Austin)

**Assistant Professors.** Ana D Duenas, PHD (Michigan State University); Esther Lindström, PHD (Vanderbilt University); Kristi Morin, PHD (Texas A&M University)

**Professor Of Practice.** Noor Syed, PHD (Columbia University)

Lehigh undergraduates may enroll in either of the College of Education's 5-year teacher certification areas: Elementary Education (grade levels PreK through 4) and Secondary Education (grade levels 7 through 12). A Minor in Education is offered through the College of Arts and Sciences. For information on the 5-year programs, see below. For information on the Education Minor, see the College of Arts and Sciences 'Minor Programs in the College'.

**5-YEAR MASTER OF EDUCATION IN ELEMENTARY EDUCATION AND PREK-4 TEACHER CERTIFICATION**

The College of Education offers a five-year degree program that is designed to allow students to earn both a bachelor’s degree and a master’s degree in five years instead of the traditional six. The combined degree program leads to either a B.A. or B.S. degree in an academic discipline from the College of Arts and Sciences, the P.C. Rossin College of Engineering and Applied Sciences, or the College of Business, and an M.Ed. degree in Elementary Education. In addition, students also earn eligibility for an Instructional I teaching certificate from the Pennsylvania Department of Education (PDE) in grades PreK-4.

**PROGRAM OF STUDY FOR PREK-4 CERTIFICATION:**
B.A. or B.S. plus Master of Education (M.Ed.) in Elementary Education and PA Certification eligibility. This 42-credit (minimum) master’s program prepares students for certification as PreK-4 teachers. Students complete coursework in three categories:

**Core Course Work (21 credit hours)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPED 332</td>
<td>Education and Inclusion of Individuals with Special Needs in K-12</td>
<td>3</td>
</tr>
<tr>
<td>TLT 380</td>
<td>Child Development and Cognition</td>
<td>3</td>
</tr>
<tr>
<td>TLT 404</td>
<td>Diversity, Families, and School Collaborations in K-12</td>
<td>3</td>
</tr>
<tr>
<td>TLT 405</td>
<td>Principles and Applications of K-12 Assessment</td>
<td>3</td>
</tr>
<tr>
<td>TLT 407</td>
<td>Instructional Design for K-12 Classrooms</td>
<td>3</td>
</tr>
<tr>
<td>TLT 409</td>
<td>K-12 Classroom Environment and Management</td>
<td>3</td>
</tr>
<tr>
<td>TLT 411</td>
<td>Early Childhood Education</td>
<td>3</td>
</tr>
</tbody>
</table>

**Development of Professional Skills (18 credit hours)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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</tr>
</thead>
<tbody>
<tr>
<td>TLT 412</td>
<td>Social Studies in PreK through 4th Grade</td>
<td>3</td>
</tr>
<tr>
<td>TLT 420</td>
<td>Literacy in PreK through 4th Grade: Reading and Its Foundations</td>
<td>3</td>
</tr>
<tr>
<td>TLT 422</td>
<td>Literacy in PreK through 4th Grade: Writing and Its Foundations</td>
<td>3</td>
</tr>
<tr>
<td>TLT 426</td>
<td>Science in PreK through 4th Grade</td>
<td>3</td>
</tr>
<tr>
<td>TLT 428</td>
<td>Mathematics and Numeracy in PreK through 4th Grade</td>
<td>3</td>
</tr>
</tbody>
</table>
Students complete coursework in three categories: content-area competence (see below).

The requirements for the bachelor's degree, students must satisfy the Pennsylvania teacher certification eligibility. In addition to meeting the B.A. or B.S. plus Master of Education (M.Ed., 33 credits minimum)

PROGRAM OF STUDY:

Students in the 5-year program will take 18 credits pre-bachelor's and an additional 27 credits post-bachelor's. However, the University requires that master's degrees carry at least 30 credits minimum. This means students in the 5-year program must have at least 3 credits "left over" from their bachelor's program to move across to the College of Education to put toward their master's degree.

5-YEAR MASTER OF EDUCATION IN SECONDARY EDUCATION AND 7-12 TEACHER CERTIFICATION

The College of Education offers a five-year degree program that is designed to allow students to earn both a bachelor's degree and a master's degree in five years instead of the traditional six.

The combined degree program leads to (1) a B.A./B.S. degree in an academic discipline from the College of Arts and Sciences, the P.C. Rossin College of Engineering and Applied Sciences, or the College of Business, and (2) an M.Ed. degree in Secondary Education. In addition, students also earn eligibility for Instructional I teacher certification from the Pennsylvania Department of Education (PDE) in one of the 8 subject areas below:

- Biology 7-12
- Chemistry 7-12
- Earth and Space Science 7-12
- English 7-12
- General Science 7-12
- Mathematics 7-12
- Physics 7-12
- Social Studies 7-12

PROGRAM OF STUDY:

B.A. or B.S. plus Master of Education (M.Ed., 33 credits minimum) and Pennsylvania teacher certification eligibility. In addition to meeting the requirements for the bachelor's degree, students must satisfy the Pennsylvania Department of Education guidelines for demonstrated content-area competence (see below).

Students complete coursework in three categories:

Core Coursework (15 credits)

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>SPED 332</td>
<td>Education Inclusion of Individuals with Special Needs in K-12</td>
<td>3</td>
</tr>
<tr>
<td>TLT 404</td>
<td>Diversity, Families, and School Collaborations in K-12</td>
<td>3</td>
</tr>
<tr>
<td>TLT 405</td>
<td>Principles and Applications of K-12 Assessment</td>
<td>3</td>
</tr>
<tr>
<td>TLT 407</td>
<td>Instructional Design for K-12 Classrooms</td>
<td>3</td>
</tr>
</tbody>
</table>

Extended Field Experience (3-6 credit hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLT 444</td>
<td>General Education Student Teaching and Seminar</td>
<td>1-6</td>
</tr>
</tbody>
</table>

In order to be eligible for PreK-4 certification, by the time a student finishes the program he or she must have demonstrated competence in the core content areas for that certification. At time of acceptance, each student will be informed of any additional content-area coursework he or she will be required to complete in order to demonstrate competence in the PreK-4 core content areas. The student is responsible for completing this coursework prior to applying for PreK-4 certification. The credits for this coursework are not included in the master's degree.

Distribution of coursework across undergraduate and graduate study:

Sophomore Year (3 credit hours)

Junior Year (3 credit hours)

Senior Year (12 credit hours)

College of Education - Summer (12 credits)

College of Education - Fall (9 credits)

College of Education - Spring (3-6 credits)

Students in this 5-year program will take 18 credits pre-bachelor's and an additional 27 credits post-bachelor's. However, the University requires that master's degrees carry at least 30 credits minimum. This means students in the 5-year program must have at least 3 credits "left over" from their bachelor's program to move across to the College of Education to put toward their master's degree.

In order to be eligible for secondary certification, by the time a student finishes the program he or she must have demonstrated competence in the subject matter area of that certification. Each student upon admission meets with the content-area specialist in the field in which that student seeks secondary certification. The content-area specialist, who is a faculty member in the College of Arts and Sciences, reviews the student's transcripts and compares that student's coursework with the content-area guide sheet approved by the Pennsylvania Department of Education (PDE). Following this audit, the content-area specialist will identify what additional coursework in the content-area is needed, if any. The student is responsible for completing this coursework prior to applying for secondary certification. The credits for this course work are not included in the M.Ed. degree.

Students in the secondary teacher-preparation program are expected to have completed almost all their content area coursework prior to going out to student teach. This is important because student teachers need to have mastery of their content in order to fulfill their responsibilities to their students and to derive maximum benefit from the student teaching experience.

Distribution of coursework across undergraduate and graduate study:

Sophomore Year (3 credit hours)

Junior Year (6 credit hours)

Senior Year (6 credit hours)

College of Education - Summer (6 credits)

College of Education - Fall (9 credits)

College of Education - Spring (3-6 credits)

Students in this program unable to accrue enough credits outside their undergraduate degree programs may need to take additional credits after beginning graduate study in order to reach the 33-credit minimum.

Students in this program who wish to obtain the Master of Arts (M.A.) degree rather than the M.Ed. degree may petition to change to that degree after admission to graduate study. The M.A. degree requires 42 credits instead of 33 credits and has specific content-area expertise requirements. See the M.A. degree description for its requirements.

Development of Professional Skills (12 credits)

Content-area teaching methods course with approval of adviser (one of the following):

<table>
<thead>
<tr>
<th>Course</th>
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<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLT 431</td>
<td>Social Studies in Middle Level and High School Education</td>
<td>3</td>
</tr>
<tr>
<td>TLT 434</td>
<td>English in Middle Level and High School Education</td>
<td>3</td>
</tr>
<tr>
<td>TLT 436</td>
<td>Science in Middle Level and High School Education</td>
<td>3</td>
</tr>
<tr>
<td>TLT 438</td>
<td>Mathematics in Middle Level and High School Education</td>
<td>3</td>
</tr>
</tbody>
</table>

Extended Field Experiences (6-9 credits)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLT 440</td>
<td>Pre-professional Seminar</td>
<td>3</td>
</tr>
<tr>
<td>TLT 444</td>
<td>General Education Student Teaching and Seminar</td>
<td>1-6</td>
</tr>
</tbody>
</table>

In order to be eligible for secondary certification, by the time a student finishes the program he or she must have demonstrated competence in the subject matter area of that certification. Each student upon admission meets with the content-area specialist in the field in which that student seeks secondary certification. The content-area specialist, who is a faculty member in the College of Arts and Sciences, reviews the student's transcripts and compares that student's coursework with the content-area guide sheet approved by the Pennsylvania Department of Education (PDE). Following this audit, the content-area specialist will identify what additional coursework in the content-area is needed, if any. The student is responsible for completing this coursework prior to applying for secondary certification. The credits for this course work are not included in the M.Ed. degree.

Students in the secondary teacher-preparation program are expected to have completed almost all their content area coursework prior to going out to student teach. This is important because student teachers need to have mastery of their content in order to fulfill their responsibilities to their students and to derive maximum benefit from the student teaching experience.

Distribution of coursework across undergraduate and graduate study:

Sophomore Year (3 credit hours)

Junior Year (6 credit hours)

Senior Year (6 credit hours)

College of Education - Summer (6 credits)

College of Education - Fall (9 credits)

College of Education - Spring (3-6 credits)

Students in this program unable to accrue enough credits outside their undergraduate degree programs may need to take additional credits after beginning graduate study in order to reach the 33-credit minimum.

Students in this program who wish to obtain the Master of Arts (M.A.) degree rather than the M.Ed. degree may petition to change to that degree after admission to graduate study. The M.A. degree requires 42 credits instead of 33 credits and has specific content-area expertise requirements. See the M.A. degree description for its requirements.

Doctor of Philosophy in Special Education

This 60 credit post-master's degree program is individualized and emphasizes applied research, faculty-student mentoring, and the development of professional competencies such as writing for publication, college teaching, grant writing, and program administration.
# Master of Education in Special Education

The Master of Education (M.Ed.) degree in Special Education is designed for the college graduate who holds instructional certification in special education and who is interested in pursuing advanced studies in the education of individuals with special needs. The mission of this special education master’s program is to enhance the skills of highly qualified special educators who are not only skilled practitioners, but also leaders in establishing effective teaching and learning environments for individuals with disabilities in their schools and communities.

## Core Course Work (15 credits)

<table>
<thead>
<tr>
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<tbody>
<tr>
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</tr>
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<td>SPED 401</td>
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</table>

## Area of Study (3 credits; must choose one of the following; courses not chosen here may be taken as Electives, below)

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</tr>
<tr>
<td>SPED 419</td>
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</table>

## Electives (12 credits; the one course chosen above under Area of Study may not also be counted toward fulfilling Electives credits)

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</table>

## Special Education Major Core (15 credits)

Choose from special education courses or independent studies in special interest areas with approval of adviser.

## Research Core (18 credits)

Required:

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>EDUC 410</td>
<td>Univariate Statistical Models</td>
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Other:

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<td>3</td>
</tr>
<tr>
<td>SCHP 473</td>
<td>Advanced Research Methods in Applied Psychology</td>
<td>1-3</td>
</tr>
<tr>
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</tr>
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Other courses with approval of adviser.

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</tbody>
</table>

## Apprenticeship (6 credits)

Supervised mentored experiences such as college teaching, student teaching supervision, writing for publication, participation in research projects, presentations at national conferences, grant writing, or educational leadership in schools and community.

## Doctoral Core (12 credits)

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<tbody>
<tr>
<td>SCHP 496</td>
<td>Doctoral Seminar in School Psychology</td>
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<tr>
<td>and/or</td>
<td></td>
<td></td>
</tr>
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<td>3</td>
</tr>
</tbody>
</table>

## Research Core (18 credits)

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</tr>
</tbody>
</table>

## Other electives as approved by adviser

The Behavior Analyst Certification Board, Inc.® has verified the following course sequence as meeting the coursework requirements for eligibility to take the Board Certified Behavior Analyst Examination®. Applicants will have to meet additional requirements to qualify (http://bacb.com/bcba-requirements/).

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<tbody>
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<td>K-12 Classroom Environment and Management</td>
<td>3</td>
</tr>
<tr>
<td>SPED 410</td>
<td>Behavior Analysts: Ethics and Professional Conduct</td>
<td>3</td>
</tr>
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<td>3</td>
</tr>
<tr>
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</tr>
<tr>
<td>SPED 430</td>
<td>Advanced Seminar in Special Education</td>
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</tr>
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<td>EDL 432</td>
<td>Special Education Law</td>
<td>3</td>
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<tr>
<td>EDL 479</td>
<td>School Law and Ethics</td>
<td>3</td>
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<tr>
<td>SCHP 412</td>
<td>Consultation Procedures</td>
<td>2</td>
</tr>
<tr>
<td>SCHP 426</td>
<td>Advanced School and Family Interventions</td>
<td>3</td>
</tr>
</tbody>
</table>

## Courses

### SPED 330 Special Topics in Special Education 1-3 Credits
Current issues in the education of individuals with special needs. Titles vary.

### Repeat Status: Course may be repeated.

### SPED 332 Education and Inclusion of Individuals with Special Needs in K-12 3 Credits
Overview of social, developmental, legal, and educational issues and practices related to the special education of individuals with disabilities. Covers social, environmental, and physiological etiology; development; identification; learning characteristics; and needs of individuals identified for special education. Emphasizes meeting diverse needs of students in general education classrooms through evidence-based practices and adaptations matched to learner needs. Addresses legal rights of students and their families, as well as legal responsibilities of teachers as required by IDEIA and other related special legislation.

### SPED 338 Emotional and Behavioral Disorders of Children 3 Credits
Definition, classification, etiology, treatment, and historical perspective of children and adolescent disorders.

### SPED 402 (SCHP 402) Applied Behavior Analysis 3 Credits
Theory and application of behavior modification methods in classroom and clinical settings. Topics include behavior analysis, outcome research, task utilization, and single case research.
SPED 404 (TLT 404) Diversity, Families, and School Collaborations in K-12 3 Credits
Cultural and linguistic diversity as critical variables in educational equity for all learners, including ELL. Explores home-school partnerships, family and professional collaboration, and teacher self-awareness. Implementing culturally sensitive and responsive classroom practices as well as forming collaborative relationships with families that respect diversity of family contexts. Collaborative, multidisciplinary teaming to support, optimize, and advocate for student’s educational needs and connect to community services and resources available to individuals and families. Addresses family mental health issues and wraparound services.

SPED 405 (TLT 405) Principles and Applications of K-12 Assessment 3 Credits
Assessment applied to learning in classroom learning environments, including universal screening and progress monitoring. Discusses assessment approaches, ways to implement assessment, and use of assessment tools to monitor all students, including ELL and students with disabilities. Use of data-management and grading systems. Addresses diagnostic assessments for student placement and analysis of assessment data to tailor instruction to diverse student needs. Emphasis on research-based practices and assessment data to tailor instruction to diverse student needs. Emphasis on research-based practices of assessment to inform instructional decision-making consistent with the RtII framework.

SPED 409 (TLT 409) K-12 Classroom Environment and Management 3 Credits
Designing inclusive classroom environments that maximize learning. Emphasis on fostering a community of learners using connections among classroom arrangement, classroom management, and cognitive development to create positive learning outcomes for all students, including ELL learners and students with disabilities. Addresses the tiered model of prevention and positive behavior support, including the role of functional assessment and individual positive behavior support plans in classroom management. Highlights the ways a positive climate for learning involves establishing and maintaining partnerships with families.

SPED 410 Behavior Analysts: Ethics and Professional Conduct 3 Credits
This course is designed to provide students an in-depth review of the BACB Professional and Ethics Compliance Code for Behavior Analysts and other relevant content and readings that further support student understanding of the topic area. Class discussions, review of case studies, and student-lead small group problem-solving activities will enable students to apply ethical and professional standards to their work, further promoting quality interactions between the children and adults they serve, families, teachers, and others stakeholders.

SPED 411 (TLT 411) Early Childhood Education 3 Credits
Introduction to development of early childhood education in the U.S. Emphasizes evidence-based methods and materials to assist young children in the learning process, including arrangement of indoor/ outdoor space, developmentally appropriate practices, and the design of instruction to foster young children’s emotional, social, language, cognitive, physical, and creative development. Includes embedded instruction and adaptations for students with identified disabilities, children at risk for developing disabilities, and children with culturally and linguistically diverse backgrounds, and family collaboration within the instructional planning process.

SPED 416 Autism Spectrum Disorders and Evidence-Based Practices 3 Credits
This course provides an overview of Autism Spectrum Disorders (ASD) and an introduction to the evidence-based practices (EBPs) for practitioners, based on recently published and publicly available reports and other supporting materials. Assignments help students translate EBPs, grounded in Applied Behavior Analysis (ABA), into concrete goals and practices that have a meaningful impact on the day-to-day functioning of students with ASD.

SPED 418 Alternative Curricular Approaches 3 Credits
Curricular and instructional methods for students with pervasive support needs (e.g., intellectual disabilities, autism) who follow an alternative or modified curriculum. Methods for developing an individualized curriculum, embedding instruction and accessing the general education curriculum, systematic instruction, and instruction for full participation in school, home, and community settings are covered. Strategies for facilitating emergent social and communication skills, teaching augmentative and alternative communication, and use of assistive technologies to enhance self-directed learning are included.

SPED 419 Academic Interventions: PreK-8 3 Credits
Methods course designed to address the needs of students with disabilities to increase knowledge of instruction of comprehensive pre-literacy and literacy skills and their components. Additionally, pre-reading, reading, language arts, mathematics, and content area reading literacy skills in primary and elementary settings will be addressed. Emphasis on instructional planning, differentiated instructional strategies, appropriate assessments modifications, and adaptations needed for use with individuals with disabilities through a conceptual foundation in the components of reading and the integration of research validated interventions.

SPED 420 Field Experience: Special Education Certification 1-3 Credits
Intensive practice in the application of principles of teaching in a supervised experience in the schools for students who already hold another content area certification (e.g., elementary, middle school, secondary). Consent of the program.

SPED 421 Academic Interventions: Secondary Level 3 Credits
Methods course designed to increase knowledge of core components of reading in secondary settings, language arts, mathematics, and content area literacy skills for students with disabilities and those who are culturally and/or linguistically diverse. Emphasis on instructional planning, differentiated instructional strategies, appropriate assessments, modifications, and adaptations needed for use with individuals with disabilities through a conceptual foundation in the components of reading and the integration of research validated interventions.

SPED 423 Transition to Post-school Life 3 Credits
Best instructional practices for preparing students for post-school adult life: employment, post-secondary education, and community participation in inclusive settings. Topics include transition planning, person-centered and work-based assessments, family and interagency collaboration, innovative post-school and inschool transition services, and self-determination. Evidence-based practices to promote positive student outcomes are emphasized.

SPED 425 Applied Behavior Analysis Practicum 1-6 Credits
This practicum is designed to shape supervisee’s clinical and behavioral skills as well as his/her professional, ethical, and collegial behavior. This experience embeds the concepts, principles, methods, and applications of behavior analysis learned in the course sequence and applies them to educational, clinical, and community/home settings.

Repeat Status: Course may be repeated.

SPED 427 Contemporary Service Delivery Models 3 Credits
This course is to provide students with knowledge and skills related to contemporary academic and behavioral service delivery models such as multi-tier systems of supports (MTSS). Relevant research literature will be explored to promote critical reflection on the models. Students will gain knowledge and skills in the following areas: (1) core components of service delivery models; (2) implementation of the services delivery model within k-12 schools; and (3) legal, ethical, and administrative issues related to service delivery implementation.

SPED 429 Professional Seminar 3 Credits
Master’s seminar on current issues in the area of special education and research design. Must have 18 graduate credits in special education.

SPED 430 Advanced Seminar in Special Education 3 Credits
Advanced issues relating to the field of special education. Titles will vary.

Repeat Status: Course may be repeated.
**SPED 432 Positive Behavior Support 3 Credits**
Design of comprehensive, multi-component behavior support plans for individuals with a variety of disabilities who engage in problem behavior. Topics include functional assessment, antecedent and setting event interventions, replacement behaviors, consequence and crisis procedures, lifestyle interventions, and teaming strategies. Assessment focuses on the link between curriculum, academic performance, and behavior problems. Promotes consideration of diverse populations for understanding behavioral differences. Describes strategies for ongoing monitoring and maintenance of behavior reductions.

**SPED 434 Applied Research Practicum 1-3 Credits**
Designing and conducting research projects in applied settings.

**SPED 440 Early Academic Intervention 3 Credits**
Explores the potential effectiveness of interventions to prevent academic failure of children at risk for educational and behavioral problems. Emphasis on research-based interventions in the areas of beginning reading, language and vocabulary, writing and spelling, awareness of print and exposure to print, and mathematics (number sense).

**SPED 442 (TLT 442) General Education and Special Education Student Teaching and Seminar 1-6 Credits**
Intensive practice in the application of principles of teaching for both general and special education settings in a supervised internship in the schools (for dual certification). Regular meetings among student teachers for critical analysis and discussion of classroom instructional practices, as illustrated by the student teachers' experiences in the schools. Practical mentoring on professionalism, applying differentiated instructional models in real-world setting, and aligning instruction with standards. Consent of program director required.

**SPED 452 Assessment in Special Education 3 Credits**
Identification, administration and interpretation of a variety of assessments used for planning and to determine special education eligibility and to assess social, emotional, behavioral, and academic functioning. Discusses strengths and limitations of various models and assessment, both formal and informal, instruments used to evaluate the need for special education. Describes strategies to enhance the relationship between assessment and service delivery. Addresses assessment practices to identify curricular needs consistent with the RtI framework.

**SPED 465 Advanced Inclusionary Practices in K-12 3 Credits**
Advanced techniques grounded in current research-based methods and best practice for educating and assessing students with disabilities, students from diverse backgrounds, and English language learners using a standards-aligned system. Accommodations, modifications, planning for physical and instructional inclusion through embedded strategic instruction, adaptations, and curriculum overlapping. Addresses decision hierarchies for level of instructional adaptation and social inclusion methods through social facilitation techniques. Explores critical factors in developing, implementing, and modifying curriculum using evidence-based practices. Explores collaborative co-planning and co-teaching models.

**Prerequisites:** SPED 332

**SPED 482 Practicum in University Teaching: Special Education 1-4 Credits**
Mentored and guided co-teaching focused on the design, organization, pedagogy and assessment of university courses in Special Education. Students in this course will work with a faculty member to apply best evidence-based practices. Explores collaborative co-planning and co-teaching focused on the design, organization, strategic instruction, adaptations, and curriculum overlapping. Addresses decision hierarchies for level of instructional adaptation and social inclusion methods through social facilitation techniques. Explores critical factors in developing, implementing, and modifying curriculum using evidence-based practices. Explores collaborative co-planning and co-teaching models.

**SPED 490 Doctoral Seminar in Special Education 3 Credits**
Advanced knowledge of issues and research in the education of individuals with special needs. Topics will vary. Must be admitted for doctoral studies.

**Repeat Status:** Course may be repeated.

**SPED 499 Dissertation 1-15 Credits**

**Repeat Status:** Course may be repeated.

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**Teacher Preparation: Elementary and Secondary Education**

The Teaching, Learning, and Technology (TLT) Program offers a 5-year program in which undergraduates are permitted to take selected courses while completing their undergraduate degrees in a content area.

Following graduation, in an additional year, these students complete the remaining coursework toward teacher certification and a master’s degree.

Lehigh undergraduates who did not participate in our 5-year program, as well as students who have graduated from other institutions with at least a bachelor’s degree, may also earn their teacher certification, either alone or as part of an appropriate master’s degree.

Students seeking initial teacher certification may earn a Master of Education in Elementary Education with PreK-4 Teacher Certification or a Master of Education (or a Master of Arts) in Secondary Education with Teacher Certification. Students wishing to earn dual certification in both general education and special education may earn their master’s degree and acquire such dual certification by completing additional courses in Special Education. If these students wish, they may also earn a second master’s degree. Applicable Special Education master’s degrees include the M.Ed. in Special Education at either the elementary level (PreK-8) or secondary level (7-12).

Courses toward initial teacher certification are taught by faculty from the Special Education program and the Teaching, Learning, and Technology program. Our preparation programs highlight research-based, inquiry-oriented, and technology-enabled strategies to reach all learners. We emphasize collaborative and equitable approaches to instruction and learning.

Lehigh’s College of Education is accredited by the Pennsylvania Department of Education (PDE) to offer 11 teacher certifications:

- Elementary Education (PreK-4);
- Eight Secondary (7th-12th) grade certifications: Biology, Chemistry, Earth and Space Science, General Science, Physics, English, Mathematics, and Social Studies, and
- Two additional Special Education certifications: Elementary (PreK-8) and Secondary (7-12). Students may acquire special education dual certification either at the same time as they earn one of the general education certifications above or after they have earned that certification.

Pennsylvania has reciprocal agreements with 47 other states and the District of Columbia; individuals holding teacher certification in Pennsylvania may receive equivalent certification in one of those states. The College of Education also has relationships with international schools all over the world, enabling new teacher graduates to pursue teaching opportunities abroad.

For additional information about the program, please visit: [http://coe.lehigh.edu/academics/disciplines/teachered](http://coe.lehigh.edu/academics/disciplines/teachered)

**Professors.** Linda M. Bambara, EDD (Vanderbilt University); Alec M. Bodzin, PHD (North Carolina State University); Lee Kern, PHD (University of South Florida)

**Associate Professors.** Helen Lynn Columba-Piervello, EDD (University of Louisville); Minyi Shih Dennis, PHD (University of Texas at Austin); Thomas Chalmers Hammond, PHD (University of Virginia); Brook Sawyer, PHD (University of Virginia)

**Assistant Professors.** Ana D Duenas, PHD (Michigan State University); Sara Kangas, PHD (Temple University); Esther Lindstrøm, PHD (Vanderbilt University); Kristi Morin, PHD (Texas A&M University)

**Professors Of Practice.** Noor Syed, PHD (Columbia University); Farah L. Vailla, PHD (Lehigh University)

**Emeriti.** Ward M. Cates, EDD (Duke University); Scott Roy Garrigan, EDD (Lehigh University); Warren R. Heydenberk, PHD (University of Northern Colorado)

Lehigh undergraduates may enroll in either of the College of Education’s 5-year teacher certification areas: Elementary Education (grade levels preK through 4) and Secondary Education (grade levels 7 through 12). A Minor in Education is offered through the College of Arts and Sciences.
For information on the 5-year programs, see below. For information on the Education Minor, see the College of Arts and Sciences’ Minor Programs in the College.

5-YEAR MASTER OF EDUCATION IN ELEMENTARY EDUCATION AND PREK-4 TEACHER CERTIFICATION

The College of Education offers a five-year degree program that is designed to allow students to earn both a bachelor’s degree and a master’s degree in five years instead of the traditional six. The combined degree program leads to either a B.A. or B.S. degree in an academic discipline from the College of Arts and Sciences, the P.C. Rossin College of Engineering and Applied Sciences, or the College of Business, and an M.Ed. degree in Elementary Education. In addition, students also earn eligibility for an Instructional I teaching certificate from the Pennsylvania Department of Education (PDE) in grades PreK-4.

PROGRAM OF STUDY FOR PREK-4 CERTIFICATION:

B.A. or B.S. plus Master of Education (M.Ed.) in Elementary Education and PA Certification eligibility. This 42-credit (minimum) master’s program prepares students for certification as PreK-4 teachers. Students complete coursework in three categories:

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<td>3</td>
</tr>
<tr>
<td>TLT 380</td>
<td>Child Development and Cognition</td>
<td>3</td>
</tr>
<tr>
<td>TLT 404</td>
<td>Diversity, Families, and School Collaborations in K-12</td>
<td>3</td>
</tr>
<tr>
<td>TLT 405</td>
<td>Principles and Applications of K-12 Assessment</td>
<td>3</td>
</tr>
<tr>
<td>TLT 407</td>
<td>Instructional Design for K-12 Classrooms</td>
<td>3</td>
</tr>
<tr>
<td>TLT 409</td>
<td>K-12 Classroom Environment and Management</td>
<td>3</td>
</tr>
<tr>
<td>TLT 411</td>
<td>Early Childhood Education</td>
<td>3</td>
</tr>
</tbody>
</table>

### Development of Professional Skills (18 credit hours)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLT 412</td>
<td>Social Studies in PreK through 4th Grade</td>
<td>3</td>
</tr>
<tr>
<td>TLT 420</td>
<td>Literacy in PreK through 4th Grade: Reading and Its Foundations</td>
<td>3</td>
</tr>
<tr>
<td>TLT 422</td>
<td>Literacy in PreK through 4th Grade: Writing and Its Foundations</td>
<td>3</td>
</tr>
<tr>
<td>TLT 426</td>
<td>Science in PreK through 4th Grade</td>
<td>3</td>
</tr>
<tr>
<td>TLT 428</td>
<td>Mathematics and Numeralcy in PreK through 4th Grade</td>
<td>3</td>
</tr>
<tr>
<td>SPED 465</td>
<td>Advanced Inclusionary Practices in K-12</td>
<td>3</td>
</tr>
</tbody>
</table>

### Extended Field Experience (3-6 credit hours)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLT 444</td>
<td>General Education Student Teaching and Seminar</td>
<td>1-6</td>
</tr>
</tbody>
</table>

In order to be eligible for PreK-4 certification, by the time a student finishes the program he or she must have demonstrated competence in the core content areas for that certification. At time of acceptance, each student will be informed of any additional content-area coursework he or she will be required to complete in order to demonstrate competence in the PreK-4 core content areas. The student is responsible for completing this coursework prior to applying for PreK-4 certification. The credits for this coursework are not included in the master’s degree.

Distribution of coursework across undergraduate and graduate study: Sophomore Year (3 credit hours)

Junior Year (3 credit hours)

Senior Year (12 credit hours)

College of Education - Summer (12 credits)

College of Education - Fall (9 credits)

College of Education - Spring (3-6 credits)

Students in the 5-year program will take 18 credits pre-bachelor’s and an additional 27 credits post-bachelor’s. However, the University requires that master’s degrees carry at least 30 credits minimum. This means students in the 5-year program must have at least 3 credits “left over” from their bachelor’s program to move across to the College of Education to put toward their master’s degree.

5-YEAR MASTER OF EDUCATION IN SECONDARY EDUCATION AND 7-12 TEACHER CERTIFICATION

The College of Education offers a five-year degree program that is designed to allow students to earn both a bachelor’s degree and a master’s degree in five years instead of the traditional six.

The combined degree program leads to (1) a B.A./B.S. degree in an academic discipline from the College of Arts and Sciences, the P.C. Rossin College of Engineering and Applied Sciences, or the College of Business, and (2) an M.Ed. degree in Secondary Education. In addition, students also earn eligibility for Instructional I teacher certification from the Pennsylvania Department of Education (PDE) in one of the 8 subject areas below:

- Biology 7-12
- Chemistry 7-12
- Earth and Space Science 7-12
- English 7-12
- General Science 7-12
- Mathematics 7-12
- Physics 7-12
- Social Studies 7-12

PROGRAM OF STUDY:

B.A. or B.S. plus Master of Education (M.Ed., 33 credits minimum) and Pennsylvania teacher certification eligibility. In addition to meeting the requirements for the bachelor’s degree, students must satisfy the Pennsylvania Department of Education guidelines for demonstrated content-area competence (see below).

Students complete coursework in three categories:

### Core Coursework (15 credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPED 332</td>
<td>Education and Inclusion of Individuals with Special Needs in K-12</td>
<td>3</td>
</tr>
<tr>
<td>TLT 404</td>
<td>Diversity, Families, and School Collaborations in K-12</td>
<td>3</td>
</tr>
<tr>
<td>TLT 405</td>
<td>Principles and Applications of K-12 Assessment</td>
<td>3</td>
</tr>
<tr>
<td>TLT 407</td>
<td>Instructional Design for K-12 Classrooms</td>
<td>3</td>
</tr>
<tr>
<td>TLT 409</td>
<td>K-12 Classroom Environment and Management</td>
<td>3</td>
</tr>
<tr>
<td>TLT 411</td>
<td>Early Childhood Education</td>
<td>3</td>
</tr>
</tbody>
</table>

### Development of Professional Skills (12 credits)

Content-area teaching methods course with approval of adviser (one of the following):

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLT 431</td>
<td>Social Studies in Middle Level and High School Education</td>
<td>3</td>
</tr>
<tr>
<td>TLT 434</td>
<td>English in Middle Level and High School Education</td>
<td>3</td>
</tr>
<tr>
<td>TLT 436</td>
<td>Science in Middle Level and High School Education</td>
<td>3</td>
</tr>
<tr>
<td>TLT 438</td>
<td>Mathematics in Middle Level and High School Education</td>
<td>3</td>
</tr>
</tbody>
</table>

Plus:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLT 432</td>
<td>Reading and Critical Thinking in Middle Level and High School Education</td>
<td>3</td>
</tr>
<tr>
<td>SPED 465</td>
<td>Advanced Inclusionary Practices in K-12</td>
<td>3</td>
</tr>
</tbody>
</table>

### Extended Field Experiences (6-9 credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLT 440</td>
<td>Pre-professional Seminar</td>
<td>3</td>
</tr>
<tr>
<td>TLT 444</td>
<td>General Education Student Teaching and Seminar</td>
<td>1-6</td>
</tr>
</tbody>
</table>
In order to be eligible for secondary certification, by the time a student finishes the program he or she must have demonstrated competence in the subject matter area of that certification. Each student upon admission meets with the content-area specialist in the field in which that student seeks secondary certification. The content-area specialist, who is a faculty member in the College of Arts and Sciences, reviews the student’s transcripts and compares that student’s coursework with the content-area guide sheet approved by the Pennsylvania Department of Education (PDE). Following this audit, the content-area specialist will identify what additional coursework in the content-area is needed, if any. The student is responsible for completing this coursework prior to applying for secondary certification. The credits for this course work are not included in the M.Ed. degree.

Students in the secondary teacher-preparation program are expected to have completed almost all their content area coursework prior to going out to student teach. This is important because student teachers need to have mastery of their content in order to fulfill their responsibilities to their students and to derive maximum benefit from the student teaching experience.

Distribution of coursework across undergraduate and graduate study:
Sophomore Year (3 credit hours)
Senior Year (6 credit hours)
College of Education - Fall (9 credits)
College of Education - Spring (3-6 credits)

Students in this program unable to accrue enough credits outside their undergraduate degree programs may need to take additional credits after beginning graduate study in order to reach the 33-credit minimum.

Students in this program who wish to obtain the Master of Arts (M.A.) degree rather than the M.Ed. degree may petition to change to that degree after admission to graduate study. The M.A. degree requires 42 credits instead of 33 credits and has specific content-area expertise requirements. See the M.A. degree description for its requirements.

**Five-Year Bachelor’s Plus Master of Education in Elementary Education and PreK-4 Certification**

The College of Education offers a five-year degree program that is designed to allow students to earn both a bachelor’s degree and a master’s degree in five years instead of the traditional six. The combined degree program leads to either a B.A. or B.S. degree in a secondary academic discipline from the College of Arts and Sciences, the P.C. Rossin College of Engineering and Applied Sciences, or the College of Business, and an M.Ed. degree in Elementary Education. In addition, students also earn eligibility for an Instructional I teaching certificate from the Pennsylvania Department of Education (PDE) in grades PreK-4.

**PROGRAM OF STUDY FOR PREK-4 CERTIFICATION:**

B.A. or B.S. plus Master of Education (M.Ed.) in Elementary Education and PA Certification eligibility. This 42-credit (minimum) master’s program prepares students for certification as PreK-4 teachers. Students complete coursework in three categories:

**Core Course Work (21 credit hours)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>SPED 332</td>
<td>Education and Inclusion of Individuals with Special Needs in K-12</td>
<td>3</td>
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<tr>
<td>TLT 380</td>
<td>Child Development and Cognition</td>
<td>3</td>
</tr>
<tr>
<td>TLT 404</td>
<td>Diversity, Families, and School Collaborations in K-12</td>
<td>3</td>
</tr>
<tr>
<td>TLT 405</td>
<td>Principles and Applications of K-12 Assessment</td>
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<td>Instructional Design for K-12 Classrooms</td>
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<tr>
<td>TLT 409</td>
<td>K-12 Classroom Environment and Management</td>
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</tr>
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<td>Early Childhood Education</td>
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</tbody>
</table>

**Development of Professional Skills (18 credit hours)**

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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>TLT 412</td>
<td>Social Studies in PreK through 4th Grade</td>
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</tr>
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<td>TLT 420</td>
<td>Literacy in PreK through 4th Grade: Reading and Its Foundations</td>
<td>3</td>
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</tr>
<tr>
<td>TLT 426</td>
<td>Science in PreK through 4th Grade</td>
<td>3</td>
</tr>
<tr>
<td>TLT 428</td>
<td>Mathematics and Numeracy in PreK through 4th Grade</td>
<td>3</td>
</tr>
<tr>
<td>SPED 465</td>
<td>Advanced Inclusionary Practices in K-12</td>
<td>3</td>
</tr>
</tbody>
</table>

**Extended Field Experience (3-6 credit hours)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLT 444</td>
<td>General Education Student Teaching and Seminar</td>
<td>1-6</td>
</tr>
</tbody>
</table>

In order to be eligible for PreK-4 certification, by the time a student finishes the program he or she must have demonstrated competence in the core content areas for that certification. At time of acceptance, each student will be informed of any additional content-area coursework he or she will be required to complete in order to demonstrate competence in the PreK-4 core content areas. The student is responsible for completing this coursework prior to applying for PreK-4 certification. The credits for this coursework are not included in the master’s degree.

Distribution of coursework across undergraduate and graduate study:
Sophomore Year (3 credit hours)
Senior Year (12 credit hours)
College of Education - Fall (9 credits)
College of Education - Spring (3-6 credits)

Students in the 5-year program will take 18 credits pre-bachelor’s and an additional 27 credits post-bachelor’s. However, the University requires that master’s degrees carry at least 30 credits minimum. This means students in the 5-year program must have at least 3 credits “left over” from their bachelor’s program to move across to the College of Education to put toward their master’s degree.

**Five-Year Bachelor’s Plus Master of Education in Secondary Education and Teacher Certification**

The College of Education offers a five-year degree program that is designed to allow students to earn both a bachelor’s degree and a master’s degree in five years instead of the traditional six.

The combined degree program leads to (1) a B.A./B.S. degree in an academic discipline from the College of Arts and Sciences, the P.C. Rossin College of Engineering and Applied Sciences, or the College of Business, and (2) an M.Ed. degree in Secondary Education. In addition, students also earn eligibility for Instructional I teacher certification from the Pennsylvania Department of Education (PDE) in one of the 8 subject areas below:

- Biology 7-12
- Chemistry 7-12
- Earth and Space Science 7-12
- English 7-12
- General Science 7-12
- Mathematics 7-12
- Physics 7-12
- Social Studies 7-12

**PROGRAM OF STUDY:**

B.A. or B.S. plus Master of Education (M.Ed., 33 credits minimum) and Pennsylvania teacher certification eligibility. In addition to meeting the requirements for the bachelor’s degree, students must satisfy the Pennsylvania Department of Education guidelines for demonstrated content-area competence (see below).

Students complete coursework in three categories:
Core Coursework (15 credits)

SPED 332  Education and Inclusion of Individuals with Special Needs in K-12  3
TLT 404  Diversity, Families, and School Collaborations in K-12  3
TLT 405  Principles and Applications of K-12 Assessment  3
TLT 407  Instructional Design for K-12 Classrooms  3
TLT 409  K-12 Classroom Environment and Management  3

Development of Professional Skills (12 credits)

Content-area teaching methods course with approval of adviser (one of the following):

TLT 431  Social Studies in Middle Level and High School Education  3
TLT 434  English in Middle Level and High School Education  3
TLT 436  Science in Middle Level and High School Education  3
TLT 438  Mathematics in Middle Level and High School Education  3

Plus:

TLT 432  Reading and Critical Thinking in Middle Level and High School Education  3
SPED 465  Advanced Inclusionary Practices in K-12  3
TLT XXX Elective with adviser approval  3

Extended Field Experiences (6-9 credits)

TLT 440  Pre-professional Seminar  3
TLT 444  General Education Student Teaching and Seminar  1-6

In order to be eligible for secondary certification, by the time a student finishes the program he or she must have demonstrated competence in the subject matter area of that certification. Each student upon admission meets with the content-area specialist in the field in which that student seeks secondary certification. The content-area specialist, who is a faculty member in the College of Arts and Sciences, reviews the student’s transcripts and compares that student’s coursework with the content-area guide sheet approved by the Pennsylvania Department of Education (PDE). Following this audit, the content-area specialist will identify what additional coursework in the content-area is needed, if any. The student is responsible for completing this coursework prior to applying for secondary certification. The credits for this course work are not included in the M.Ed. degree.

Students in the secondary teacher-preparation program are expected to have completed almost all their content area coursework prior to going out to student teach. This is important because student teachers need to have mastery of their content in order to fulfill their responsibilities to their students and to derive maximum benefit from the student teaching experience.

Distribution of coursework across undergraduate and graduate study:

Sophomore Year (3 credit hours)
Junior Year (6 credit hours)
Senior Year (6 credit hours)
College of Education - Summer (6 credits)
College of Education - Fall (9 credits)
College of Education - Spring (3-6 credits)

Students in this program unable to accrue enough credits outside their undergraduate degree programs may need to take additional credits after beginning graduate study in order to reach the 33-credit minimum.

Students in this program who wish to obtain the Master of Arts (M.A.) degree rather than the M.Ed. degree may petition to change to that degree after admission to graduate study. The M.A. degree requires 42 credits instead of 33 credits and has specific content-area expertise requirements. See the M.A. degree description for its requirements.

Master of Arts in Secondary Education and Teacher Certification

This 42 credit (minimum) program of study prepares students for Pennsylvania Level I certification as secondary content-area teachers in one of 8 subject areas below and leads to eligibility for a master’s degree in secondary education:

- Biology 7-12
- Chemistry 7-12
- Earth and Space Science 7-12
- English 7-12
- General Science 7-12
- Mathematics 7-12
- Physics 7-12
- Social Studies 7-12

Students complete coursework in four categories:

Core Coursework (15 credit hours)

SPED 332  Education and Inclusion of Individuals with Special Needs in K-12  3
TLT 404  Diversity, Families, and School Collaborations in K-12  3
TLT 405  Principles and Applications of K-12 Assessment  3
TLT 407  Instructional Design for K-12 Classrooms  3
TLT 409  K-12 Classroom Environment and Management  3

Development of Professional Skills (12 credit hours)

Content-area teaching methods course with approval of your adviser (one of the following):

TLT 431  Social Studies in Middle Level and High School Education  3
TLT 434  English in Middle Level and High School Education  3
TLT 436  Science in Middle Level and High School Education  3
TLT 438  Mathematics in Middle Level and High School Education  3

Plus:

TLT 432  Reading and Critical Thinking in Middle Level and High School Education  3
SPED 465  Advanced Inclusionary Practices in K-12  3
TLT XXX: Elective with adviser approval. [These credits may be used for content-area course.]  3

Extended Field Experiences (6 credit hours)

TLT 440  Pre-professional Seminar  3
TLT 444  General Education Student Teaching and Seminar  1-6

Content Area Knowledge (12 credit hours)

Twelve credits are required for the M.A. degree and these courses must be taken from Lehigh departments outside the College of Education at the 200 level and above.

In order to be eligible for secondary certification, by the time a student finishes the program he or she must have demonstrated competence in the subject matter area of that certification. Each student upon admission meets with the content-area specialist in the field in which that student seeks secondary certification. The content-area specialist, who is a faculty member in the College of Arts and Sciences, reviews the student’s transcripts and compares that student’s coursework with the content-area guide sheet approved by the Pennsylvania Department of Education (PDE). Following this audit, the content-area specialist will identify what additional coursework in the content-area is needed, if any. The student is responsible for completing this coursework prior
to applying for secondary certification. For the MA degree, at least 12 credits of content area courses must be taken at Lehigh at the 200 level or higher.

Students in the secondary teacher-preparation program are expected to have completed almost all their content area coursework prior to going out to student teach. This is important because student teachers need to have mastery of their content in order to fulfill their responsibilities to their students and to derive maximum benefit from the student teaching experience.

**Master of Education in Elementary Education and PreK-4 Teacher Certification**

This 42-credit (minimum) program prepares students for Pennsylvania Level I certification as PreK-4 teachers and leads to the awarding of a master’s degree in Elementary Education. Students complete coursework in three categories:

**Core Course Work (21 credit hours)**

<table>
<thead>
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<th>Course Code</th>
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<td>Early Childhood Education</td>
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</tbody>
</table>

**Development of Professional Skills (12 credit hours)**

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<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>TLT 412</td>
<td>Social Studies in PreK through 4th Grade</td>
<td>3</td>
</tr>
<tr>
<td>TLT 420</td>
<td>Reading and Literacy in PreK through 4th Grade</td>
<td>3</td>
</tr>
<tr>
<td>TLT 422</td>
<td>Language Arts in PreK through 4th Grade</td>
<td>3</td>
</tr>
<tr>
<td>TLT 426</td>
<td>Science in PreK through 4th Grade</td>
<td>3</td>
</tr>
<tr>
<td>TLT 428</td>
<td>Mathematics and Numeracy in PreK through 4th Grade</td>
<td>3</td>
</tr>
<tr>
<td>SPED 465</td>
<td>Advanced Inclusionary Practices in K-12</td>
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</tbody>
</table>

**Extended Field Experience (3 credit hours)**

<table>
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<tr>
<th>Course Code</th>
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</thead>
<tbody>
<tr>
<td>TLT 444</td>
<td>General Education Student Teaching and Seminar</td>
<td>1-6</td>
</tr>
</tbody>
</table>

Thirty (30) credits minimum is required for the master’s degree. In order to be eligible for PreK-4 certification, by the time a student finishes the program he or she must have demonstrated competence in the core content areas for that certification (English, mathematics, science, social studies). At time of acceptance, each student will be informed of any additional content-area coursework he or she will be required to complete in order to demonstrate competence in the PreK-4 core content areas (language arts, mathematics, science and social studies). The student is responsible for completing this coursework prior to applying for PreK-4 certification. The credits for this coursework are not included in the master’s degree.

**Master of Education in Secondary Education and Teacher Certification**

This 33 credit (minimum) program of study prepares students for Pennsylvania Level I certification as secondary content-area teachers in one of the subject areas (below) and leads to eligibility for a master’s degree in secondary education:

- Biology 7-12
- Chemistry 7-12
- Earth and Space Science 7-12
- English 7-12
- General Science 7-12
- Mathematics 7-12

**Additional Certification**

- Biology 7-12
- Social Studies 7-12

Students complete coursework in three categories:

**Core Course Work (18 credits)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPED 404</td>
<td>Diversity, Families, and School Collaborations in K-12</td>
<td>3</td>
</tr>
<tr>
<td>SPED 418</td>
<td>Alternative Curricular Approaches</td>
<td>3</td>
</tr>
<tr>
<td>SPED 429</td>
<td>Professional Seminar</td>
<td>3</td>
</tr>
</tbody>
</table>
Students take coursework in four categories:

**Education 7-12 teachers.**

Students seeking Pennsylvania additional certification as Special Education PreK-8 teachers (with dual certification eligibility).

**Master of Education in Special Education and Special Education PreK-8 Dual Certification**

This 30 credit (minimum) master’s program is designed for graduate students seeking Pennsylvania certification as Special Education 7-12 teachers (with dual certification eligibility).

**Students complete the following coursework:**

<table>
<thead>
<tr>
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<td>SPED 411</td>
<td>Early Childhood Education</td>
<td>3</td>
</tr>
<tr>
<td>SPED 418</td>
<td>Alternative Curricular Approaches</td>
<td>3</td>
</tr>
<tr>
<td>SPED 419</td>
<td>Academic Interventions: PreK-8</td>
<td>3</td>
</tr>
<tr>
<td>SPED 432</td>
<td>Positive Behavior Support</td>
<td>3</td>
</tr>
<tr>
<td>SPED 452</td>
<td>Assessment in Special Education</td>
<td>3</td>
</tr>
<tr>
<td>SPED 465</td>
<td>Advanced Inclusionary Practices in K-12</td>
<td>3</td>
</tr>
</tbody>
</table>

**Course Work in the Area of Specialization (6 credits)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPED 420</td>
<td>Field Experience: Special Education Certification</td>
<td>1-3</td>
</tr>
<tr>
<td>SPED 421</td>
<td>Academic Interventions: Secondary Level</td>
<td>3</td>
</tr>
<tr>
<td>SPED 423</td>
<td>Transition to Post-school Life</td>
<td>3</td>
</tr>
</tbody>
</table>

**Intensive Teaching Experience (2 credits)**

<table>
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<tr>
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<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPED 420</td>
<td>Field Experience: Special Education Certification</td>
<td>1-3</td>
</tr>
</tbody>
</table>

**Master of Education in Special Education and Special Education 7-12 Dual Certification**

This 30 credit (minimum) master’s program is designed for graduate students seeking Pennsylvania certification as Special Education 7-12 teachers (with dual certification eligibility).

**Students complete the following coursework:**

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<tr>
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<tr>
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<td>Diversity, Families, and School Collaborations in K-12</td>
<td>3</td>
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<td>Principles and Applications of K-12 Assessment</td>
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<td>SPED 418</td>
<td>Alternative Curricular Approaches</td>
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<tr>
<td>SPED 421</td>
<td>Academic Interventions: Secondary Level</td>
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<td>3</td>
</tr>
<tr>
<td>SPED 432</td>
<td>Positive Behavior Support</td>
<td>3</td>
</tr>
<tr>
<td>SPED 452</td>
<td>Assessment in Special Education</td>
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</tr>
<tr>
<td>SPED 465</td>
<td>Advanced Inclusionary Practices in K-12</td>
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**Course Work in the Area of Specialization (6 credits)**

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**Education Electives (6 credits, with approval of the adviser)**

**Intensive Teaching Experience (2 credits)**

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**Master of Education in Special Education and Special Education 7-12 Dual Certification**

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**Students complete the following coursework:**

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**NOTE:** Students seeking dual certification in general education 7-12 (initial certification) and Special Education 7-12 (additional certification) must complete 5 courses (15 credits) that are not listed above [including SPED 442, General Education and Special Education Student Teaching and Seminar]. These courses/credits are required to be eligible for dual certification but are not part of the master’s program in Special Education.

**Special Education Courses**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>SPED 330</td>
<td>Special Topics in Special Education 1-3 Credits</td>
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<tr>
<td>SPED 332</td>
<td>Special Education and Inclusion of Individuals with Special Needs in K-12</td>
<td>3</td>
</tr>
<tr>
<td>SPED 338</td>
<td>Emotional and Behavioral Disorders of Children 3 Credits</td>
<td></td>
</tr>
<tr>
<td>SPED 402</td>
<td>Applied Behavior Analysis 3 Credits</td>
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<tr>
<td>SPED 402</td>
<td>SCHP 402</td>
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</tbody>
</table>
SPED 404 (TLT 404) Diversity, Families, and School Collaborations in K-12 3 Credits
Cultural and linguistic diversity as critical variables in educational equity for all learners, including ELL. Explores home-school partnerships, family and professional collaboration, and teacher self-awareness. Implementing culturally sensitive and responsive classroom practices as well as forming collaborative relationships with families that respect diversity of family contexts. Collaborative, multidisciplinary teaming to support, optimize, and advocate for student’s educational needs and connect to community services and resources available to individuals and families. Addresses family mental health issues and wraparound services.

SPED 405 (TLT 405) Principles and Applications of K-12 Assessment 3 Credits
Assessment applied to learning in classroom learning environments, including universal screening and progress monitoring. Discusses assessment approaches, ways to implement assessment, and use of assessment tools to monitor all students, including ELL and students with disabilities. Use of data-management and grading systems. Addresses diagnostic assessments for student placement and analysis of assessment data to tailor instruction to diverse student needs. Emphasis on research-based practices of assessment to influence instructional decision-making consistent with the RTI framework.

SPED 409 (TLT 409) K-12 Classroom Environment and Management 3 Credits
Designing inclusive classroom environments that maximize learning. Emphasis on fostering a community of learners using connections among classroom arrangement, classroom management, and cognitive development to create positive learning outcomes for all students, including ELL learners and students with disabilities. Addresses the tiered model of prevention and positive behavior support, including the role of functional assessment and individual positive behavior support plans in classroom management. Highlights the ways a positive climate for learning involves establishing and maintaining partnerships with families.

SPED 410 Behavior Analysts: Ethics and Professional Conduct 3 Credits
This course is designed to provide students an in-depth review of the BACB Professional and Ethics Compliance Code for Behavior Analysts and other relevant content and readings that further support student understanding of the topic area. Class discussions, review of case studies, and student-lead small group problem-solving activities will enable students to apply ethical and professional standards to their work, further promoting quality interactions between the children and adults they serve, families, teachers, and others stakeholders.

SPED 411 (TLT 411) Early Childhood Education 3 Credits
Introduction to development of early childhood education in the U.S. Emphasizes evidence-based methods and materials to assist young children in the learning process, including arrangement of indoor/outdoor space, developmentally appropriate practices, and the design of instruction to foster young children’s emotional, social, language, cognitive, physical, and creative development. Includes embedded instruction and adaptations for students with identified disabilities, children at risk for developing disabilities, and children with culturally and linguistically diverse backgrounds, and family collaboration within the instructional planning process.

SPED 416 Autism Spectrum Disorders and Evidence-Based Practices 3 Credits
This course provides an overview of Autism Spectrum Disorders (ASD) and an introduction to the evidence based practices (EBPs) for practitioners, based on recently published and publicly available reports and other supporting materials. Assignments help students translate EBPs, grounded in Applied Behavior Analysis (ABA), into concrete goals and practices that have a meaningful impact on the day-to-day functioning of students with ASD.
SPED 432 Positive Behavior Support 3 Credits
Design of comprehensive, multi-component behavior support plans for individuals with a variety of disabilities who engage in problem behavior. Topics include functional assessment, antecedent and setting event interventions, replacement behaviors, consequence and crisis procedures, lifestyle interventions, and teaming strategies. Assessment focuses on the link between curriculum, academic performance, and behavior problems. Promotes consideration of diverse populations for understanding behavioral differences. Describes strategies for ongoing monitoring and maintenance of behavior reductions.

SPED 434 Applied Research Practicum 1-3 Credits
Designing and conducting research projects in applied settings.

SPED 440 Early Academic Intervention 3 Credits
Explores the potential effectiveness of interventions to prevent academic failure of children at risk for learning difficulties. Emphasis on research-based interventions in the areas of beginning reading, language and vocabulary, writing and spelling, awareness of print and exposure to print, and mathematics (number sense).

SPED 442 (TLT 442) General Education and Special Education Student Teaching and Seminar 1-6 Credits
Intensive practice in the application of principles of teaching for both general and special education settings in a supervised internship in the schools (for dual certification). Regular meetings among student teachers for critical analysis and discussion of classroom instructional practices, as illustrated by the student teachers’ experiences in the schools. Practical mentoring on professionalism, applying differentiated instructional models in real-world setting, and aligning instruction with standards. Consent of program director required.

SPED 452 Assessment in Special Education 3 Credits
Identification, administration and interpretation of a variety of assessments used for planning and to determine special education eligibility and to assess social, emotional, behavioral, and academic functioning. Discusses strengths and limitations of various models and assessment, both formal and informal, instruments used to evaluate the need for special education. Describes strategies to enhance the relationship between assessment and service delivery. Addresses assessment practices to identity curricular needs consistent with the RtII framework.

SPED 465 Advanced Inclusionary Practices in K-12 3 Credits
Advanced techniques grounded in current research-based methods and best practice for educating and assessing students with disabilities, students from diverse backgrounds, and English language learners using a standards-aligned system. Accommodations, modifications, planning for physical and instructional inclusion through embedded strategic instruction, adaptations, and curriculum overlapping. Addresses decision hierarchies for level of instructional adaptation and social inclusion methods through social facilitation techniques. Explores critical factors in developing, implementing, and modifying curriculum using evidence-based practices. Explores collaborative co-planning and co-teaching models.
Prerequisites: SPED 332

SPED 482 Practicum in University Teaching: Special Education 1-4 Credits
Mentored and guided co-teaching focused on the design, organization, pedagogy and assessment of university courses in Special Education. Students in this course will work with a faculty member to apply best practices in university teaching with feedback while co-teaching students in a course in the College of Education. Students taking the course must meet the college standards for participation and be approved by the program director and department chair. May be repeated for credit.
Repeat Status: Course may be repeated.

SPED 490 Doctoral Seminar in Special Education 3 Credits
Advanced knowledge of issues and research in the education of individuals with special needs. Topics will vary. Must be admitted for doctoral studies.
Repeat Status: Course may be repeated.

SPED 499 Dissertation 1-15 Credits
Repeat Status: Course may be repeated.
TLT 405 (SPED 405) Principles and Applications of K-12 Assessment 3 Credits
Assessment applied to learning in classroom learning environments, including universal screening and progress monitoring. Discusses assessment approaches, ways to implement assessment, and use of assessment tools to monitor all students, including ELL and students with disabilities. Use of data-management. Includes embedded diagnostic assessments for student placement and analysis of assessment data to tailor instruction to diverse student needs. Emphasis on research-based practices of assessment to inform instructional decision-making consistent with the RtII framework.

TLT 407 Instructional Design for K-12 Classrooms 3 Credits
Introduces the systematic design of instruction following the Response to Instruction and Intervention (RtII) and Universal Design for Learning models. Explores theories of learning and instructional applications as a part of technology-based and standards-aligned classroom education grounded in the use of a quality, research-based core curriculum and effective instructional practices to meet the needs of all learners. Addresses appropriate use of instructional technologies for universal learning. Students will plan, design, and develop student-centered, standards-aligned, technology-supported instruction and appropriate learner assessments.

TLT 409 (SPED 409) K-12 Classroom Environment and Management 3 Credits
Designing inclusive classroom environments that maximize learning. Emphasis on fostering a community of learners using connections among classroom arrangement, classroom management, and cognitive development to create positive learning outcomes for all students, including ELL learners and students with disabilities. Addresses the tiered model of prevention and positive behavior support, including the role of functional assessment and individual positive behavior support plans in classroom management. Highlights the ways a positive climate for learning involves establishing and maintaining partnerships with families.

TLT 410 The Writing Process 3 Credits
Developmental characteristics of children's writing and relationships among writing, spelling and reading. Predictors of writing achievement, teaching strategies and activities, and evaluation schemes will be emphasized, K-12.

TLT 411 (SPED 411) Early Childhood Education 3 Credits
Introduction to development of early childhood education in the U.S. Emphasizes evidence-based methods and materials to assist young children in the learning process, including arrangement of indoor/outdoor space, developmentally appropriate practices, and the design of instruction to foster young children's emotional, social, language, cognitive, physical, and creative development. Includes embedded instruction and adaptations for students with identified disabilities, children at risk for developing disabilities, and children with culturally and linguistically diverse backgrounds, and family collaboration within the instructional planning process.

TLT 412 Social Studies in PreK through 4th Grade 3 Credits
Overview of Pennsylvania's PreK-4 Standards for social studies, including: Pennsylvania history, United States history, economics, civics and government, citizenship, political science/government, and geography. Development, implementation and evidence-based assessment of preK-grade 4 social studies curricula. Effective teaching techniques such as lesson planning, inclusive practices, integrating instructional technologies into instruction, reflecting on teaching, and the latest research-based teaching and assessment methods. Emphasis on alignment of instruction with standards.

TLT 420 Literacy in PreK through 4th Grade: Reading and Its Foundations 3 Credits
Knowledge of the theories, methods, and materials that can be used to teach reading and early reading skills in PreK-4th grade. Understanding of the skills of successful readers. Evidence-based practices in reading instruction and data-based decision-making to teach reading to all students, including students with disabilities and English learners. Strategies to partner with caregivers to enhance reading an early reading skills.

TLT 422 Literacy in PreK through 4th Grade: Writing and Its Foundations 3 Credits
Knowledge of the theories, methods, and materials that can be used to teach writing and foundational skills in PreK-4. Understanding of the developmental aspects of writing and the skills of successful writers. Evidence-based practices in writing instruction and data-based decision-making to teach writing to all students, including students with disabilities and English learners.

TLT 424 Children’s Literature in Elementary Education 3 Credits
Role of literature in the instructional program of the elementary schools. Use of trade books for individualized instruction in reading, language arts, mathematics, science, and social studies.

TLT 426 Science in PreK through 4th Grade 3 Credits
Overview of inquiry-based activities and investigations to promote science learning in preK-grade 4 classrooms. Emphasis on Pennsylvania's PreK-4 Standards for Science and Technology and Environment and Ecology standards and aligning instruction with standards. Activities include planning effective lessons, trying out new methods of teaching, reflective practice, inclusionary methods, and integrating instructional technologies into science learning. Evidence-based assessment types are highlighted within instructional contexts.

TLT 428 Mathematics and Numeracy in PreK through 4th Grade 3 Credits
Trends, theories, activities and manipulative materials for teaching early numeracy and elementary mathematics. Pre-school development and in-school skills and concepts, including sets, systems of numeration, experience with numbers, number operations and concepts, numerals, measurement, early algebra, and elements of geometry. Implications of developmental differences and early non-school experiences on learner readiness and skills. Helping parents support their children's mathematical conceptual development. Research-based practices and inclusionary approaches to teach mathematics to learners from a variety of backgrounds and across ability levels.

TLT 431 Social Studies in Middle Level and High School Education 3 Credits
Middle and high school curriculum, content, teaching strategies, and instructional materials for the social studies. Emphasis on organizing content, using appropriate methods, testing and evaluation, and appropriate integration of technology. Overview of Pennsylvania's 4-8 and 8-12 standards for social studies and related standards from the National Council for the Social Studies and other national organizations. Explores relevant research, courses of study, textbooks, and teacher-made materials. Addresses inclusive evidence-based and standards-aligned instructional approaches and techniques, including co-teaching.

TLT 432 Reading and Critical Thinking in Middle Level and High School Education 3 Credits
Development of reading in the secondary content areas (English/literature arts, mathematics, science, social studies). Highlights effective teaching strategies in critical areas, such as higher order reading and study skills. Addresses analysis of evidence based methods and current research for improving the reading development and analytical skills of all students.

TLT 434 English in Middle Level and High School Education 3 Credits
Curricula, philosophy, methods, strategies, and materials for the teaching of middle and high school English. Literature, genres, and the nature of text and text differences. Critical analysis and drawing inferences from narrative text and poetry. Techniques for teaching and enhancing writing in various styles. Applications of technology and assessment principles. Addresses inclusive evidence-based and standards-aligned instructional approaches and techniques, including co-teaching.
TLT 436 Science in Middle Level and High School Education 3 Credits
Overview of inquiry-based activities and investigations to promote science learning in secondary science classrooms. Emphasis on aligning instruction with Pennsylvania’s Standards for Science and Technology and Environment and Ecology standards. Activities include planning effective lessons, trying out professional teaching, inclusionary methods, reflective practice, and integrating instructional technologies into science learning. Evidence-based assessment types highlighted within instructional contexts.

TLT 438 Mathematics in Middle Level and High School Education 3 Credits
Standards-based and technology-intensive curricula, instructional activities, and manipulative aids for mathematics in middle level and high schools. This course models and explores an investigative and hands-on approach to secondary mathematics instruction. Particular attention given to learning theories, curriculum issues, and recommendations arising from state, national, and international assessments. Research-based practices and inclusionary approaches to teach mathematics to learners from a variety of backgrounds and across a range of abilities. Addresses standards-aligned instructional approaches and techniques, including co-teaching.

TLT 440 Pre-professional Seminar 3 Credits
Study, directed observation of, and initial practice in the various phases of teaching in secondary schools. Guided opportunities to try out strategies to facilitate the inclusion of special education students, differentiated instructional practices, and standards-aligned and evidence-based instructional approaches in actual school settings. Consent of program coordinator required.

TLT 442 (SPED 442) General Education and Special Education Student Teaching and Seminar 1-6 Credits
Intensive practice in the application of principles of teaching for both general and special education settings in a supervised internship in the schools (for dual certification). Regular meetings among student teachers for critical analysis and discussion of classroom instructional practices, as illustrated by the student teachers’ experiences in the schools. Practical mentoring on professionalism, applying differentiated instructional models in real-world setting, and aligning instruction with standards. Consent of program director required.

TLT 444 General Education Student Teaching and Seminar 1-6 Credits
Intensive practice in the application of principles of teaching for general education settings in a supervised internship in the schools. Regular meetings among student teachers for critical analysis and discussion of classroom instructional practices, as illustrated by the student teachers’ experiences in the schools. Practical mentoring on professionalism, applying differentiated instructional models in real-world setting, and aligning instruction with standards. Consent of program director required.

TLT 445 Applied Instructional and Interface Design Principles 3 Credits
Exploration and application of design models for learning. Special emphasis on the application of perception theory, communication theory, and learning theory to the design of media for teaching and learning. **Prerequisites:** TLT 403

TLT 456 Instructional Design and Development Studio 3 Credits
Studio-based, authentic and collaborative design experiences led by a faculty mentor. Students work in teams to complete substantial multimedia design and development projects. **Prerequisites:** TLT 454 and TLT 460

TLT 458 Introduction to Multimedia Programming and Resource Development for Learning 3 Credits
Introduction to programming and resource development tools used in the creation of interactive multimedia teaching and learning materials.

TLT 460 Advanced Multimedia Programming and Resource Development for Learning 3 Credits
Advanced exploration of programming and resource development tools used in the creation of interactive teaching and learning materials. **Prerequisites:** TLT 458

TLT 462 Special Topics in Development of Instructional Resources and Technologies for Learning 1-3 Credits
We know the use of technology in education will continue to increase. This course extrapolates current research to envision the innovations we can expect in a planning horizon of 2 to 5 years. We will study schools and systems that use emerging technologies today that could be widely adopted tomorrow. The course focuses equally on technology and pedagogy. **Repeat Status:** Course may be repeated.

TLT 466 Field Experience: General Education Certification 1-3 Credits
Intensive practice in the application of principles of teaching in general education in a supervised experience in the schools for students who already hold special education certification. Practical mentoring on professionalism, applying differentiated instructional models in real-world setting, and aligning instruction with standards. Consent of the program director.

TLT 470 Technology for Teaching and Learning 3 Credits
Analysis of available technologies (hardware, software, and Web resources), and identification of technologies matched to learner needs in traditional and/or non-traditional settings.

TLT 472 Online Teaching and Learning 3 Credits
Examination of contemporary research on online learning and recognized best practices on the design and delivery of online, hybrid, and/or flipped courses or course modules. Emphasis on online activities to experience ways to maximize instructor presence and student engagement, collaboration, and achievement.

TLT 474 Large-scale Planning and Implementation of Educational Technology 3 Credits
Addresses topics such as planning, maintaining, funding, networking, staffing, staff development, and monitoring of educational technology implementations.

TLT 476 Assessment of Instructional Technologies 3 Credits
Techniques for evaluating technology implementations for teaching and learning. Focus on topics such as instrumentation, data collection and analysis, drawing conclusions from data sets, and preparing reports for stakeholders.

TLT 480 Curriculum Theory and Design 3 Credits
Curricular models and their features, with a focus on curriculum development and enactment. Special emphasis on design principles, curriculum’s role in K-12 settings, and technology-enhanced curriculum.

TLT 482 Practicum in University Teaching: Teaching, Learning & Technology 1-4 Credits
Mentored and guided co-teaching focused on the design, organization, pedagogy and assessment of university courses in Teaching, Learning and Technology. Students in this course will work with a faculty member to apply best practices in university teaching with feedback while co-teaching students in a course in the College of Education. Students taking the course must meet the college standards for participation and be approved by the program director and department chair. May be repeated for credit. **Repeat Status:** Course may be repeated.

TLT 486 Doctoral Research Project 3 Credits
This course provides students with the opportunity to design and conduct research studies under the supervision of specific faculty.

TLT 492 Classroom Research Methods 3 Credits
Introduces students to classroom research design paradigms and the assumptions behind them, use of the literature, developing research questions, qualitative and quantitative procedures, research design, sampling design, data collection, data analysis, and reporting research results using educational applications.

TLT 494 Culminating Research Project 3 Credits
Designing and conducting research projects in classroom settings.

TLT 499 Dissertation 1-15 Credits

The Teaching, Learning and Technology (TLT) program offers six master’s degrees and one graduate certificate, divided into two areas:
teacher education and instructional technology. The program also offers a doctoral degree.

The master’s degrees in teacher education are Master of Education in Elementary Education and PreK-4 Teacher Certification, Master of Education (or Master of Arts) in Secondary Education and Teacher Certification, and Master of Education (or Master of Arts) in Teaching and Learning. Undergraduate students at Lehigh may also enroll in a five-year program for a Master of Education in Elementary Education and PreK-4 Certification or Master of Education in Secondary Education and Teacher Certification, in addition to their undergraduate degree. Teacher education students may elect to extend their coursework to earn additional certification in Special Education. All teacher certification programs have been approved by the Pennsylvania Department of Education, making graduates eligible for initial certification in Pennsylvania.

In instructional technology TLT offers a Master of Science in Instructional Technology and a Lehigh graduate certificate in Technology Use in the Schools. This certificate is endorsed by the International Society for Technology in Education (ISTE).

Finally, the program offers a Doctor of Philosophy in Teaching, Learning, and Technology, which spans both fields of teacher education and instructional technology.

The TLT program prepares professional educators through a combination of graduate-level education and certification experiences. The program highlights research-based, inquiry-oriented, and technology-enabled strategies to reach all learners. We emphasize collaborative and equitable approaches to instruction and learning. TLT graduates are not only highly skilled practitioners, but also reflective scholars and leaders in their professional communities.

Upon completion, TLT graduates become teachers in PreK-12 schools; curriculum coordinators, coaches, and educational technology specialists in both formal and informal education settings; instructional designers and/or learning designers; or professors in higher education institutions.

For more information about teacher education:
http://coe.lehigh.edu/academics/disciplines/teachered

For more information about instructional technology:
http://coe.lehigh.edu/academics/disciplines/itech

**Professor.** Alec M. Bodzin, PHD (North Carolina State University)

**Associate Professors.** Helen Lynn Columba-Piervalvo, EDD (University of Louisville); Thomas Chalmers Hammond, PHD (University of Virginia); Brook Sawyer, PHD (University of Virginia)

**Assistant Professor.** Sara Kangas, PHD (Temple University)

**Professor Of Practice.** Farah L. Valleria, PHD (Lehigh University)

**Emeriti.** Ward M. Cates, EDD (Duke University); Scott Roy Garrigan, EDD (Lehigh University); Warren R. Heydenberk, PHD (University of Northern Colorado)

Lehigh undergraduates may enroll in either of the College of Education’s 5-year teacher certification areas: Elementary Education (grade levels preK through 4) and Secondary Education (grade levels 7 through 12). A Minor in Education is offered through the College of Arts and Sciences.

For information on the 5-year programs, see below. For information on the Education Minor, see the College of Arts and Sciences ‘Minor Programs in the College’.

**5-YEAR MASTER OF EDUCATION IN ELEMENTARY EDUCATION AND PREK-4 TEACHER CERTIFICATION**

The College of Education offers a five-year degree program that is designed to allow students to earn both a bachelor’s degree and a master’s degree in five years instead of the traditional six. The combined degree program leads to either a B.A. or B.S. degree in an academic discipline from the College of Arts and Sciences, the P.C. Rossin College of Engineering and Applied Sciences, or the College of Business, and an M.Ed. degree in Elementary Education. In addition, students also earn eligibility for an Instructional I teaching certificate from the Pennsylvania Department of Education (PDE) in grades PreK-4.

**PROGRAM OF STUDY FOR PREK-4 CERTIFICATION:**

B.A. or B.S. plus Master of Education (M.Ed.) in Elementary Education and PA Certification eligibility. This 42-credit (minimum) master’s program prepares students for certification as PreK-4 teachers. Students complete coursework in three categories:

**Core Course Work (21 credit hours)**

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<td>TLT 380</td>
<td>Child Development and Cognition</td>
<td>3</td>
</tr>
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<td>TLT 404</td>
<td>Diversity,Families, and School Collaborations in K-12</td>
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**Development of Professional Skills (18 credit hours)**

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<tbody>
<tr>
<td>TLT 412</td>
<td>Social Studies in PreK through 4th Grade</td>
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</tr>
<tr>
<td>TLT 420</td>
<td>Literacy in PreK through 4th Grade: Reading and Its Foundations</td>
<td>3</td>
</tr>
<tr>
<td>TLT 422</td>
<td>Literacy in PreK through 4th Grade: Writing Its Foundations</td>
<td>3</td>
</tr>
<tr>
<td>TLT 426</td>
<td>Science in PreK through 4th Grade</td>
<td>3</td>
</tr>
<tr>
<td>TLT 428</td>
<td>Mathematics and Numeracy in PreK through 4th Grade</td>
<td>3</td>
</tr>
<tr>
<td>SPED 465</td>
<td>Advanced Inclusionary Practices in K-12</td>
<td>3</td>
</tr>
</tbody>
</table>

**Extended Field Experience (3-6 credit hours)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLT 444</td>
<td>General Education Student Teaching and Seminar</td>
<td>1-6</td>
</tr>
</tbody>
</table>

In order to be eligible for PreK-4 certification, by the time a student finishes the program he or she must have demonstrated competence in the core content areas for that certification. At time of acceptance, each student will be informed of any additional content-area coursework he or she will be required to complete in order to demonstrate competence in the PreK-4 core content areas. The student is responsible for completing this coursework prior to applying for PreK-4 certification. The credits for this coursework are not included in the master's degree.

Distribution of coursework across undergraduate and graduate study: Sophomore Year (3 credit hours)
Junior Year (3 credit hours)
Senior Year (12 credit hours)
College of Education - Summer (12 credits)
College of Education - Fall (9 credits)
College of Education - Spring (3-6 credits)

Students in the 5-year program will take 18 credits pre-bachelor’s and an additional 27 credits post-bachelor’s. However, the University requires that master’s degrees carry at least 30 credits minimum. This means students in the 5-year program must have at least 3 credits “left over” from their bachelor’s program to move across to the College of Education to put toward their master’s degree.

**5-YEAR MASTER OF EDUCATION IN SECONDARY EDUCATION AND 7-12 TEACHER CERTIFICATION**

The College of Education offers a five-year degree program that is designed to allow students to earn both a bachelor’s degree and a master’s degree in five years instead of the traditional six. The combined degree program leads to (1) a B.A./B.S. degree in an academic discipline from the College of Arts and Sciences, the P.C. Rossin College of Engineering and Applied Sciences, or the College of Business, and (2) an M.Ed. degree in Secondary Education. In addition, students also earn eligibility for Instructional I teacher certification from...
the Pennsylvania Department of Education (PDE) in one of the 8 subject areas below:

- Biology 7-12
- Chemistry 7-12
- Earth and Space Science 7-12
- English 7-12
- General Science 7-12
- Mathematics 7-12
- Physics 7-12
- Social Studies 7-12

PROGRAM OF STUDY:

B.A. or B.S. plus Master of Education (M.Ed., 33 credits minimum) and Pennsylvania teacher certification eligibility. In addition to meeting the requirements for the bachelor’s degree, students must satisfy the Pennsylvania Department of Education guidelines for demonstrated content-area competence (see below).

Students complete coursework in three categories:

Core Coursework (15 credits)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPED 332</td>
<td>Education and Inclusion of Individuals with Special Needs in K-12</td>
<td>3</td>
</tr>
<tr>
<td>TLT 404</td>
<td>Diversity, Families, and School Collaborations in K-12</td>
<td>3</td>
</tr>
<tr>
<td>TLT 405</td>
<td>Principles and Applications of K-12 Assessment</td>
<td>3</td>
</tr>
<tr>
<td>TLT 407</td>
<td>Instructional Design for K-12 Classrooms</td>
<td>3</td>
</tr>
<tr>
<td>TLT 409</td>
<td>K-12 Classroom Environment and Management</td>
<td>3</td>
</tr>
</tbody>
</table>

Development of Professional Skills (12 credits)

Content-area teaching methods course with approval of adviser (one of the following):

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLT 431</td>
<td>Social Studies in Middle Level and High School Education</td>
<td>3</td>
</tr>
<tr>
<td>TLT 434</td>
<td>English in Middle Level and High School Education</td>
<td>3</td>
</tr>
<tr>
<td>TLT 436</td>
<td>Science in Middle Level and High School Education</td>
<td>3</td>
</tr>
<tr>
<td>TLT 438</td>
<td>Mathematics in Middle Level and High School Education</td>
<td>3</td>
</tr>
<tr>
<td>Plus:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TLT 432</td>
<td>Reading and Critical Thinking in Middle Level and High School Education</td>
<td>3</td>
</tr>
<tr>
<td>SPED 465</td>
<td>Advanced Inclusionary Practices in K-12</td>
<td>3</td>
</tr>
<tr>
<td>TLT XXX</td>
<td>Elective with adviser approval</td>
<td>3</td>
</tr>
</tbody>
</table>

Extended Field Experiences (6-9 credits)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLT 440</td>
<td>Pre-professional Seminar</td>
<td>3</td>
</tr>
<tr>
<td>TLT 444</td>
<td>General Education Student Teaching and Seminar</td>
<td>1-6</td>
</tr>
</tbody>
</table>

In order to be eligible for secondary certification, by the time a student finishes the program he or she must have demonstrated competence in the subject matter area of that certification. Each student upon admission meets with the content-area specialist in the field in which that student seeks secondary certification. The content-area specialist, who is a faculty member in the College of Arts and Sciences, reviews the student’s transcripts and compares that student’s coursework with the content-area guide sheet approved by the Pennsylvania Department of Education (PDE). Following this audit, the content-area specialist will identify what additional coursework in the content-area is needed, if any. The student is responsible for completing this coursework prior to applying for secondary certification. The credits for this course work are not included in the M.Ed. degree.

Students in the secondary teacher-preparation program are expected to have completed almost all their content area coursework prior to going out to student teach. This is important because student teachers need to have mastery of their content in order to fulfill their responsibilities to their students and to derive maximum benefit from the student teaching experience.

Distribution of coursework across undergraduate and graduate study:

Sophomore Year (3 credit hours)

Senior Year (6 credit hours)

College of Education - Fall (9 credits)

College of Education - Spring (3-6 credits)

Students in this program unable to accrue enough credits outside their undergraduate degree programs may need to take additional credits after beginning graduate study in order to reach the 33-credit minimum. Students in this program who wish to obtain the Master of Arts (M.A.) degree rather than the M.Ed. degree may petition to change to that degree after admission to graduate study. The M.A. degree requires 42 credits instead of 33 credits and has specific content-area expertise requirements. See the M.A. degree description for its requirements.

Master of Arts in Teaching and Learning

The 30-credit master’s in Teaching and Learning degree program comprises a 15-credit core (5 courses) and mass credits of electives.

The goal of the post-certification master’s in Teaching and Learning is to provide professionally oriented practicing classroom teachers an in-depth understanding of classroom learning environments and experience in classroom-based research methods. These classroom teachers will enhance their pedagogical knowledge and skills, the design of classroom learning environments, and develop innovative curricula and learning activities. For the Master of Arts degree, 12 credits of content-area courses must be taken outside the College of Education.

Electives: Teaching Field Content (15 credits)

For the M.A.: Must include 12 credits of content-area courses taken outside the College of Education (300 level and above).

Core Coursework (15 credits)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDUC 403</td>
<td>Research</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 471</td>
<td>Diversity and Multicultural Perspectives</td>
<td>3</td>
</tr>
<tr>
<td>TLT 401</td>
<td>Overview of Teaching and Learning</td>
<td>3</td>
</tr>
<tr>
<td>TLT 403</td>
<td>Instructional Design</td>
<td>3</td>
</tr>
<tr>
<td>TLT 480</td>
<td>Curriculum Theory and Design</td>
<td>3</td>
</tr>
</tbody>
</table>

Other electives as approved by advisor

Master of Education in Teaching and Learning

The 30-credit master’s in Teaching and Learning degree program comprises a 15-credit core (5 courses) and 15 credits of electives.

The goal of the post-certification master’s in Teaching and Learning is to provide professionally oriented practicing classroom teachers...
an in-depth understanding of classroom learning environments and experience in classroom-based research methods. These classroom teachers will enhance their pedagogical knowledge and skills, the design of classroom learning environments, and develop innovative curricula and learning activities.

**Core Coursework (15 credits)**

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<td>EDUC 403</td>
<td>Research</td>
<td>3</td>
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<tr>
<td>EDUC 471</td>
<td>Diversity and Multicultural Perspectives</td>
<td>3</td>
</tr>
<tr>
<td>TLT 401</td>
<td>Overview of Teaching and Learning</td>
<td>3</td>
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<td>TLT 403</td>
<td>Instructional Design</td>
<td>3</td>
</tr>
<tr>
<td>TLT 480</td>
<td>Curriculum Theory and Design</td>
<td>3</td>
</tr>
</tbody>
</table>

**Electives (15 credits, select courses from the tracks below)**

**Track 1: Technology in School Settings**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLT 458</td>
<td>Introduction to Multimedia Programming and Resource Development for Learning</td>
<td>3</td>
</tr>
<tr>
<td>TLT 460</td>
<td>Advanced Multimedia Programming and Resource Development for Learning</td>
<td>3</td>
</tr>
<tr>
<td>TLT 462</td>
<td>Special Topics in Development of Instructional Resources and Technologies for Learning</td>
<td>1-3</td>
</tr>
<tr>
<td>TLT 470</td>
<td>Technology for Teaching and Learning</td>
<td>3</td>
</tr>
<tr>
<td>TLT 476</td>
<td>Assessment of Instructional Technologies</td>
<td>3</td>
</tr>
</tbody>
</table>

Other electives as approved by advisor 0-3

**Track 2: English as a Second Language**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDUC 391</td>
<td>Educational Linguistics</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 419</td>
<td>Second Language Acquisition</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 420</td>
<td>Contemporary Issues in English Language Learner Education</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 422</td>
<td>Pedagogy for Second Language Learning</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 423</td>
<td>Curriculum and Materials Design for English Language Learners</td>
<td>3</td>
</tr>
</tbody>
</table>

Other electives as approved by advisor 0-3

**Track 3: Teaching Field Content**

Content-area course taken outside the College of Education (300 level and above)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLT 367</td>
<td>Environmental Education</td>
<td>3</td>
</tr>
<tr>
<td>TLT 368</td>
<td>Teaching and Learning with Geospatial Tools</td>
<td>3</td>
</tr>
<tr>
<td>TLT 494</td>
<td>Culminating Research Project</td>
<td>3</td>
</tr>
</tbody>
</table>

Other electives as approved by advisor 0-3

**Master of Science in Instructional Technology**

A thirty-credit masters degree offered through the Teaching, Learning, and Technology program. The program is aimed at those interested in the use of technology in education, particularly preK-12 and post secondary settings.

The 30-credit Master of Science in Instructional Technology program focuses on the planning and use of instructional technology in preK-12 and post secondary settings and non-formal learning environments (such as museums and science centers). The program is targeted toward individuals from varied backgrounds who wish to help educators or learn themselves to design, develop, and incorporate technology applications more effectively in diverse educational settings including preK-12, post secondary education, and informal learning environments. This is an appropriate degree for those who teach in the classroom and online, technology specialists, informal educators, and others interested in effectively using information and communications technologies to enhance instruction.

The program is designed to help develop skills that can be used to create new curriculum and learning activities to meet the demands of a changing technological society and the needs of new generations of students. As such, graduates may be designing online courses, enhance existing curriculum with emerging technologies, or may work as technology specialists, assisting with the integration of technology in academic and informal learning environments. The Instructional Technology graduate program is intended for both current professionals in the education field as well as those who are seeking an advanced degree to upgrade their skills and knowledge base related to technology.

**College Core Requirements (3 credits)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDUC 471</td>
<td>Diversity and Multicultural Perspectives</td>
<td>3</td>
</tr>
</tbody>
</table>

**Program Core Requirements (15 credits)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLT 401</td>
<td>Overview of Teaching and Learning</td>
<td>3</td>
</tr>
<tr>
<td>TLT 403</td>
<td>Instructional Design</td>
<td>3</td>
</tr>
<tr>
<td>TLT 458</td>
<td>Introduction to Multimedia Programming and Resource Development for Learning</td>
<td>3</td>
</tr>
<tr>
<td>TLT 460</td>
<td>Advanced Multimedia Programming and Resource Development for Learning</td>
<td>3</td>
</tr>
<tr>
<td>TLT 476</td>
<td>Assessment of Instructional Technologies</td>
<td>3</td>
</tr>
<tr>
<td>TLT 477</td>
<td>Internship in: (with subtitle)</td>
<td>1-6</td>
</tr>
</tbody>
</table>

Other electives as approved by advisor 0-6

**Master of Science in Teaching, Learning, and Technology**

The master of science in Teaching, Learning, and Technology is a 30-credit master's program. The TLT M.S. is available ONLY to students previously admitted to the TLT Ph.D. program and specifically those students who are NOT completing their doctoral. This MS is provided solely for those students who have completed the core coursework (i.e., 30 or more credits completed, including 12 credits in Foundations, 3 credits in Research, and 15 credits from other courses listed and/ or through directed research) but are unable to progress through the culminating research projects of a doctoral degree. There is no thesis requirement for this master of science; it is a coursework-only masters. Awarding of such degree shall be dependent upon the student meeting all relevant university and College of Education requirements for master’s degrees.

**Doctor of Philosophy in Teaching, Learning, and Technology**

A 48-credit, post-master's doctoral degree offered through the Teaching, Learning, and Technology program.

The doctorate in Teaching, Learning, and Technology (TLT) is a 48-credit, post master's Ph.D. program. The TLT Ph.D. program employs a scientist/practitioner model of learning. That is, research is not separate from application or practice. Our doctoral students collaborate closely with faculty to generate new theories and classification systems, innovative curricula, technology-integrated learning environments, authentic approaches to assessing learning, and a wide range of creative methods of teaching and learning in a global world highly interconnected by technology. In keeping with the scientist/practitioner model, our doctoral students learn through innovative approaches, including research-based strategies for curriculum delivery, synchronous and asynchronous environments, and a wide range of other technology-enhanced designs and approaches for learning. Students take about 42 credits of coursework in addition to their qualifying examination preparation, doctoral research project, and dissertation project. Coursework is individualized according to the concentration students decide to pursue. Also, many of the course assignments are project-based, which will
allows students to apply concepts they are learning to their particular area of interest. In addition, the choice of research topic and projects is also up to the student—in consultation with his/her faculty adviser and within the broader context of the field, of course.

**Foundations (12 credits)**

Required:
- EDUC 471 Diversity and Multicultural Perspectives 3
- TLT 401 Overview of Teaching and Learning 3
- TLT 402 Critical Reading and Writing 3
- TLT 403 Instructional Design 3

**Research (12 credits)**

Required:
- EDUC 403 Research 3
- EDUC 408 Introduction to Statistics 3
- EDUC 409 Analysis of Experimental Data 3

Electives (select at least one):
- EDUC 405 Qualitative Research Methods 3
- EDUC 410 Univariate Statistical Models 3
- EDUC 411 Multivariate Statistical Models 3
- EDUC 412 Advanced Applications of Psychometric Principles 3
- EDUC 461 Single-Subject Research Design 3

**Professional Cognate (12 credits)**

Required:
- TLT 480 Curriculum Theory and Design 3

Electives:
- EDUC 491 Advanced Seminars: (with subtitle) 1-6
- EDUC 493 Internship in: (with subtitle) 1-6
- EDUC 496 Doctoral Research Seminar 3
- TLT 458 Introduction to Multimedia Programming and Resource Development for Learning 3
- TLT 460 Advanced Multimedia Programming and Resource Development for Learning 3

professional Sub-Specialty (6 credits)

These credits are intended to advance the students’ research agenda or career goals (such as a enhanced subject matter knowledge, mentored field/practical experiences with outreach programs, specialized coursework, college teaching, grant writing, and the like) with adviser approval.

**Courses**

**TLT 367 (ES 367) Environmental Education 3 Credits**

Introductory environmental education course designed to prepare students to implement environmental education opportunities in formal and non-formal education settings. Topics include history and philosophy of environmental education, environmental laws and regulations, GIS, environmental issues and decision making, curriculum integration and environmental education teaching methodologies. This is a Web enhanced containing both online and fieldwork components.

**TLT 368 (ES 368) Teaching and Learning with Geospatial Tools 3 Credits**

Exploration of geospatial tools, including but not limited to global positioning systems (GPS), geographic information systems (GIS), and related visualization tools (e.g. Google Earth). Application of these tools and techniques to instructional settings, including appropriate pedagogy and assessment.

**TLT 380 Child Development and Cognition 3 Credits**

Introduction to physical, motor, perceptual, cognitive, language, emotional, social, and gender development of young children and adolescents. Developmental history, theories, and research, as well as the effect of culture, family, peers, media, and schooling on the individual and groups. Students investigate typical and atypical development and explore the implications of individual differences for teaching and learning, with an emphasis on evidence-based instructional practices designed to optimize the growth and development of all learners. Explores mental health issues and at-risk students.

**TLT 391 Workshops 1-3 Credits**

Cooperative study of current educational problems. Provides elementary, secondary, and special education teachers an opportunity to work at their own teaching levels and in their own fields. Limited to six credits during a summer session but the student may register for more than one workshop provided there is no duplication in subject matter.

**Repeat Status**: Course may be repeated.

**TLT 394 Special Topics in Education: 1-3 Credits**

Examination of a topic of research or professional interest in education. Subtitle will vary. May be repeated for credit as subtitle varies.

**Repeat Status**: Course may be repeated.

**TLT 401 Overview of Teaching and Learning 3 Credits**

Foundations and key concepts in learning and instructional theory. Cognition and brain-based research with a focus on innovations in teaching and learning.

**TLT 402 Critical Reading and Writing 3 Credits**

Using literature to build persuasive written arguments. Searching and identifying promising sources, distilling research findings, synthesizing literature to support an argument, and organizing written materials to enhance persuasiveness. Suited to those writing qualifying projects, dissertation proposals, dissertations, funding proposals, conference proposals, and journal articles.

**TLT 403 Instructional Design 3 Credits**

Social, cognitive, and environmental factors in designing for teaching and learning. Systems theory applied to learning settings. Special emphasis on motivational theories and technological affordances.
TLT 404 (SPED 404) Diversity, Families, and School Collaborations in K-12 3 Credits
Cultural and linguistic diversity as critical variables in educational equity for all learners, including ELL. Explores home-school partnerships, family and professional collaboration, and teacher self-awareness. Implementing culturally sensitive and responsive classroom practices as well as forming collaborative relationships with families that respect diversity of family contexts. Collaborative, multidisciplinary teaming to support, optimize, and advocate for student's educational needs and connect to community services and resources available to individuals and families. Addresses family mental health issues and wraparound services.

TLT 405 (SPED 405) Principles and Applications of K-12 Assessment 3 Credits
Assessment applied to learning in classroom learning environments, including universal screening and progress monitoring. Discusses assessment approaches, ways to implement assessment, and use of assessment tools to monitor all students, including ELL and students with disabilities. Use of data-management and grading systems. Addresses diagnostic assessments for student placement and analysis of assessment data to tailor instruction to diverse student needs. Emphasis on research-based practices of assessment to inform instructional decision-making consistent with the RtII framework.

TLT 407 Instructional Design for K-12 Classrooms 3 Credits
Introduces the systematic design of instruction following the Response to Instruction and Intervention (RtII) and Universal Design for Learning models. Explores theories of learning and instructional applications as a part of technology-based and standards-aligned classroom education grounded in the use of a quality, research-based core curriculum and effective instructional practices to meet the needs of all learners. Addresses appropriate use of instructional technologies for universal learning. Students will plan, design, and develop student-centered, standards-aligned, technology-supported instruction and appropriate learner assessments.

TLT 409 (SPED 409) K-12 Classroom Environment and Management 3 Credits
Designing inclusive classroom environments that maximize learning. Emphasis on fostering a community of learners using connections among classroom arrangement, classroom management, and cognitive development to create positive learning outcomes for all students, including ELL learners and students with disabilities. Addresses the tiered model of prevention and positive behavior support, including the role of functional assessment and individual positive behavior support plans in classroom management. Highlights the ways a positive climate for learning involves establishing and maintaining partnerships with families.

TLT 410 The Writing Process 3 Credits
Developmental characteristics of children's writing and relationships among writing, spelling and reading. Predictors of writing achievement, teaching strategies and activities, and evaluation schemes will be emphasized, K-12.

TLT 411 (SPED 411) Early Childhood Education 3 Credits
Introduction to development of early childhood education in the U.S. Emphasizes evidence-based methods and materials to assist young children in the learning process, including arrangement of indoor/ outdoor space, developmentally appropriate practices, and the design of instruction to foster young children's emotional, social, language, cognitive, physical, and creative development. Includes embedded instruction and adaptations for students with identified disabilities, children at risk for developing disabilities, and children with culturally and linguistically diverse backgrounds, and family collaboration within the instructional planning process.

TLT 412 Social Studies in PreK through 4th Grade 3 Credits
Overview of Pennsylvania's PreK-4 Standards for social studies, including: Pennsylvania history, United States history, economics, civics and government, citizenship, political science/government, and geography. Development, implementation and evidence-based assessment of preK-grade 4 social studies curricula. Effective teaching techniques such as lesson planning, inclusive practices, integrating instructional technologies into instruction, reflecting on teaching, and the latest research-based teaching and assessment methods. Emphasis on alignment of instruction with standards.

TLT 420 Literacy in PreK through 4th Grade: Reading and Its Foundations 3 Credits
Knowledge of the theories, methods, and materials that can be used to teach reading and early reading skills in PreK-4th grade. Understanding of the skills of successful readers. Evidence-based practices in reading instruction and data-based decision-making to teach reading to all students, including students with disabilities and English learners. Strategies to partner with caregivers to enhance reading an early reading skills.

TLT 422 Literacy in PreK through 4th Grade: Writing and Its Foundations 3 Credits
Knowledge of the theories, methods, and materials that can be used to teach writing and foundational skills in PreK-4. Understanding of the developmental aspects of writing and the skills of successful writers. Evidence-based practices in writing instruction and data-based decision-making to teach writing to all students, including students with disabilities and English learners.

TLT 424 Children's Literature in Elementary Education 3 Credits
Role of literature in the instructional program of the elementary schools. Use of trade books for individualized instruction in reading, language arts, mathematics, science, and social studies.

TLT 426 Science in PreK through 4th Grade 3 Credits
Overview of inquiry-based activities and investigations to promote science learning in preK-grade 4 classrooms. Emphasis on Pennsylvania’s PreK-4 Standards for Science and Technology and Environment and Ecology standards and aligning instruction with standards. Activities include planning effective lessons, trying out new methods of teaching, reflective practice, inclusionary methods, and integrating instructional technologies into science learning. Evidence-based assessment types are highlighted within instructional contexts.

TLT 428 Mathematics and Numeracy in PreK through 4th Grade 3 Credits
Trends, theories, activities and manipulative materials for teaching early numeracy and elementary mathematics. Pre-school development and in-school skills and concepts, including sets, systems of numeration, experience with numbers, number operations and concepts, numerals, measurement, early algebra, and elements of geometry. Implications of developmental differences and early non-school experiences on learner readiness and skills. Helping parents support their children’s mathematics conceptual development. Research-based practices and inclusionary approaches to teach mathematics to learners from a variety of backgrounds and across ability levels.

TLT 431 Social Studies in Middle Level and High School Education 3 Credits
Middle and high school curriculum, content, teaching strategies, and instructional materials for the social studies. Emphasis on organizing content, using appropriate methods, testing and evaluation, and appropriate integration of technology. Overview of Pennsylvania's 4-8 and 8-12 standards for social studies and related standards from the National Council for the Social Studies and other national organizations. Explores relevant research, courses of study, textbooks, and teacher-made materials. Addresses inclusive evidence-based and standards-aligned instructional approaches and techniques, including co-teaching.
TLT 432 Reading and Critical Thinking in Middle Level and High School Education 3 Credits
Development of reading in the secondary content areas (English/language arts, mathematics, science, social studies). Highlights effective teaching strategies in critical areas, such as higher order reading and study skills. Addresses analysis of evidence-based methods and current research for improving reading development and analytical skills of all students.

TLT 434 English in Middle Level and High School Education 3 Credits
Curricula, philosophy, methods, strategies, and materials for the teaching of middle and high school English. Literature, genres, and the nature of text and text differences. Critical analysis and drawing inferences from narrative text and poetry. Techniques for teaching and enhancing writing in various styles. Applications of technology and assessment principles. Addresses inclusive evidence-based and standards-aligned instructional approaches and techniques, including co-teaching.

TLT 436 Science in Middle Level and High School Education 3 Credits
Overview of inquiry-based activities and investigations to promote science learning in secondary science classrooms. Emphasis on aligning instruction with Pennsylvania’s Standards for Science and Technology and Environment and Ecology standards. Activities include planning effective lessons, trying out new methods of teaching, inquiry-based methods, reflective practice, and integrating instructional technologies into science learning. Evidence-based assessment types highlighted within instructional contexts.

TLT 438 Mathematics in Middle Level and High School Education 3 Credits
Standards-based and technology-intensive curricula, instructional activities, and manipulative aids for mathematics in middle level and high schools. This course models and explores an investigative and hands-on approach to secondary mathematics instruction. Particular attention given to learning theories, curriculum issues, and recommendations arising from state, national, and international assessments. Research-based practices and inclusionary approaches to teach mathematics to learners from a variety of backgrounds and across a range of abilities. Addresses standards-aligned instructional approaches and techniques, including co-teaching.

TLT 440 Pre-professional Seminar 3 Credits
Study, directed observation of, and initial practice in the various phases of teaching in secondary schools. Guided opportunities to try out strategies to facilitate the inclusion of special education students, differentiated instructional practices, and standards-aligned and evidence-based instructional approaches in actual school settings. Consent of program coordinator required.

TLT 442 (SPED 442) General Education and Special Education Student Teaching and Seminar 1-6 Credits
Intensive practice in the application of principles of teaching for both general and special education settings in a supervised internship in the schools (for dual certification). Regular meetings among student teachers for critical analysis and discussion of classroom instructional practices, as illustrated by the student teachers’ experiences in the schools. Practical mentoring on professionalism, applying differentiated instructional models in real-world setting, and aligning instruction with standards. Consent of program director required.

TLT 444 General Education Student Teaching and Seminar 1-6 Credits
Intensive practice in the application of principles of teaching for general education settings in a supervised internship in the schools. Regular meetings among student teachers for critical analysis and discussion of classroom instructional practices, as illustrated by the student teachers’ experiences in the schools. Practical mentoring on professionalism, applying differentiated instructional models in real-world setting, and aligning instruction with standards. Consent of program director required.

TLT 445 Applied Instructional and Interface Design Principles 3 Credits
Exploration and application of design models for learning. Special emphasis on the application of perception theory, communication theory, and learning theory to the design of media for teaching and learning.
Prerequisites: TLT 403

TLT 456 Instructional Design and Development Studio 3 Credits
Studio-based, authentic and collaborative design experiences led by a faculty mentor. Students work in teams to complete substantial multimedia design and development projects.
Prerequisites: TLT 454 and TLT 460

TLT 458 Introduction to Multimedia Programming and Resource Development for Learning 3 Credits
Introduction to programming and resource development tools used in the creation of interactive multimedia teaching and learning materials.

TLT 460 Advanced Multimedia Programming and Resource Development for Learning 3 Credits
Advanced exploration of programming and resource development tools used in the creation of interactive teaching and learning materials.
Prerequisites: TLT 458

TLT 462 Special Topics in Development of Instructional Resources and Technologies for Learning 1-3 Credits
We know the use of technology in education will continue to increase. This course extrapolates current research to envision the innovations we can expect in a planning horizon of 2 to 5 years. We will study schools and systems that use emerging technologies today that could be widely adopted tomorrow. The course focuses equally on technology and pedagogy.
Repeat Status: Course may be repeated.

TLT 466 Field Experience: General Education Certification 1-3 Credits
Intensive practice in the application of principles of teaching in general education in a supervised experience in the schools for students who already hold special education certification. Practical mentoring on professionalism, applying differentiated instructional models in real-world setting, and aligning instruction with standards. Consent of the program director.

TLT 470 Technology for Teaching and Learning 3 Credits
Analysis of available technologies (hardware, software, and Web resources), and identification of technologies matched to learner needs in traditional and/or non-traditional settings.

TLT 472 Online Teaching and Learning 3 Credits
Examination of contemporary research on online learning and recognized best practices on the design and delivery of online, hybrid, and/or flipped courses or course modules. Emphasis on online activities to experience ways to maximize instructor presence and student engagement, collaboration, and achievement.

TLT 474 Large-scale Planning and Implementation of Educational Technology 3 Credits
Addresses topics such as planning, maintaining, funding, networking, staffing, staff development, and monitoring of educational technology implementations.

TLT 476 Assessment of Instructional Technologies 3 Credits
Techniques for evaluating technology implementations for teaching and learning. Focus on topics such as instrumentation, data collection and analysis, drawing conclusions from data sets, and preparing reports for stakeholders.

TLT 480 Curriculum Theory and Design 3 Credits
Curricular models and their features, with a focus on curriculum development and enactment. Special emphasis on design principles, curriculum’s role in K-12 settings, and technology-enhanced curriculum.
The mission of Lehigh’s College of Health will be to understand, preserve and improve the health and well-being of populations and communities through excellence, innovation, research, education and service. The goals for the College of Health align with this mission and the university’s mission of truly interdisciplinary research and service.

The College of Health will incorporate cutting-edge and innovative coursework, distance learning and experiential learning, with educational programs in epidemiology, biostatistics, social and behavioral health, and health innovation and technology—all of which will build on Lehigh’s existing strengths in bioengineering, health systems, health economics and early childhood health. The College will also leverage Lehigh’s robust experiential and international academic culture as it prepares students for the global workplace.

The spirit of innovation and technology will be woven into all aspects of the educational and research programs. Research results will be made accessible to the populations studied to facilitate deeper understanding and clear decision making through creative data visualization. These goals will seek to draw upon the humanities to better tell the stories of our communities and the health experiences of our population through narrative and visual arts. College of Health students will be equipped with the knowledge, skills and expertise that they will need for leadership in health related organizations, including nonprofit organizations, governmental agencies, the private sector and academia.

To read more about Lehigh’s innovative new College of Health, click (https://www1.lehigh.edu/health) here (https://www1.lehigh.edu/health). (https://www1.lehigh.edu/health)

P.C. Rossin College of Engineering and Applied Science

Stephen P. DeWeerth, Dean
John P. Coulter, Senior Associate Dean for Research
Gregory L. Tonkay, Associate Dean for Academic Affairs
Svetlana Tatic-Lucic, Associate Dean for Faculty Development
Donna Mohr, Assistant Dean

The P.C. Rossin College of Engineering and Applied Science offers the bachelor of science degree in 17 programs, combining a strong background in sciences and mathematics with requirements in humanities and social sciences. Students in college programs learn principles they can apply immediately in professional work; those who plan on further academic experience can design a curriculum centering on interests they will pursue in graduate school.

The mission of the college is to prepare undergraduate and graduate students to be critical thinkers, problem solvers, innovators, leaders and life-long learners in a global society and to create an environment where students pursue cutting-edge research in engineering and engineering science.

DEGREE PROGRAMS

The P.C. Rossin College of Engineering and Applied Science includes eight departments and offers undergraduate and graduate degree programs at the bachelor, master, and doctor of philosophy levels. The undergraduate degree programs leading to the bachelor of science degree are:

- Applied Science (p. 359)
- Bioengineering (p. 361)¹
- Chemical Engineering (p. 367)¹
- Chemistry (p. 98)
- Civil Engineering (p. 375)¹
- Computer Engineering (p. 386)¹
- Computer Science (p. 388)²
- Computer Science And Business (p. 437)³
- Electrical Engineering (p. 398)¹
- Engineering Mechanics (p. 424)
- Engineering Physics (p. 396)
- Environmental Engineering (p. 375)¹
- Industrial & Systems Engineering (p. 410)¹
- Integrated Business And Engineering (p. 444)⁴
- Integrated Degree In Engineering, Arts And Sciences (p. 442)
- Materials Science And Engineering (p. 417)¹
- Mechanical Engineering (p. 424)¹

¹ Accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org
² Accredited by the Computing Accreditation Commission of ABET, http://www.abet.org
³ Accredited by the Computing Accreditation Commission of ABET, http://www.abet.org and AACSB, the Association to Advance Collegiate Schools of Business
⁴ Accredited by AACSB, the Association to Advance Collegiate Schools of Business

Programs in chemistry and physics have been approved by the faculty program review committee in these disciplines.

FIRST YEAR COURSES FOR ENGINEERING DEGREES

<table>
<thead>
<tr>
<th>First Year</th>
<th>First Semester</th>
<th>Second Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 001</td>
<td>3</td>
<td>ENGL 002</td>
</tr>
<tr>
<td>MATH 021</td>
<td>4</td>
<td>MATH 022</td>
</tr>
</tbody>
</table>
| ENGR 005   | 2              | Select one of the following: 5-6
|            |                | CHM 030 & ENGR 010 |
|            |                | 5-6 PHY 011 & ENGR 010 |
|            |                | 5-6 PHY 012 & ENGR 010 |
| PHY 011 & PHY 012 | 5 HSS Elective | 3-4 |

Total Credits: 29-32

Bioengineering students take CHM 030 and ENGR 010 in the fall along with BIOE 001 instead of ENGR 005. In the spring they take BIOS 041 (instead of HSS elective) along with PHY 011/012. The HSS elective is pushed to later semesters.

Students in Computer Science and Business, Integrated Business and Engineering, and Integrated Degree in Engineering, Arts and Sciences follow a different first year curriculum.
MINIMUM HUMANITIES/SOCIAL SCIENCES (HSS) REQUIREMENTS FOR ALL ENGINEERING PROGRAMS

Basic Requirement
Economics and English. Three courses totaling a minimum of ten credit hours: Students must complete all three:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECO 001</td>
<td>Principles of Economics</td>
<td>4</td>
</tr>
<tr>
<td>ENGL 001</td>
<td>Critical Reading and Composition</td>
<td>3</td>
</tr>
<tr>
<td>or ENGL 003</td>
<td>Composition and Literature I for International Writers</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 002</td>
<td>Research and Argument</td>
<td>3</td>
</tr>
<tr>
<td>or ENGL 005</td>
<td>Composition and Literature II for International Writers</td>
<td>3</td>
</tr>
<tr>
<td>or ENGL 011</td>
<td>Seminar in Critical Reading &amp; Writing</td>
<td></td>
</tr>
</tbody>
</table>

Note: ENGL 011 is only for students with AP credit for ENGL 001.

Total Credits: 10

Advanced Requirement
A minimum of four multi-credit courses and a minimum of 13 credits in courses designated as HU (humanities) or SS (social science), with the following restrictions:

1. Depth: At least eight credits must be in a common discipline and from the same department or program. At least three of these credits must be at the 100-level or above, or at the intermediate level above for a single modern foreign language.

2. Breadth: At least three credits in a discipline different from, and not cross-listed with, the discipline employed to satisfy the depth requirement.

3. At least three credits must be designated as HU.

4. None of the courses used for HSS can be taken Pass/Fail.

5. None of the course can be one-credit courses.

FREE ELECTIVES
The college, through its advisors, is prepared to help students to use the credit hours of “free electives” that, along with other electives in the curriculum, may be used to develop a program of personal interest. Free electives may be satisfied by taking regular course offerings or up to six credit hours from each of the following from Mus 21-79, from Jour 1-8, or up to six credit hours of advanced ROTC courses.

INTERDISCIPLINARY DEGREES

Computer science & business
The College of Business and the Computer Science and Engineering department in the P.C. Rossin College of Engineering and Applied Science jointly offer the Computer Science and Business (CSB) program. It is a four-year program that is fully accredited by AACSB International, the Association to Advance Collegiate Schools of Business, and by the Computing Accreditation Commission of ABET, http://www.abet.org.

Integrated Business & Engineering Honors Program

The Integrated Business and Engineering Honors Program (IBE) is offered jointly by the P.C. Rossin College of Engineering and Applied Science and the College of Business. The program recognizes the need for today’s leaders in business and industry to have a sound foundation in both commerce and technology.

After four years and a minimum of 137 credits, students will receive a single Bachelor of Science Degree in Integrated Business and Engineering. The program meets the accreditation standards of the American Assembly of Collegiate Schools of Business. Students are expected to maintain a minimum GPA of 3.25 in order to remain in the program.

A second option is the five-year dual degree program. This option allows students to obtain a second Bachelor of Science degree in engineering by completing course work in the engineering field chosen by the student as their IBE major. Students enrolled in the four year IBE Honors Program and in satisfactory standing are able to transfer to a dual-degree at any time, and stay within the honors program cohort. The additional time necessary to complete the second degree will depend on the curriculum selected, and the number of advanced placement credits.

The number of additional credit hours will typically be in the range of 20 to 30.

Students in the IBE Honors Program can major in nearly any area of engineering or business that Lehigh offers. After their freshman year, each student will declare a major in either the P. C. Rossin College of Engineering and Applied Science or the College of Business.

Admission to the Integrated Business and Engineering Program is highly selective, with annual admission limited to approximately 50 students. The University’s Office of Admissions can explain the procedure for applying to the program. It is possible that a small number of exceptional students may be admitted to the program following the completion of their freshman year. Admission at this point would be highly competitive and based upon freshman year GPA, faculty recommendations, and space availability.

The Co-Directors of the IBE Honors Program are Robert H. Storer, Professor of Industrial and Systems Engineering (rhsz@lehigh.edu) and Richard J. Kish, Professor of Finance (rk7@lehigh.edu) (sgb2@lehigh.edu). For additional information, see the IBE Honors Program or visit the IBE web site at www.lehigh.edu/IBE.
coursework of the junior year. The Co-Op experience is completed with a second work rotation the following summer (mid-May through August). Students earn three, free elective credits per successful work assignment for a total of six free elective credits. These six credits are in ENGR 200 (p. 407) and are taken as P/F (Pass/Fail).

Technical minors (Available to all students but most require prerequisites from engineering curricula)

<table>
<thead>
<tr>
<th>Technical Minor</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>aerospace engineering</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>biotechnology</td>
<td>Chemical Engineering</td>
</tr>
<tr>
<td>chemical engineering</td>
<td>Chemical Engineering</td>
</tr>
<tr>
<td>computer science</td>
<td>Computer Science and Engineering</td>
</tr>
<tr>
<td>electrical engineering</td>
<td>Electrical Engineering</td>
</tr>
<tr>
<td>engineering leadership</td>
<td>Industrial and Systems Engineering</td>
</tr>
<tr>
<td>energy engineering</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>environmental engineering</td>
<td>Civil &amp; Environmental Engineering</td>
</tr>
<tr>
<td>manufacturing systems</td>
<td>Industrial &amp; Systems Engineering</td>
</tr>
<tr>
<td>materials science</td>
<td>Materials Science &amp; Engineering</td>
</tr>
<tr>
<td>nanotechnology</td>
<td>Materials Science &amp; Engineering</td>
</tr>
<tr>
<td>polymer science</td>
<td>Center for Polymer Science</td>
</tr>
<tr>
<td></td>
<td>Engineering</td>
</tr>
</tbody>
</table>

Interdisciplinary Minors (For engineering students)

A minor in Engineering Leadership provides students with knowledge, experiences and interaction with successful business managers in order to become more effective leaders. For more information about this minor: http://www.lehigh.edu/~inleader/curriculum.html

The College of Business offers a minor in Business for students in the College of Arts and Sciences and P.C. Rossin College of Engineering and Applied Science to provide students with knowledge and skills to allow them to make informed business decisions. A sequential sequence of courses is designed to integrate such traditional topics as accounting, finance, marketing, and management. For more information about his minor: http://cbe.lehigh.edu/academics/undergraduate/degree-programs/business-minor . There is also a minor in Real Estate: http://cbe.lehigh.edu/academics/undergraduate/degree-programs/real-estate-minor and a minor in Entrepreneurship: http://cbe.lehigh.edu/academics/undergraduate/degree-programs/entrepreneurship-minor . The courses in the latter treat subjects such as intellectual property, creativity and innovation, venture capital, positioning of products and services, and understanding the entrepreneurial mindset.

Students in engineering can also earn a minor in various humanities or social sciences by using their humanities and social science electives coupled with their free electives.

Engineering Minor (for non-engineering students)

The College of Engineering enables undergraduate students enrolled in the Colleges of Arts and Sciences and in the College of Business to earn a minor in engineering. This unique program provides students with insight into the world of engineers: who they are, what they do, and how they think. Students pursuing the Engineering Minor develop an understanding of the tools and techniques engineering use on a day-to-day basis.

The mission of the minor is to educate non-engineering students about engineering methodology, specifically how engineers solve problems; how they design, manufacture, and analyze problems; and how other factors such as economics, safety, ethics, and environmental issues affect the engineering design process. Fifteen credit hours of required and elective coursework are required to fulfill the engineering minor. For more information about this minor: http://www.lehigh.edu/~inengmr/ index.html

Music Option

Music and Engineering is not a major in itself. However, Lehigh attracts many engineering and science students who wish to continue their active involvement in music and the music department. For those students who are interested in pursuing this option, music can be taken as a second degree, minor or through free electives.

Undergraduate research through Centers and Institutes

Faculty and students in the college also have research and scholarship activities in a number of centers and institutes, where graduate and undergraduate students work closely with faculty members.

Applied Science

Director, Associate Dean for Academic Affairs of the P.C. Rossin College of Engineering and Applied Science

The Applied Science Program enables students to create interdisciplinary specialties that prepare them for careers in a world that increasingly bridges academic disciplines. Students pursue subject-area concentrations that represent academic interests they wish to integrate into a meaningful program. The core offers students the intellectual tools to identify connections between the concentrations and engage in interdisciplinary problem-solving and critical thinking.

The program leads to the Bachelor of Science in Applied Science. Each student's curriculum combines a general engineering education with a carefully customized concentration in engineering and/or science as well as another area of emphasis, which may include courses taken inside the P.C. Rossin College of Engineering & Applied Science and may also include courses taken in one or more of the other three Colleges within the University.

In order to ensure the success of this individualized approach to education, Applied Science places primary emphasis on advisement. Each student is teamed with an advisor who helps the student plan the course of study and who supervises independent study and internships. The advisor remains the student’s advisor throughout his or her undergraduate career.

Unlike students in the traditional college programs, students in the Applied Science program of individualized study do not declare a major in a particular academic department. Instead, they develop a concentration that may combine study in several areas. Students are encouraged by their advisor to develop the concentration in such a way that the student will be well prepared for further study in graduate school or for pursuing a particular career path. While the chosen concentration can be highly customized in consultation with the advisor, examples of concentrations include: Technical Communications, Digital Media, Entertainment Science, Technology/Science and Education, Technology/Science and Pre-law, Technology/Science and Pre-Medicine, Technology Management, Technology Marketing, and Engineering and Architecture. Many other combinations are possible.

The requirements for a BS in Applied Science program are a minimum of 128 credit hours including:

First Year Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 001</td>
<td>Critical Reading and Composition</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 002</td>
<td>Research and Argument</td>
<td>3</td>
</tr>
<tr>
<td>ENGR 005</td>
<td>Introduction to Engineering Practice</td>
<td>2</td>
</tr>
<tr>
<td>ENGR 010</td>
<td>Applied Engineering Computer Methods</td>
<td>2</td>
</tr>
<tr>
<td>CHM 030</td>
<td>Introduction to Chemical Principles</td>
<td>4</td>
</tr>
<tr>
<td>PHY 011 &amp; PHY 012</td>
<td>Introductory Physics I &amp; II Laboratory I</td>
<td>5</td>
</tr>
<tr>
<td>MATH 021</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 022</td>
<td>Calculus II</td>
<td>4</td>
</tr>
</tbody>
</table>

Other Natural Science

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM 031</td>
<td>Chemical Equilibria in Aqueous Systems</td>
<td>4</td>
</tr>
<tr>
<td>BIOS 041</td>
<td>Biology Core I: Cellular and Molecular</td>
<td>3</td>
</tr>
<tr>
<td>EES 080</td>
<td>Introduction to the Earth System</td>
<td>4</td>
</tr>
<tr>
<td>PHY 021 &amp; PHY 022</td>
<td>Introductory Physics I &amp; II Laboratory II</td>
<td>5</td>
</tr>
</tbody>
</table>

Other Mathematics

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 021</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 022</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 023</td>
<td>Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>MATH 205</td>
<td>Linear Methods</td>
<td>3</td>
</tr>
</tbody>
</table>
Engineering and Applied Science discipline degree program with any course of study in Arts-Engineering may link any College of Engineering and Applied Science requirements of the College of Arts and Sciences while also satisfying distribution requirements in consultation with advisers in both colleges is necessary to guarantee completion of all major, distribution and total credit requirements for the Bachelor of Arts-Biology degree.

For all students, very careful planning of the academic program done in consultation with advisers in both colleges is necessary to guarantee completion of all major, distribution and total credit requirements for the two degrees in five years. Courses selected must fulfill major and distribution requirements of both the College of Arts and Sciences and the College of Engineering and Applied Science.

Selection of a major in the College of Engineering and Applied Science occurs prior to beginning the sophomore year. A major leading to a degree in the College of Arts and Sciences should be chosen prior to beginning the junior year. Arts-Engineering candidates should recognize that pursuit of a bachelor of arts program with larger than average credit requirements (e.g., art, architecture, physical sciences, cognitive science, international careers, among others) will severely restrict choices of free electives.

Courses selected must fulfill major and distribution requirements of both the College of Arts and Sciences and the College of Engineering and Applied Science. For all students, very careful planning of the academic program done in consultation with advisers in both colleges is necessary to guarantee completion of all major, distribution and total credit requirements for the two degrees in five years. When selected properly, courses meet distribution requirements in the College of Arts and Sciences while also satisfying distribution requirements of the College of Engineering and Applied Science.

A course of study in Arts-Engineering may link any College of Engineering and Applied Science discipline degree program with any College of Arts and Sciences major. Please see individual departments for details concerning required courses and sequences for completing discipline – specific degrees and combinations of degree requirements for Arts Engineering. Below is a template listing all courses required for a civil engineering-architecture combination (the most common Arts-Engineering linkage). Please note that the large number of required credits for both degrees means that this combination results in a larger number of total credits than is required for some other combinations.

CIVIL ENGINEERING - ARCHITECTURE
A total of 164-169 credits is needed for the Bachelor of Science in Civil Engineering and the Bachelor of Art in Architecture degrees.

### First Year

**First Semester**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 001</td>
<td>3</td>
</tr>
<tr>
<td>MATH 021</td>
<td>4</td>
</tr>
<tr>
<td>PHY 011</td>
<td>4</td>
</tr>
<tr>
<td>PHY 012</td>
<td>1</td>
</tr>
<tr>
<td>(Dept) 90 College Seminar or FYC</td>
<td>1-4</td>
</tr>
<tr>
<td>ENGR 005</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td>15-18</td>
</tr>
</tbody>
</table>

**Second Semester**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 002</td>
<td>3</td>
</tr>
<tr>
<td>MATH 022</td>
<td>4</td>
</tr>
<tr>
<td>CHM 030</td>
<td>4</td>
</tr>
<tr>
<td>ENGR 010</td>
<td>2</td>
</tr>
<tr>
<td>Humanities /Social Science Elective</td>
<td>3-4</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td>16-17</td>
</tr>
</tbody>
</table>

### Second Year

**First Semester**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 023</td>
<td>4</td>
</tr>
<tr>
<td>CEE 003</td>
<td>3</td>
</tr>
<tr>
<td>CEE 010</td>
<td>3</td>
</tr>
<tr>
<td>ART 001</td>
<td>4</td>
</tr>
<tr>
<td>ART 003</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td>18</td>
</tr>
</tbody>
</table>

**Second Semester**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 205</td>
<td>3</td>
</tr>
<tr>
<td>CEE 059</td>
<td>3</td>
</tr>
<tr>
<td>PHY 021 &amp; PHY 022</td>
<td>5</td>
</tr>
<tr>
<td>ARCH 002</td>
<td>4</td>
</tr>
<tr>
<td>ARCH 004</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td>19</td>
</tr>
</tbody>
</table>

### Third Year

**First Semester**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE 117</td>
<td>2</td>
</tr>
<tr>
<td>CEE 222</td>
<td>3</td>
</tr>
<tr>
<td>ARCH 143</td>
<td>4</td>
</tr>
<tr>
<td>ECO 001</td>
<td>4</td>
</tr>
<tr>
<td>Architectural History Elective</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td>16</td>
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</tbody>
</table>

**Second Semester**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE 202</td>
<td>3</td>
</tr>
<tr>
<td>CEE 242</td>
<td>3</td>
</tr>
<tr>
<td>CEE 262 or 264</td>
<td>3</td>
</tr>
<tr>
<td>ARCH 343</td>
<td>4</td>
</tr>
<tr>
<td>ARCH 210</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td>17</td>
</tr>
</tbody>
</table>

### Fourth Year

**First Semester**

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### Fifth Year

**First Semester**

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<tr>
<td>Civil Engineering Approved electives</td>
<td>8-9</td>
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<tr>
<td>Architectural History Elective</td>
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### Required HSS courses

- ECO 001 Principles of Economics 4
- PHIL 128 Philosophy Of Science 4
- or HIST 008 Technology in Modern America 4
- or HIST 145 Introduction to the History of Science 4
- or POLS 106 Environmental Values and Ethics 4
- PSYC 001 Introduction to Psychology 4

### Humanities & Social Science electives

Select 13 additional credits subject to college requirements. 13

### Major electives

Select 24 credits 24

### Approved electives

Select 18 credits 18

### Arts-Engineering

Program co-directors, William Best, MS, (Virginia Tech), professor of practice of mechanical engineering and Nikolai Nikolov, M. Arch, (Rice University), associate professor of architecture. The Arts-Engineering program provides the student with an opportunity to experience the breadth of an arts education and simultaneously follow the focused curriculum of an engineering major. This is a five-year, dual degree program administered by the College of Arts and Sciences and the College of Engineering and Applied Science, the latter a professional degree.

A typical freshman year class schedule for an Arts-Engineer is shown below. Note that an Arts-Bioengineering program has a different freshman year class schedule.

<table>
<thead>
<tr>
<th>First Year</th>
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<th>CR</th>
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<td>ENGL 002</td>
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<tr>
<td>MATH 021</td>
<td>4</td>
<td>MATH 022</td>
<td>4</td>
</tr>
<tr>
<td>PHY 011 &amp; PHY 012</td>
<td>5</td>
<td>CHM 030</td>
<td>4</td>
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<td>Humanities /Social Science Elective</td>
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<tr>
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<td>ENGR 010</td>
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### College of Engineering and Applied Science

Total Credits: 31-35

A typical freshman year class schedule for an Arts-Engineer is shown below. Note that an Arts-Bioengineering program has a different freshman year class schedule.

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<tr>
<th>First Year</th>
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<th>Second Semester</th>
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<tr>
<td>ENGL 001</td>
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<td>ENGL 002</td>
<td>3</td>
</tr>
<tr>
<td>MATH 021</td>
<td>4</td>
<td>MATH 022</td>
<td>4</td>
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<tr>
<td>PHY 011</td>
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<tr>
<td>PHY 012</td>
<td>1</td>
<td>ENGR 010</td>
<td>2</td>
</tr>
<tr>
<td>(Dept) 90 College Seminar or FYC</td>
<td>1-4</td>
<td>Humanities /Social Science Elective</td>
<td>3-4</td>
</tr>
<tr>
<td>ENGR 005</td>
<td>2</td>
<td>ENGR 010</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total Credits:</strong></td>
<td>15-18</td>
<td>16-17</td>
<td></td>
</tr>
</tbody>
</table>
Bioengineering

Bioengineering is a broad and rapidly evolving field. At the core of its varied options is the goal of advancing human health through scientific discovery and through the development of new biomedical technologies. The Bioengineering Department at Lehigh offers a Bachelor of Science degree in Bioengineering to undergraduate students as well as graduate programs leading to the Master of Science and Doctor of Philosophy degrees in Bioengineering.

OUR MISSION

The mission of the Bioengineering Department at Lehigh University is to prepare students to be critical thinkers, problem solvers, innovators, leaders, and life-long learners in the field of Bioengineering. We aim to produce ground-breaking research and new knowledge at the interface of the physical and life sciences, and engineering.

OVERVIEW

As the newest engineering department at Lehigh, we hold true to the Lehigh tradition of world-class excellence in education and research. We accomplish this with outstanding and dedicated faculty members, a vibrant curriculum, state of the art technologies, and a highly integrative and interdisciplinary, research-driven focus.

Our undergraduate curriculum fuses comprehensive fundamentals in engineering and physical sciences, such as fluid mechanics, physics, chemistry and thermodynamics, with a focus on biological systems and bioengineering applications — and then combines it with valuable hands-on, experiential learning opportunities. The result is a rigorous training regimen that prepares our students to be at the forefront of established and emerging fields such as pharmaceuticals, biomaterials, healthcare, bioelectronics, biomedicine and other biotechnology-related industries.

Lehigh's graduate program in Bioengineering trains students to combine life and physical sciences and engineering to develop effective and affordable solutions for health care and biotechnology problems. We offer diverse opportunities for advanced studies in areas such as biomaterials, computational bioengineering, biomechanics, optics, nanotechnology, biosensors, biophotonics and bioelectronics. Our key research themes are (1) Biocomputations and Modeling, (2) Diagnostics, Sensors, and Devices, and (3) Materials and Therapies. Our graduate students are an integral part of this active and multi-disciplinary research environment.

For more information, please visit our website: http://www.lehigh.edu/bioe/

Professors Of Practice. Lori Herz, PHD (Rutgers University); Susan Fueshko Perry, PHD (The Pennsylvania State University)

UNDERGRADUATE PROGRAM

PROGRAM EDUCATIONAL OBJECTIVES

The Bioengineering Department has established the following set of Program Educational Objectives for our undergraduate program. Three to five years after graduation, we expect that:

1. Graduates in professional practice function effectively as responsible and collaborative professionals in Bioengineering or in a related field.
2. Graduates pursue advanced degrees or engage in other forms of continuing education.

STUDENT OUTCOMES

The Bioengineering program has established that by graduation students will attain:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

DESCRIPTION

The B.S. in Bioengineering degree provides a structured curriculum comprised of three tracks. Biopharmaceutical Engineering is for students whose interests lie in genomics, proteomics, bioinformatics, recombinant DNA, protein engineering, bioprocessing, drug synthesis and delivery. The Bioelectronics/photonics track covers education and research dealing with signal processing, biosensors, MEMs, biochips for DNA sequencing, laser and fiber based optical technology for biomedical applications. The Biomechanics and Biomaterials track encompasses applications of engineering principles to an understanding of biology and physiology, ranging from cells and tissues to organs and systems.

The B.S. in Bioengineering will prepare students for careers in established and emerging fields that require combining engineering principles with the life sciences. Potential paths open to students include the health care, biomedical, pharmaceutical, biomaterials, and other biotechnology related industries through careers in medicine or graduate studies.

The program strongly encourages experiential learning, including two summers of internships, required participation in Lehigh's Technical Entrepreneurship Capstone Design Projects, and opportunities for undergraduate research for credit.

A total of 132 credit hours are required for graduation with a degree of bachelor of science in bioengineering.

BIOENGINEERING CORE REQUIREMENTS

General Requirements

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<th>Course</th>
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<td>ECO 001</td>
<td>Principles of Economics</td>
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<td>BIOE 226</td>
<td>Ethics in Bioengineering Practice</td>
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<td>or PHIL 116</td>
<td>Bioethics</td>
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<tr>
<td>or PHIL 105</td>
<td>Ethics</td>
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Note: The College of Arts and Sciences requires a junior writing intensive course. This may be filled by an appropriate choice of elective.

Art Studio Elective  4

14-15

16

Total Credits: 164-169

1 One Architectural History elective should be filled by a course designated (SS) in order to fulfill the social science distribution requirement.
2 Of 17 CEE approved elective credits required for Civil Engineering three credits are satisfied by ARCH 343.
3 Multidisciplinary teaming versions of CEE 205 or CEE 381 can be substituted with departmental permission.
4 Basic Science Elective - List of approved courses is available from the CEE department.

Note: The College of Arts and Sciences requires a junior writing intensive course. This may be filled by an appropriate choice of elective.

Professors Of Practice. Lori Herz, PHD (Rutgers University); Susan Fueshko Perry, PHD (The Pennsylvania State University)
ENGR 010 Applied Engineering Computer Methods 2

Electives to satisfy HSS depth and breadth requirements 13
Free Electives (Number of general requirements and free elective credits are track-dependent.) 3-5

Mathematics
MATH 021 Calculus I 4
MATH 022 Calculus II 4
MATH 023 Calculus III 4
MATH 205 Linear Methods 1 3
MATH 231 Probability and Statistics 1 3

Chemistry
CHM 030 Introduction to Chemical Principles 4
CHM 031 Chemical Equilibria in Aqueous Systems 4
CHM 110 & CHM 111 Organic Chemistry I and Organic Chemistry Laboratory I 4

Biological Sciences
BIOS 041 & BIOS 042 Biology Core I: Cellular and Molecular and Biology Core I: Cellular and Molecular Lab 4
BIOS 115 & BIOS 116 Biology Core II: Genetics and Biology Core II: Genetics Laboratory 4

Integrated Bioengineering
Required by all Three Tracks
BIOE 001 Freshman Seminar 1, Introduction to Bioengineering 1: Philosophy to Practice (Pass/Fail) 1
BIOE 002 Freshman Seminar 2, Introduction to Bioengineering 2: Current Topics (Pass/Fail) 1
BIOE 110 Elements of Bioengineering 4
BIOE 210 Introduction to Engineering Physiology 4
TE 211 Capstone Design Projects-1 3
TE 212 Capstone Design Projects-2 2
BIOE 225 GMP Good manufacturing practice and regulatory affairs for bioengineers 1

Engineering Requirement by Track
Select one of the following tracks: 22-24

Biopharmaceutical Engineering Track
CHM 112 Organic Chemistry II 4
BIOE 343 Integrated Biotechnology Laboratory 5
MAT 033 Engineering Materials and Processes 4
CHE 031 Material and Energy Balances of Chemical Processes 4
CHE 210 Chemical Engineering Thermodynamics 3
CHE 211 Chemical Reactor Design 2
BIOE 247 Biological Fluid Mechanics 4

Bioelectronic/Biophotonics Track
ECE 108 Signals and Systems 4
BIOE 331 Integrated Bioelectronics/Biophotonics Laboratory 5
ECE 081 Principles of Electrical Engineering 4
ECE 121 Electronic Circuits Laboratory 4
ECE 123 Electronic Circuits 4
ECE 202 Introduction to Electromagnetics 4

MECH 003 Fundamentals of Engineering Mechanics 2
MAT 033 Engineering Materials and Processes 3

Biomechanics and Biomaterials Track
MECH 003 Fundamentals of Engineering Mechanics 2
MECH 012 Strength of Materials 4
MAT 033 Engineering Materials and Processes 3
MAT 205 Thermodynamics of Macro/Nanoscale Materials 4
ME or ME 104 Thermodynamics I 3
BIOE 257 Biomechanics and Biomaterials 4
BIOE 357 Integrated Biomechanics Laboratory 4

BIOE 247 Biological Fluid Mechanics 4

Bioengineering Electives
Select one of the following: 3
BIUE/ME 315 Bioengineering Statistics 3
BIOE 341 Biotechnology I 3
BIOE/PHY 321 Biomolecular & Cellular Mechanics 4
BIOE 349 Metabolic Engineering 4
BIOE/CHE 345 Quantitative Biology 4
ECE 337 Introduction to Micro- and Nanofabrication 3

Technical Electives 4 9

Total Credits 127-131

1 Students must achieve a minimum of a C- in both MATH 205 and MATH 231 for the B.S. in Bioengineering.
2 Note: BIOE 349 (Metabolic Engineering) may be taken in lieu of CHE 211. If BIOE 349 is taken instead of CHE 211, it may not count as an elective.
3 Students in the Biopharmaceutical Engineering track are required to take BIOE 341, since it is a prerequisite for BIOE 343.
4 Students must take nine (9) credits of technical electives, which include undergraduate research, graphics for engineering design, engineering courses at the 200-level or higher, and BIOS/CHM/PHY/MATH courses at the 200-level or higher. (Some 200-level courses are excluded from this list; the complete list of approved courses is available from the Bioengineering Program.) At least three (3) of the nine (9) credits must be a BIOE class at the 300-level or higher. No more than six (6) credits can be from CSE 002, CSE 017, ME 010, BIOE 020, BIOE 132, BIOE 142, BIOE 242, and BIOE 290.

TYPICAL FOUR-YEAR COURSE SCHEDULE FOR BS IN BIOENGINEERING

Biopharmaceutical Engineering Track

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Second Year

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#### Total Credits: 132

### Biomechanics and Biomaterials Track

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#### Total Credits: 132

### Bioelectronics/Biophotonics Track

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</table>

#### Total Credits: 136

### GRADUATE PROGRAM

Bioengineering offers graduate programs leading to a doctor of philosophy or a master of science degree. The graduate program will train students to solve problems that require the application of interdisciplinary knowledge, combining life sciences, physical sciences, and engineering. The program will emphasize cellular and biomolecular science and engineering, and aims to attract students with diverse academic backgrounds. Students who do not complete the doctor of philosophy have the option to earn a master of science.

**Graduate program objectives**

1. Understand complexities and challenges associated with working in the field of Bioengineering with an advanced degree.
2. Demonstrate depth of knowledge in Bioengineering and related fields.
3. Be creators of new knowledge and products in the field of Bioengineering.
4. Succeed in a variety of career paths.

**Major Requirements**

**Doctor of Philosophy Degree**
Candidates for the doctor of philosophy degree are required to complete a minimum of 72 credits.

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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ENGR 452</td>
<td>Mathematical Methods in Engineering</td>
<td>3</td>
</tr>
<tr>
<td>BIOS 411</td>
<td>Advanced Cell Biology (or a course from an approved list of BIOS or related courses)</td>
<td>3</td>
</tr>
</tbody>
</table>

Two additional core courses from an approved list of courses: 6

Twelve credits of adviser-approved technical electives at the 300-level or higher: 12

Six credits of dissertation research: 6

Additional 42 credits of electives and/or dissertation research: 42

Total Credits: 72

Students must pass a qualification exam, typically taken after three semesters of study, a final written dissertation as well as an oral defense of the dissertation.

**Master of Science Degree**
An oral defense of thesis research is dependent upon the requirements of the student's advisor. Two options for the master of science degree are available: a **thesis option** and a **non-thesis option**. Candidates for both the thesis and non-thesis master of science degree are required to complete a minimum of 30 credits. Per university policy, graduate students may count no more than 20 credits at the 300-level toward the M.S. degree.

**Thesis Option**

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<td>3</td>
</tr>
</tbody>
</table>

Two additional core courses from an approved list of courses: 6

Twelve credits of adviser-approved technical electives at the 300-level or higher: 12

Six credits of thesis research, culminating in a written thesis: 6

Total Credits: 30

**Non-Thesis Option**

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<tr>
<th>Course Code</th>
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<th>Credits</th>
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<td>BIOS 411</td>
<td>Advanced Cell Biology (or a course from an approved list of BIOS or related courses)</td>
<td>3</td>
</tr>
</tbody>
</table>

Two additional core courses from an approved list of courses: 6

Eighteen credits of adviser-approved technical electives at the 300-level or higher: 18

No thesis research or written thesis is required.

Total Credits: 30

**Courses**

**Bioengineering Sophomore Research Seminar 1 Credit**
Exposure to opportunities for on-campus research in bioengineering. Review of current literature on bioengineering topics through written reports and/or oral presentations. Preparation of written research proposal, including definition of topic, objectives, methodologies, research plans, and expected impact.

**Elements of Bioengineering 4 Credits**
An introduction to the fields of biotechnology and biomedical engineering. The areas include biomechanics, biomaterials, bioinstrumentation, medical imaging, rehabilitation engineering, biosensors, biotechnology and tissue engineering.

**Bioengineering Research 1-4 Credits**
Research on a topic chosen by students, with a faculty advisor typically from the three bioengineering tracks (biopharmaceutical engineering, bioelectronic/biophotonics or biomechanics and biomaterials). Independent meetings with advising professor will track progress. Includes written reports and/or oral presentations. Consent of instructor required.

**Bioengineering Sophomore Research Seminar 1 Credit**
Introduction to ethical principles and role of critical thinking in ethical decision-making. Analysis of contemporary issues in bioengineering practice. Topics include biomedical device risk and failure, ethics of clinical trials, animal research, human enhancement, and research conduct.

**Bioengineering Research 1-4 Credits**
Research on a topic chosen by students, with a faculty advisor typically from the three bioengineering tracks (biopharmaceutical engineering, bioelectronic/biophotonics or biomechanics and biomaterials). Independent meetings with advising professor will track progress. Includes written reports and/or oral presentations. Consent of instructor required.

**Repeat Status**: Course may be repeated.

**Bioengineering Junior Seminar 1 Credit**
Overview of the bioengineering field, the advancements of related topics in sciences, technology, engineering and applications for health care and medicine. Humanity and ethical issues. Pass/Fail.

**Bioengineering Seminar 2, Introduction to Bioengineering II: Current Topics 1 Credit**
Overview of a broad spectrum of current topical areas in biotechnology and bioengineering and their applications in health care and medicine. Pass/Fail.
BIOE 307 (CSE 307) 3 Credits
Computational techniques and principles of structural biology used to examine molecular structure, function, and evolution. Topics include: protein structure alignment and prediction; molecular surface analysis; statistical modeling; QSAAR; computational drug design; influences on binding specificity; protein-ligand; -protein, and -DNA interactions; molecular simulation, electrostatics. Tutorials on UNIX systems and research software support an interdisciplinary collaborative project in computational structural biology. Credit will not be given for both CSE 307 and CSE 407. Must have junior standing or higher.
Prerequisites: BIOS 120 or CSE 109 or CHM 113 or MATH 231

BIOE 308 (CSE 308) 3 Credits
Computational problems and their associated algorithms arising from the creation, analysis, and management of bioinformatics data. Genetic sequence comparison and alignment, physical mapping, genome sequencing and assembly, clustering of DNA microarray results in gene expression studies, computation of genomic rearrangements and evolutionary trees. Credit will not be given for both BIOE 308 (CSE 308) and BIOE 408 (CSE 408). No prior background in biology is assumed.
Prerequisites: CSE 017 or CSE 018
Attribute/Distribution: ND

BIOE 315 (ME 315) Bioengineering Statistics 3 Credits
Advanced methods in probability and statistics applied to bioengineering problems focusing on modeling and data analysis. Topics include the following: types of data, types of distributions, parametric and nonparametric analyses, goodness-of-fit, regression, power analysis, and multivariate analysis, life models, simulation, cluster analysis, and Bayesian statistics. Special emphasis is placed on projects and case studies.
Prerequisites: MATH 231

BIOE 316 (ME 316) Introduction to Force Spectroscopy 3 Credits
Fundamentals of major force spectroscopy methods, including atomic force microscopy, optical tweezers, and magnetic tweezers. Principles of force measurement, force calibration, and signal and noise. Applications to the mechanical properties of biomaterials, such as polymer elasticity, protein folding, nanoindentation, and structural transitions in macromolecules. Closed to students who have taken BIOE 416.
Prerequisites: MECH 003

BIOE 320 (CSE 320) 3 Credits
Biomedical Image Computing and Modeling
Biomedical image modalities, image computing techniques, and imaging informatics systems. Understanding, using, and developing algorithms and software to analyze biomedical image data and extract useful quantitative information: Biomedical image modalities and formats; image processing and analysis; geometric and statistical modeling; image informatics systems in biomedicine. Credit will not be given for both BioE 320 and BioE 420.
Prerequisites: (MATH 205 or MATH 043) and CSE 017
Attribute/Distribution: ND

BIOE 321 Biomolecular & Cellular Mechanics 3 Credits
Mechanics and physics of the components of the cell, ranging in length scale from fundamental biomolecules to the entire cell. The course covers the mechanics of proteins and other biopolymers in 1D, 2D, and 3D structures, cell membrane structure and dynamics, and the mechanics of the whole cell.
Prerequisites: MATH 205 and MATH 231 and PHY 022 and (PHY 013 or PHY 021 or PHY 023)

BIOE 324 (MAT 324) Introduction to Organic Biomaterials 3 Credits
Property, characterization, fabrication and modification of organic materials for biomedical and biological applications; host responses to biomaterials on the molecular, cellular and system level; general introduction to biosensors, drug delivery devices and tissue engineering.
Prerequisites: BIOE 110

BIOE 325 (MAT 325) Inorganic Biomaterials 3 Credits
Fabrication methods for biomedical implants and devices. Selection of metals and ceramics with specific bulk and surface physical as well as chemical properties. The role of materials chemistry and microstructure. Biocompatibility. Case studies (dental and orthopedic implants, stents, nonporous ceramic filters for kidney dialysis).
Prerequisites: MAT 033

BIOE 326 (MAT 326) Biomimetic and Bio-enabled Materials 3 Credits
The structure, function, properties and use of biopolymers, biocomposites, and biominerals. Biomimetic materials design, including colloids, interfaces, macromolecules, and applications of such materials. Environmental and ethical considerations, such as degradation products when using biomimetic materials. Closed to students who have taken MAT 426 (BioE 426).
Prerequisites: MAT 033 or BIOE 110

BIOE 331 Integrated Bioelectronics/Biophotonics Laboratory 2 Credits
Experiments in design and analysis of bioelectronics circuits, micropatterning of biological cells, micromanipulation of biological cells using electric fields, analysis of pacemakers, instrumentation and computer interfaces, ultrasound, optic, laser tweezers and advanced imaging and optical microscopy techniques for biological applications.
Prerequisites: (ECE 081 or PHY 190) and (PHY 013 or PHY 021 or PHY 023) and PHY 022 and ECE 121 and ECE 123
Can be taken Concurrently: ECE 121, ECE 123

BIOE 335 BioFluid Mechanics of Physiological Systems 3 Credits
Application of advanced fluid dynamic principles to physiological systems with emphasis on micron sized structures such as pulmonary airway/alveoli, small blood vessels and biological cells. Introduction to advanced topics relevant to the human body including a) oscillatory and transient flows in the cardiovascular and pulmonary systems b) non-Newtonian flows, c) surface tension driven flows, d) fluid-structure interactions, and e) cellular fluid mechanics.
Prerequisites: (MATH 205 and ME 231 and MATH 231)

BIOE 339 Neuronal Modeling and Computation 3 Credits
Neuroscience in a computational, mathematical, and engineering framework. Literature surveys and case studies with simulations. Computational aspects of information processing within the nervous system by focusing on single neuron modeling. Single neurons and how their biological properties relate to neuronal coding. Biophysics of single neurons, signal detection and signal reconstruction, information theory, population coding and temporal coding.
Prerequisites: ENGR 010 and MATH 205

BIOE 341 (CHE 341) Biotechnology I 3 Credits
Applications of material and energy balances; heat, mass, and momentum transfer; enzyme and microbial kinetics; and mathematical modeling to the engineering design and scale-up of bio-reactor systems. Closed to students who have taken CHE 441 (BIOE 341 and BIOE 441).
Prerequisites: MATH 205 and CHE 031 and (CHM 031 or CHM 041)

BIOE 342 (CHE 342) Biotechnology II 3 Credits
Engineering design and analysis of the unit operations used in the recovery and purification of products manufactured by the biotechnology industries. Requirements for product finishing and waste handling will be addressed. Closed to students who have taken CHE 442 (BIOE 342 and BIOE 442).
Prerequisites: MATH 205 and CHE 031 and (CHM 031 or CHM 041)

BIOE 343 Integrated Biotechnology Laboratory 3 Credits
Biosafety, sterilization, media formulation, biochemical and enzyme assays, recombinant DNA technique, protein and DNA isolation and purification, for microbial fermentation and animal cell culture. Integration of biotechnology techniques for biopharmaceutical production. Consent of instructor required.
Prerequisites: BIOE 110 and (CHE 341 or BIOE 341)
BIOE 344 (CHE 344) Molecular Bioengineering 3 Credits
Kinetics in small systems, stochastic simulation of biochemical processes, receptor-mediated adhesion, dynamics of ion-channels, ligand binding, biochemical transport, surface Plasmon resonance, DNA microarray design, and chemical approaches to systems biology. Senior standing in BIOE.
Prerequisites: (MATH 205 and MATH 231)

BIOE 345 (CHE 345) Quantitative Biology 3 Credits
Basic concepts in molecular and cellular biology as well as biochemistry. Connects these to engineering principles in order to (1) develop a quantitative understanding of biological systems and (2) understand how applications of methods and principles in biology are used in modern engineering. Topics include protein structure and function, enzymology, membrane transport and trafficking, transcription/translation, signal transduction and models for cellular processes. An important part of this course is also taking topics discussed in lecture and translating them into practice.
Prerequisites: MATH 205

BIOE 349 Metabolic Engineering 3 Credits
Prerequisites: MATH 205

BIOE 350 Special Topics 1-4 Credits
Special topics of study in bioengineering. Permission of Instructor.
Repeat Status: Course may be repeated.

BIOE 357 Integrated Biostuctural Mechanics Laboratory 2 Credits
Experimental manipulation and analysis of mammalian cells, with a focus on the biomechanical properties of cells, the interface of living and non-living materials, and on bioengineering applications. Experimental techniques include mammalian cell culture, advanced microscopy techniques, preparation of bioactive substrates, microfluidic device fabrication, micropatterning of cells and cell growth in 3D matrices. Consent of instructor required.
Prerequisites: BIOE 110

BIOE 358 Biomechanics 3 Credits
Applications of mechanics to study behavior of anatomical structures and biological tissues of the musculoskeletal system. Specific topics include structure and function of biological tissues, mechanical properties of biological tissues, and analysis of specific tissues (i.e. bone, muscle, and soft connective tissues).
Prerequisites: MECH 003
Can be taken Concurrently: MECH 003

BIOE 359 Biomechanics Laboratory 1 Credit
Applications of mechanics to study behavior of anatomical structures and biological tissues of the musculoskeletal system. Specific topics include structure and function of biological tissues, mechanical properties of biological tissues, and analysis of specific tissues (i.e. bone, muscle, and soft connective tissues).
Prerequisites: MECH 003 and BIOE 358
Can be taken Concurrently: MECH 003, BIOE 358

BIOE 363 (CHE 363) Numerical Methods for Scientists and Engineers 3 Credits
Introduction to numerical methods in science and engineering. Expose students to the numerical solution of a variety of commonly encountered problems, enhance their numerical programming skills, and provide a broad base on which to build more specialized knowledge of computational methods. Topics include solution of linear and nonlinear sets of algebraic equations, linear and logistic regression, ordinary differential equations, Fourier analysis, eigenvalues, partial differential equations by finite difference and finite element methods.
Prerequisites: MATH 205

BIOE 366 (ECE 366) Neural Engineering 3 Credits
Neural system interfaces for scientific and health applications. Basic properties of neurons, signal detection and stimulation, instrumentation and microfabricated electrode arrays. Fundamentals of peripheral and central neural signals and EEG, and applications such as neural prostheses, implants and brain-computer interfaces. Closed to students who have taken BIOE 466, ECE 366, or ECE 466.
Prerequisites: ECE 081

BIOE 368 (ECE 368) Introduction to Biophotonics and Optical Biomedical Imaging 3 Credits
Optical principles, techniques, and instruments used in biomedical research and clinical medicine. Fundamental concepts of optical imaging and spectroscopy systems, and details of light-tissue interaction. Commercial devices and instruments, as well as novel optical imaging technologies in development. Closed to students who have taken BIOE 468, ECE 368, or ECE 468.
Prerequisites: ECE 202 or PHY 212

BIOE 380 (BIOS 380) Biomolecular & Cellular Biophysics 3-4 Credits
Physical principles of biomolecular and cellular organization. Biomolecular interactions and recognition, molecular motors, physical organization and functioning of cellular membranes, electrical signaling in live cells. Modern techniques in biophysics, molecular spectroscopy, molecular modeling, florescence imaging, electrophysiology, electron microscopy.
Prerequisites: (BIOS 115) and (PHY 013 or PHY 021)

BIOE 407 (CSE 407) 3 Credits
Computational techniques and principles of structural biology used to examine molecular structure, function, and evolution. Topics include: protein structure alignment and prediction; molecular surface analysis; statistical modeling; QSAR; computational drug design; influences on binding specificity; protein-ligand, -protein, and –DNA interactions; molecular simulation, electrostatics. This course, a version of 307 for graduate students, requires advanced assignments and a collaborative project. Credit will not be given for both BIOE 307 and 407. Consent of instructor required.

BIOE 408 (CSE 408) Bioinformatics: Issues and Algorithms 3 Credits
Computational problems and their associated algorithms arising from the creation, analysis, and management of bioinformatics data. Genetic sequence comparison and alignment, physical mapping, genome sequencing and assembly, clustering of DNA microarray results in gene expression studies, computation of genomic rearrangements and evolutionary trees. This course, a version of 308 for graduate students requires advanced assignments. Credit will not be given for both BIOE 308 (CSE 308) and BIOE 408 (CSE 408). No prior background in biology is assumed.
Prerequisites: CSE 017 or CSE 018
Attribute/Distribution: ND

BIOE 416 Introduction to Force Spectroscopy 3 Credits
This course is a graduate version of BIOE 316 (ME 316). While the lecture content will be the same as the 300-level course, students in the 400-level class will be expected to complete more advanced assignments. Closed to students who have taken BIOE 316 (ME 316).

BIOE 420 (CSE 420) Biomedical Image Computing and Modeling 3 Credits
Biomedical image modalities, image computing techniques, and imaging informatics systems. Understanding, using, and developing algorithms and software to analyze biomedical image data and extract useful quantitative information: Biomedical image modalities and formats, image processing and analysis; geometric and statistical modeling; image informatics systems in biomedicine. This course, a graduate version of BioE 320, requires additional advanced assignments. Credit will not be given for both BioE 320 and BIOE 420.
Prerequisites: MATH 205 and CSE 109
Attribute/Distribution: ND
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<tr>
<td>BIOE 421 (CHE 421)</td>
<td>Biomolecular &amp; Cellular Mechanics 3 Credits</td>
<td>Mechanics and physics of cell components, from fundamental biomolecules to the entire cell. The mechanics of proteins and other biopolymers in 1D, 2D, and 3D structures, cell membrane structure and dynamics, and the mechanics of the whole cell. This course is a graduate version of CHE 321 (BioE/Phy 321). The lecture content will be the same as in CHE 321 (BioE/Phy 321), but students enrolled in CHE 421 (BioE 421) will have more advanced assignments. Closed to students who have completed ChE 321 (BioE/Phy 321). Must have graduate standing.</td>
<td>MAT 032; 400-level credit, the student must do an additional, more advanced term project. As defined by the instructor.</td>
</tr>
<tr>
<td>BIOE 424 (MAT 424)</td>
<td>Introduction to Organic Biomaterials 3 Credits</td>
<td>Property, characterization, fabrication, and modification of organic materials for biomedical and biological applications; host responses to biomaterials on the molecular, cellular, and system level; general introduction to biosensors, drug delivery, and tissue engineering. Graduate version of BioE 324 requiring additional assignments. Credit is not given for both BioE 324 (MAT 324) and BioE 424 (MAT 424).</td>
<td>MAT 033</td>
</tr>
<tr>
<td>BIOE 425 (MAT 425)</td>
<td>Inorganic Biomaterials 3 Credits</td>
<td>Fabrication methods for biomedical implant and devices. Selection of metals and ceramics with specific bulk and surface physical as well as chemical properties. The role of materials chemistry and microstructure. Biocompatibility. Case studies (dental and orthopedic implants, stents, nonporous ceramic filters for kidney dialysis). Graduate version of MAT 325; credit will not be given for both MAT 325 and MAT 425.</td>
<td>MAT 033</td>
</tr>
<tr>
<td>BIOE 426 (MAT 426)</td>
<td>Biomimetic and Bio-enabled Materials 3 Credits</td>
<td>This course is a graduate version of BIOE 326 (MAT 326). While the lecture content will be the same as the 300-level course, students enrolled in BIOE 426 (MAT 426) will have more advanced assignments. Closed to students who have taken BIOE 326 (MAT 326). Must have graduate standing in Bioengineering or Materials Science and Engineering.</td>
<td>ND</td>
</tr>
<tr>
<td>BIOE 439 (CHE 439)</td>
<td>Neuronal Modeling and Computation 3 Credits</td>
<td>This course is a graduate version of BIOE 339 (CHE 339). While the lecture content will be the same as the 300-level course, students in the 400-level class will be expected to complete an independent term project. Closed to students who have completed BIOE 339 (CHE 339). Must have graduate standing in Bioengineering or Chemical Engineering.</td>
<td>BIOE 439 (CHE 339)</td>
</tr>
<tr>
<td>BIOE 441 (CHE 441)</td>
<td>Biotechnology I 3 Credits</td>
<td>See the course description listed for BioE 341. In order to receive 400-level credits, the student must do an additional, more advanced term project, as defined by the instructor at the beginning of the course. Closed to students who have taken BioE 341 (CHE 341).</td>
<td>BIOE 341 (CHE 341)</td>
</tr>
<tr>
<td>BIOE 442 (CHE 442)</td>
<td>Biotechnology II 3 Credits</td>
<td>See the course description listed for BIOE 342 (CHE 342). In order to receive 400-level credit, the student must do an additional, more advanced term project, as defined by the instructor at the beginning of the course. Closed to students who have taken BIOE 342 (CHE 342).</td>
<td>BIOE 342 (CHE 342)</td>
</tr>
<tr>
<td>BIOE 447 (CHE 447)</td>
<td>Molecular Bioengineering 3 Credits</td>
<td>This course is a graduate version of CHE 344 (BioE 344). While the lecture content will be the same as the 300-level course, students enrolled in CHE 447 will have more advanced assignments. Closed to students who have completed BioE 344 (CHE 344).</td>
<td>CHE 344 (BioE 344)</td>
</tr>
<tr>
<td>BIOE 449 (CHE 449)</td>
<td>Metabolic Engineering 3 Credits</td>
<td>This course is a graduate version of BIOE 349. While the lecture content will be the same as the 300-level course, students enrolled in BIOE 449 (CHE 449) will have more advanced assignments. Closed to students who have completed BIOE 349. Must have graduate standing in Chemical Engineering or Bioengineering.</td>
<td>BIOE 349 (CHE 349)</td>
</tr>
<tr>
<td>BIOE 450 Special Topics 1-3 Credits</td>
<td>Special topics of study in bioengineering. Permission of instructor.</td>
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</table>
of chemical engineering courses in which logic and mathematical manipulation are applied to chemical processing problems. With the resulting habits of precise thought coupled to a broad base in scientific and general education, Lehigh graduates have been effective throughout industry and in advanced professional education. No effort is made toward any specific industry, but adaptation is rapid and the fundamental understanding forms the base for an expanding career.

The program is also designed to prepare a student for graduate study in chemical and biomolecular engineering. Further study at the graduate level leading to advanced degrees is highly desirable if an individual wishes to participate in the technical development of the field. The increasing complexity of modern manufacturing methods requires superior education for men and women working in research, development, and the design fields or for teaching.

PHYSICAL FACILITIES
The Chemical and Biomolecular Engineering Department is the only engineering department located on Lehigh’s 780 acres Mountaintop Campus. Here the department occupies approximately one-third of Iacocca Hall, the 200,000-square-foot flagship building that contains offices, classrooms, and laboratories. Additional plant facilities, and the undergraduate chemical processing laboratory occupy approximately 10,000-square-feet in the nearby Imbt building.

These facilities provide excellent support for a wide range of general and special laboratory equipment for undergraduate and graduate studies of the behavior of typical chemical processing units; bioengineering research; nanotechnology; energy; biochemical engineering; polymers; digital computation for process dynamics research; and study of thermodynamics, kinetics, heat transfer, and mass transfer.

The chemical engineering department has established a senior design laboratory in Iacocca Hall featuring 35 PCs, which is dedicated to undergraduate process design courses.

Professors. Hugo S. Caram, PHD (University of Minnesota Minneapolis); Manoj K. Chaudhury, PHD (State University of New York at Buffalo); James F. Gilchrist, PHD (Northwestern University); Tsai- An Hsue, PHD (Northwestern University); Anand Jagota, PHD (Cornell University); Christopher J. Kiely, PHD (University of Bristol); Mayuresh V. Kothare, PHD (California Institute of Technology); William L. Luyben, PHD (University of Delaware); Anthony J. McHugh, PHD (University of Delaware); Steven McIntosh, PHD (University of Pennsylvania); Jeetain Mittal, PHD (University of Texas at Austin); Arup K. Sengupta, PHD (University of Houston University Park); Israel E. Wachs, PHD (Stanford University)

Associate Professors. Javier Buceta Fernandez, PHD (National University of Distance Education); Kelly Schultz, PHD (University of Delaware); Mark A Snyder, PHD (University of Delaware)

Assistant Professors. Jonas Baltrusaitis, PHD (University of Iowa); Angela C Brown, PHD (Drexel University); Srinivas Rangarajan, PHD (University of Minnesota Minneapolis)

Professors Of Practice. Vincent G. Grassi, PHD (Lehigh University); Kemal Tuzla, PHD (Istanbul Technical University)

Emeriti. Marvin Charles, PHD (Polytechnic University); Mohamed S El-Aasser, PHD (Mcgill University); Arthur E. Humphrey, PHD (Columbia University); William E. Schiesser, PHD (Princeton University); Cesar A. Silebi, PHD (Lehigh University); Fred P. Stein, PHD (University of Michigan)

UNDERGRADUATE PROGRAM
The mission of the undergraduate program is “to educate students in the scientific principles of chemical and biomolecular engineering and provide opportunities to explore their applications in the context of a humanistic education that prepares them to address technological and societal challenges.”

PROGRAM EDUCATIONAL OBJECTIVES
To achieve its educational mission, the Department of Chemical and Biomolecular Engineering has established the following set of Program Educational Objectives: Graduates of the Undergraduate Program in Chemical Engineering will:

1. Apply their broad education in chemical engineering to pursue careers in industry, government agencies, consulting firms, educational institutions, financial institutions, business, law, and medicine.
2. Pursue graduate studies, research, or continuing education.
3. Be sensitive to the social, ethical, and technical implications of their work as it affects the environment, safety, and health of citizens worldwide.

In order to achieve these program educational objectives, the chemical engineering program ensures that the graduates are capable of the following Student Outcomes proposed by the accreditation organization ABET:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

CAREER OPPORTUNITIES
Chemical engineers play important roles in all activities bearing on the chemical process industry. These include the functions of research, development, design, plant construction, plant operation and management, corporate planning, technical sales, and market analysis.

The industries that produce chemical and/or certain physical changes in fluids, including petroleum and petrochemicals, rubbers and polymers, pharmaceuticals, bioengineering, metals, industrial and fine chemicals, foods, and industrial gases, have found chemical engineers to be vital to their success. Chemical engineers are also important participants in pollution abatement, energy resources, national defense programs, and more recently in the manufacture of microelectronic devices and integrated circuits.

SPECIAL PROGRAMS AND OPPORTUNITIES
Co-op Program
The department, in conjunction with the P.C. Rossin College of Engineering and Applied Science, operates a cooperative program that is optional for specially selected students who are entering their junior year. This program offers early exposure to industry and an opportunity to integrate an academic background with significant periods of engineering practice. Our program is unique in offering two work experiences and still allowing the co-op students to graduate in four years with their class.

OSI Program
The Opportunities for Student Innovation (OSI) program seeks to develop students’ propensities for critical assessment and innovative solution of meaningful problems. The OSI program offers selected seniors an opportunity to experience team research leading toward technological benefits. Some projects are hosted by industrial companies and carried out under the supervision of a Lehigh faculty members.

Minors and Specializations
Technical minors are available in biotechnology, energy engineering, computer science, environmental engineering, manufacturing systems, materials science and engineering, and polymer science and engineering. Minors are also available from the Business College and the College of Arts and Sciences.
Minor in Biotechnology

The department of Chemical and Biomolecular Engineering encourages engineering students to broaden their education by taking a minor. In this regard, a Biotechnology Minor is offered to students majoring in Engineering College. The Biotechnology minor requires 16 credit hours. A detailed listing of the required courses for the Biotechnology Minor can be obtained from the Chemical and Biomolecular Engineering Department.

Concentrations

Chemical and Biomolecular Engineering offers five concentration areas, students majoring in Chemical Engineering can take three courses to have a certificate in a specific concentration. These courses may also be used to satisfy other elective requirements for their major.

Biomolecular Engineering

- CHE/BIOE 345 - Quantitative Biology (3 cr)
- CHE 306 - Intro to Biomedical Engineering (3 cr)
- CHE 321 - Biomolecular and Cellular mechanics (3 cr)
- CHE/BIOE 341 - Biotechnology I (3 cr)
- CHE/BIOE 342 - Biotechnology II (3 cr)
- CHE/BIOE 344 - Molecular Bioengineering (3 cr)
- CHE 339 - Neuronal Modeling and Computation (3 cr)
- CHE 396 - Engineering in Medicine (3 cr)
- CHM 371 - Biochemistry I (3 cr)

Computational Methods in Engineering

- CHE 339 - Neuronal Modeling and Computation (3 cr)
- CHE 363 - Numerical Methods for Scientists and Engineers (3 cr)
- CHE 365 - Molecular Modeling and Simulation (3 cr)
- CHE 396 - Data Driven Modeling (2 cr)
- CSE 002 - Fundamentals of Programming (2 cr)
- CSE 017 - Programming and Data Structures (3 cr)
- CSE 160 - Intro to Data Science (3 cr)
- CSE 202 - Programming Languages (3 cr)
- ISE 172 - Algorithms in System Engineering (4 cr)

Energy and Environment

- CHE 376 - Energy: issues & technology (3 cr)
- CHE 377 - Electrochemical Engineering (3 cr)
- CEE 170 - Intro to Environmental Engineering (3 cr)
- CHE/CEE 373 - Fundamentals of Air Pollution (3 cr)
- CHE/CEE 375 - Environmental Engineering Processes (3 cr)
- ME 360 - Nuclear Reaction Engineering (3 cr)
- CHE 374 - Environmental Catalysis (3 cr)
- CHE 398 - Advanced porous Material (3 cr)

Entrepreneurship

- ENTP 101 - Introduction to Entrepreneurship (3 cr)
- ENTP/IR/SDEB 307 - International Social Entrepreneurship (4 cr)
- Approved Internship
- Approved Mountaintop Experience
- Approved Study Abroad
- Approved Research in the Department

Polymer/ Functional Materials

- CHE 392 - Introduction to Polymer Science (3 cr)
- CHM (CHE) 391 - Colloid and Surface Chemistry (3 cr)
- CHE 317 - Soft Materials: Rheology and Characterization (3 cr)
- CHM 394 - Organic Polymer Science (3 cr)
- MAT 204 - Processing and Properties of Polymeric Mats (3 cr)
- MAT 386 - Polymer Nanocomposites (3 cr)
- CHE (CHM) 393 - Physical Polymer Science (3 cr)
- CHE 398 - Characteristics of Advanced Functional Materials (3 cr)

Overseas

Study abroad is available in exchange programs that have been established by the department for the junior year at the University of Nottingham (United Kingdom) and for the summer following the junior year at the University of Dortmund (Germany). Please visit http://www.aaa.tu-dortmund.de/cms/en/International_Students/International_Summer_Program__ISP_/index.html

Requirements of the Major

131 credit hours are required for graduation with the degree of bachelor of science in chemical engineering.

<table>
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<tr>
<th>First Year</th>
<th>Credits</th>
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Total Credits: 15-18

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Total Credits: 18

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Total Credits: 15-16

1 Required natural science courses, one taken fall semester and the other taken in spring

There are six types of electives:
1. Humanities/Social Sciences: See the requirements (p. 357) set by the P.C. Rossin College of Engineering and Applied Science. Note that ECO 001 is required, as well as Freshman English.

2. Bio-Elective: Students must have AP BIOS credits or must pick one from BIOS 041, BIOE 321, BIOE 349, CHE 341, CHE 345, or CHM 371.

3. Three credit hours from approved courses in other engineering departments (BioE, CEE, CSE, ECE, ISE, MEM, MSE).

4. Chemistry: 3 credit hours of CHM 300-level or higher, or CHE 380.

5. Chemical Engineering: 3 credit hours of CHE 300 level or higher.

6. Free electives: 6 credit hours in any subject area.

Electives in (2) to (5) above can be combined with any technical minor in RCEAS.

GRADUATE PROGRAMS
The Department of Chemical and Biomolecular Engineering offers graduate programs leading to the master of science, master of engineering, and doctor of philosophy degrees in Chemical Engineering and master of engineering degree in Chemical Engineering, Biological Chemical Engineering and Chemical Energy Engineering. The programs are all custom tailored for individual student needs and professional goals. These individual programs are made possible by a diversity of faculty interests that are broadened and reinforced by cooperation between the department and several research centers on the campus.

A free flow of personnel and ideas between the centers and academic departments ensures that the student will have the widest choice of research activities. The student is also exposed to a wide range of ideas and information through courses and seminars to which both faculty and center personnel contribute. In addition, strong relationships with industry are maintained by the department and the research centers, some of which operate industrially-sponsored liaison programs whereby fundamental non-proprietary research is performed in areas of specific interest to participating sponsors.

In addition to interacting with the centers, the department originates and encourages programs that range from those that are classical chemical engineering to those that are distinctly interdisciplinary. The department offers active and growing programs in adhesion and tribology; emulsion polymerization and latex technology; bulk polymer systems; process control; process improvement studies; rheology; computer applications; environmental engineering; thermodynamics; kinetics and catalysis; enzyme technology; data science; and biochemical engineering.

Career Opportunities
Master of science, master of engineering, and doctor of philosophy graduates in the chemical engineering area are sought by industry for activities in the more technical aspects of their operations, especially design, process and product development, and research. Many of these graduates also find opportunities in research or project work in government agencies and in university teaching and research.

Physical Facilities
The department is well equipped for research in bioengineering, nanotechnology, energy, colloids and surface science, adhesion and tribology, polymer science and engineering, catalysis and reaction kinetics, thermodynamic property studies, fluid dynamics, heat and mass transfer, process dynamics and control, and enzyme engineering and biochemical engineering.

The departmental and university computing facilities include PCs and workstations, connected by a university-wide high speed network, which in turn provides worldwide networking via the Internet.

All of these facilities can access a wide variety of general purpose, and scientific and engineering software via the university and local networks, including software specifically for the steady state and dynamic simulation of chemical engineering systems.

Special Programs
Polymers Science and Engineering. The polymers activity includes work done in the Department of Chemical and Biomolecular Engineering as well as the Departments of Chemistry, Materials Science, and Physics, the Materials Research Center, the Center for Polymer Science and Engineering, and the Emulsion Polymers Institute. More than 20 faculty members from these organizations or areas have major interests in polymers and cooperate on a wide range of research projects. For students with deep interest in the area, degree programs are available leading to the master of science, master of engineering, and doctor of philosophy degrees in polymer science and engineering.

There are three major polymer research thrusts in which chemical engineering students and faculty are involved. These are polymer colloids (latexes), polymer interfaces, and polymer materials. The Emulsion Polymers Institute, with strong industrial support, sponsors projects in the preparation of monosize polymer particles, in mechanisms and kinetics of emulsion, miniemulsion and dispersion polymerization, in latex particle morphology and film-formation, and in rheological properties of latexes and thickeners. The Engineering Polymers Laboratory investigates the behavior of bulk polymer materials, focusing on multicomponent polymers and composites.

Distance Education
Delivered online through the Office of Distance Education, these programs are convenient for the part-time student and courses are the same level of quality of instruction that is available to our on-campus students. Choose from the following engineering programs: Master of Engineering degree in Chemical Engineering, Biological Chemical Engineering, Chemical Energy Engineering and Certificate in Chemical and Biomolecular Engineering. To learn more, visit the Office of Distance Education Online Programs (https://distance.lehigh.edu/online-programs).

Major Requirements
All Ph.D. students must complete eight courses in consultation with his/her committee, although CHE 400, CHE 410, CHE 415 and CHE 452 are required. In addition to approved courses, all Ph.D. students must pass a qualification examination given during the second year of residence.

Candidates for Master of Science degree are required to complete 30 credits hours of course work which must include CHE 400, CHE 410, CHE 415 and CHE 452, and a research report or thesis for which six hours of graduate credits are earned.

Candidates for the Master of Engineering degrees do not do research; all 30 credit hours are fulfilled by course work. Course selection is done individually for each student within the University requirements for a master's degree.

The requirements for each of the Master degrees is slightly different. For more information on all of our Master degrees, please visit the Graduate Chemical and Biomolecular Engineering page at http://engineering.lehigh.edu/chbe/graduate

Courses
CHE 031 Material and Energy Balances of Chemical Processes 3 Credits
Material and energy balances with and without chemical reaction. Introduction to phase equilibrium calculations. Applications in chemical process calculations and in design of staged separations: binary distillation, liquid-liquid extraction. Plant trips and special lectures introducing the profession.

Prerequisites: ENGR 010 and CHM 030
Can be taken Concurrently: ENGR 010, CHM 030

CHE 044 Fluid Mechanics 3 Credits

CHE 085 Undergraduate Research 1 Credit
Independent study of a problem involving laboratory investigation, design, or theoretical studies under the guidance of a faculty. Consent of the department chair.

Repeat Status: Course may be repeated.

CHE 151 Introduction to Heat Transfer 3 Credits
Fundamental principles of heat transfer. Fourier's law, conduction and radiation. Analysis of steady and unsteady state heat transfer. Evaporation and condensation. Applications to the analysis and design of chemical processing units involving heat transfer.

Prerequisites: CHE 031 and CHE 044 and CHE 210
CHE 171 (CEE 171, EMC 171, ES 171) Fundamentals of Environmental Technology 4 Credits
Introduction to water and air quality, water, air and soil pollution. Chemistry of common pollutants. Technologies for water purification, wastewater treatment, solid and hazardous waste management, environmental remediation, and air quality control. Global changes, energy and environment. Constraints of environmental protection on technology development and applications. Constraints of economic development on environmental quality. Environmental life cycle analysis and environmental policy. Not available to students in RCEAS.

CHE 179 Professional Development 1 Credit
Elements of professional growth, registration, ethics, and the responsibilities of engineers both as employees and as independent practitioners. Proprietary information and its handling. Patents and their importance. Discussions with the staff and with visiting Lecturers. A few plant trips.

CHE 185 Undergraduate Research 1-3 Credits
Independent study of a problem involving laboratory investigation, design, or theoretical studies under the guidance of a faculty member. Repeat Status: Course may be repeated.

CHE 186 Undergraduate Research II 1-3 Credits
A continuation of the project begun under CHE 185. Consent of department chair.
Repeat Status: Course may be repeated.
Prerequisites: CHE 185

CHE 201 Methods of Analysis in Chemical Engineering 4 Credits
Analytical and numerical methods of solution applied to dynamic, discrete and continuous chemical engineering processes. Laplace Transforms. MATLAB based computations. Methods of analysis applied to equilibrium, characteristic value and non-linear chemical engineering problems.
Prerequisites: CHE 044 and CHE 210 and MATH 023 and MATH 205
Can be taken Concurrently: MATH 205

CHE 202 Chemical Engineering Lab I 3 Credits
The laboratory study of chemical engineering unit operations and the reporting of technical results. One three-hour laboratory and one lecture period per week. Independent study and both group and individual reporting.
Prerequisites: CHE 151 and CHE 211 and CHE 244

CHE 203 Chemical Engineering Laboratory II 2 Credits
Laboratory experience with more complex chemical processing situations including processes involving chemical reactions and those controlled automatically.
Prerequisites: CHE 202

CHE 210 Chemical Engineering Thermodynamics 4 Credits
Prerequisites: CHE 031

CHE 211 Chemical Reactor Design 3 Credits
The theory of chemical kinetics to the design and operation of chemical reactors. Plug flow and continuous stirred tank reactors. Homogeneous and heterogeneous reaction kinetics. Design of isothermal and adiabatic reactors.
Prerequisites: CHE 210

CHE 233 Process Design I 0.3 Credits
Design of chemical plants incorporating traditional elements of engineering economics and synthesis of steady-state flowsheets with (1) both heuristic and rigorous optimization methods and (2) consideration of dynamic controllability of the process. Economic principles involved in the selection of process alternatives and determination of process capital, operating costs, and venture profitability. Energy conservation, pinch techniques, heat exchanger networks, and separation sequences. Considerations of market limitations, environmental and regulatory restrictions, and process safety. Use of modern computer aided software for steady-state and dynamic simulation and optimization. Group design projects.
Prerequisites: (CHE 211 and CHE 242 and CHE 244)
Can be taken Concurrently: CHE 242

CHE 234 Process Design II 3 Credits
Continuation of CHE 233.
Prerequisites: CHE 233
Can be taken Concurrently: CHE 233

CHE 242 Introduction to Process Control and Simulation 3 Credits
Prerequisites: CHE 201 and CHE 151 and ENGR 010

CHE 244 Mass Transfer and Separation Processes 3 Credits
Prerequisites: CHE 031 and CHE 044 and CHE 210

CHE 280 Unit Operations Survey 3 Credits
The theory of heat, mass and momentum transport. Laminar and turbulent flow of real fluids. Heat transfer by conduction, convection and radiation. Application to a wide range of operations in the chemical and metallurgical process industries.

CHE 281 Chemical Engineering Fundamentals I 4 Credits
Fundamentals of material balances, fluid mechanics and heat transfer. Must have undergraduate degree in a scientific or engineering discipline or one semester undergraduate level general chemistry, one semester undergraduate level physics (statics and dynamics), and two semesters undergraduate calculus. Consent of department required.

CHE 282 Chemical Engineering Fundamentals II 4 Credits
Fundamentals of heat and mass transfer, process energy balances and unit operations. Consent of department required.
Prerequisites: CHE 281

CHE 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

CHE 306 Introduction to Biomedical Engineering and Mathematical Biology 3 Credits
Prerequisites: MATH 205

CHE 321 Biomolecular & Cellular Mechanics 3 Credits
Mechanics and physics of the components of the cell, ranging in length scale from fundamental biomolecules to the entire cell. The course covers the mechanics of proteins and other biopolymers in 1D, 2D, and 3D structures, cell membrane structure and dynamics, and the mechanics of the whole cell.
Prerequisites: MATH 205 and MATH 231 and PHY 022 and (PHY 013 or PHY 021)
CHE 331 Separation Processes 3 Credits

CHE 334 (MAT 334) Electron Microscopy and Microanalysis 4 Credits
Fundamentals and experimental methods in electron optical techniques including scanning electron microscopy (SEM), conventional transmission (TEM) and scanning transmission (STEM) electron microscopy. Specific topics covered will include electron optics, electron beam interactions with solids, electron diffraction and chemical microanalysis. Applications to the study of the structure of materials are given. Consent of department required.

CHE 339 Neuronal Modeling and Computation 3 Credits
Neuroscience in a computational, mathematical, and engineering framework. Literature surveys and case studies with simulations. Computational aspects of information processing within the nervous system by focusing on single neuron modeling. Single neurons and how their biological properties relate to neuronal coding. Biophysics of single neurons, signal detection and signal reconstruction, information theory, population coding and temporal coding.
Prerequisites: ENGR 010 and MATH 205

CHE 341 (BIO 341) Biotechnology I 3 Credits
Applications of material and energy balances; heat, mass, and momentum transfer; enzyme and microbial kinetics; and mathematical modeling to the engineering design and scale-up of bio-reactor systems. Closed to students who have taken CHE 441 (BIOE 341 and BIOE 441).
Prerequisites: MATH 205 and CHE 031 and (CHM 031 or CHM 041)

CHE 342 (BIOE 342) Biotechnology II 3 Credits
Engineering design and analysis of the unit operations used in the recovery and purification of products manufactured by the biotechnology industries. Requirements for product finishing and waste handling will be addressed. Closed to students who have taken CHE 442 (BIOE 342 and BIOE 442).
Prerequisites: MATH 205 and CHE 031 and (CHM 031 or CHM 041)

CHE 344 (BIOE 344) Molecular Bioengineering 3 Credits
Kinetics in small systems, stochastic simulation of biochemical processes, receptor-mediated adhesion, dynamics of ion-channels, ligand binding, biochemical transport, surface Plasmon resonance, DNA microarray design, and chemical approaches to systems biology. Senior standing in ChE.
Prerequisites: MATH 205 and MATH 231

CHE 345 (BIOE 345) Quantitative Biology 3 Credits
Basic concepts in molecular and cellular biology as well as biochemistry. Connects these to engineering principles in order to (1) develop a quantitative understanding of biological systems and (2) understand how applications of methods and principles in biology are used in modern engineering. Topics include protein structure and function, enzymology, membrane transport and trafficking, transcription/translation, signal transduction and models for cellular processes. An important part of this course is also taking topics discussed in lecture and translating them into practice.
Prerequisites: MATH 205

CHE 346 Biochemical Engineering Laboratory 3 Credits
Laboratory and pilot-scale experiments in fermentation and enzyme technology, tissue culture, and separations techniques. Consent of instructor required. Closed to students who have taken CHE 446.
Prerequisites: CHE 341
Can be taken Concurrently: CHE 341

CHE 350 Special Topics 1-3 Credits
A study of areas in chemical engineering not covered in courses presently listed in the catalog.
Repeat Status: Course may be repeated.

CHE 363 (BIOE 363) Numerical Methods for Scientists and Engineers 3 Credits
Introduction to numerical methods in science and engineering. Expose students to the numerical solution of a variety of commonly encountered problems, enhance their numerical programming skills, and provide a broad base on which to build more specialized knowledge of computational methods. Topics include solution of linear and nonlinear sets of algebraic equations, linear and logistic regression, ordinary differential equations, Fourier analysis, eigenvalues, partial differential equations by finite difference and finite element methods.
Prerequisites: MATH 205

CHE 365 Molecular Modeling and Simulation 3 Credits
Introduction to molecular modeling and simulation techniques. Expose students to programming environments and give a broad overview of molecular simulation methods used in chemical engineering. Topics include density functional theory including periodic systems, molecular dynamics, Monte Carlo techniques, review of statistical mechanics and ensembles, biased sampling and free energy methods, and microkinetic modeling. Student will use existing software as well as develop their own computer codes in this class.

CHE 373 (CEE 373) Fundamentals of Air Pollution 3 Credits
Introduction to the problems of air pollution including such topics as: sources and dispersion of pollutants; sampling and analysis; technology of economics and control processes; legislation and standards. Must have senior standing in the College of Engineering and Applied Science.

CHE 374 Environmental Catalysis 3 Credits
Pollution emissions in the USA (NOx, SOx, NH3, CO, VOCs, PM, heavy metals and persistent bioaccumulative chemicals) and their sources and fate. Fundamental concepts of catalysis (surface and their characterization, physical adsorption, surface reaction mechanisms and their kinetics). Application of catalysis to a wide range of environmental issues (catalytic combustion of VOCs, automotive catalytic converter, selective catalytic conversion of NOx, etc.) Must have senior standing. Consent of instructor required.

CHE 375 (CEE 375) Environmental Engineering Processes 3 Credits
Processes applied in environmental engineering for air pollution control, treatment of drinking water, municipal wastewater, industrial wastes, hazardous/toxic wastes, and environmental remediation. Kinetics, reactor theory, mass balances, application of fundamental physical, chemical and biological principles to analysis and design.
Prerequisites: CEE 170

CHE 376 (ME 376) Energy: Issues & Technology 3 Credits
Energy usage and supply, fossil fuel technologies, renewable energy alternatives and environmental impacts. The scope will be broad to give some perspective of the problems, but in-depth technical analysis of many aspects will also be developed.
Prerequisites: CHE 210 or ME 104 or CHM 342 or MAT 205

CHE 377 Electrochemical Engineering 3 Credits
Fundamental concepts of electrochemistry, covering the thermodynamics, kinetics, and transport phenomena that occur in both liquid and solid state electrochemical systems. This course draws upon concepts from physical chemistry, chemical engineering and materials science to address the phenomena that govern the performance of electrochemical devices, and that drive important engineering phenomena such as corrosion. The course will serve as a basis for a career in electrochemistry as it applies to energy issues. Prerequisites: Senior level in ChE or instructor approval.

CHE 380 Senior Research Project (OSI) 1-6 Credits
Independent study of a problem involving laboratory investigation, design, and theory, when possible involves one of the local communities or industries. Team work under the guidance of Faculty advisors. Experiential learning opportunity to bridge educational gap between conventional textbook learning and industrial approaches to real-world technical problem solving. Must have senior standing. Consent of department required.
Repeat Status: Course may be repeated.
CHE 383 Chemical Engineering Fundamentals III 4 Credits
Fundamentals of thermodynamics, reaction kinetics and reactor analysis, and applied mathematics. Consent of department required. Cannot apply towards a Chemical Engineering undergraduate degree. Prerequisites: CHE 282

CHE 386 Process Control 3 Credits
Open-loop and closed-loop stability analysis using root locus and Nyquist techniques, design of feedback controllers with time and frequency domain specifications. Experimental process identification. Control of multivariable processes. Introduction to sampled-data control theory. Prerequisites: CHE 242

CHE 387 (ECE 387, ME 387) Digital Control 3 Credits
Sampled-data systems; z-transforms; pulse transfer functions; stability in the z-plane; root locus and frequency response design methods; minimal prototype design; digital control hardware; discrete state variables; state transition matrix; Liapunov stability state feedback control (2 lectures and one laboratory per week). Prerequisites: CHE 386 or ECE 212 or ME 343

CHE 388 (CHM 388, MAT 388) Polymer Synthesis and Characterization Laboratory 3 Credits
Techniques include: free radical and condensation polymerization; molecular weight distribution by gel chromatography; crystallinity and order by differential scanning calorimetry; pyrolysis and gas chromatography; dynamic mechanical and dielectric behavior; morphology and microscopy; surface properties. Must have senior level standing in CHE, CHM or MAT. Prerequisites: CHM 341 and CHM 110

CHE 389 (ECE 389, ME 389) Control Systems Laboratory 2 Credits
Experiments on a variety of mechanical, electrical and chemical dynamic control systems. Exposure to state-of-the-art control instrumentation: sensors, transmitters, control valves, analog and digital controllers. Emphasis on comparison of theoretical computer simulation predictions with actual experimental data. Lab teams will be interdisciplinary. Prerequisites: CHE 242 or ECE 212 or ME 343

CHE 391 (CHM 391) Colloid and Surface Chemistry 3 Credits
Physical chemistry of everyday phenomena. Inter-molecular forces and electrostatic phenomena at interfaces, boundary tensions and films at interfaces, mass and charge transport in colloidal suspensions, electrostatic and London forces in disperse systems, gas adsorption and heterogeneous catalysis. Consent of instructor required. Prerequisites: CHE 392 (MAT 392) Introduction to Polymer Science 3 Credits
Introduction to concepts of polymer science. Kinetics and mechanism of polymerization, synthesis and processing of polymers, characterization. Relationship of molecular conformation, structure and morphology to physical and mechanical properties. CHE 393 (CHM 393, MAT 393) Physical Polymer Science 3 Credits
Structural and physical aspects of polymers (organic, inorganic, natural). Molecular and atomic basis for polymer properties and behavior. Characteristics of glassy, crystalline, and paracrystal-line states (including viscoelastic and relaxation behavior) for single- and multi-component systems. Thermodynamics and kinetics of transition phenomena. Structure, morphology, and behavior. Available to graduate and undergraduate students (with senior level standing) in CHE, CHEM or MAT. CHE 394 (CHM 394) Organic Polymer Science I 3 Credits
Organic chemistry of synthetic high polymers. Polymer nomenclature, properties, and applications. Functionality and reactivity or monomers and polymers. Mechanism and kinetics of step-growth and chain-growth polymerization in homogenous and heterogeneous media. Brief description of emulsion polymerization, ionic polymerization, and copolymerization. Must have completed one year of physical chemistry and one year of organic chemistry. CHE 400 Chemical Engineering Thermodynamics 3 Credits
Applications of thermodynamics in chemical engineering. Topics include energy and entropy, heat effects accompanying solution, flow of compressible fluids, refrigeration including cycle analysis, engines, absorption and condensation processes, and chemical equilibria. Must have completed an introductory course in thermodynamics.

CHE 401 Chemical Engineering Thermodynamics II 3 Credits
A detailed study of the uses of thermodynamics in predicting phase equilibria in solid, liquid, and gaseous systems. Fugacities of gas mixtures, liquid mixtures, and solids. Solution theories; uses of equations of state; high-pressure equilibria.

CHE 410 Chemical Reaction Engineering 3 Credits
The application of chemical kinetics to the design and operation of reactors. Non-isothermal and adiabatic reactions. Homogeneous and heterogeneous catalysis. Residence time distribution in reactors.

CHE 413 Heterogeneous Catalysis and Surface Characterization 3 Credits
History and concepts of heterogeneous catalysis. Surface characterization techniques, and atomic structure of surfaces and adsorbed monolayers. Kinetics of elementary steps (adsorption, desorption, and surface reaction) and overall reactions. Catalysis by metals, metal oxides, and sulfides. Industrial applications of catalysis: selective oxidation, pollution control, ammonia synthesis, hydrogenation of carbon monoxide to synthetic fuels and chemicals, polymerization, hydro-treating, and cracking.

CHE 415 Transport Processes 4 Credits
A combined study of the fundamentals of momentum transport, energy transport and mass transport and the analogies between them. Evaluation of transport coefficients for single and multicomponent systems. Analysis of transport phenomena through the equations of continuity, motion, and energy. Prerequisites: CHE 461 or ENGR 452 or CHE 452

CHE 419 (MECH 419) Asymptotic Methods in the Engineering Sciences 3 Credits

CHE 421 (BIOE 421) Biomolecular & Cellular Mechanics 3 Credits
Mechanics and physics of cell components, from fundamental biomolecules to the entire cell. The mechanics of proteins and other biopolymers in 1D, 2D, and 3D structures, cell membrane structure and dynamics, and the mechanics of the whole cell. This course is a graduate version of CHE 321 (BioE/Phy 321). The lecture content will be the same as in CHE 321 (BioE/Phy 321), but students enrolled in CHE 421 (BioE 421) will have more advanced assignments. Closed to students who have completed CHE 321 (BioE/Phy 321). Must have graduate standing or consent of instructor.

CHE 428 Rheology 3 Credits
An intensive study of momentum transfer in elastic viscous liquids. Rheological behavior of solution and bulk phase polymers with emphasis on the effect of molecular weight, molecular weight distribution and branching. Derivation of constitutive equations based on both molecular theories and continuum mechanics principles. Application of the momentum equation and selected constitutive equations to geometries associated with viscometric flows. Consent of instructor required. Prerequisites: CHE 461 or CHE 452

CHE 430 Mass Transfer 3 Credits
Theory and developments of the basic diffusion and mass transfer equations and transfer coefficients including simultaneous heat and mass transfer, chemical reaction and dispersion effects. Applications to various industrially important operations including continuous contact mass transfer, absorption, humidification, etc. Brief coverage of equilibrium stage operations as applied to absorption and to binary and multicomponent distillation.
CHE 433 (ECE 433, ME 433) Linear Systems and Control 3 Credits
This course covers the following topics in linear systems and control theory: review of fundamental concepts in linear algebra, state-space representation of linear systems, linearization, time-variance and linearity properties of systems, impulse response, transfer functions and their state-space representations, solution to LTI and LTV state equations, Jordan form, Lyapunov stability, input-output stability, controllability, stabilizability, observability, detectability, Canonical forms, minimal realizations, introduction to optimal control theory, Linear Quadratic Regulator (LQR), Algebraic Riccati Equation (ARE), frequency domain properties of LQR controllers.
Prerequisites: CHE 386 or ME 343 or ECE 212

CHE 434 (ECE 434, ME 434) Multivariable Process Control 3 Credits
A state-of-the-art review of multivariable methods of interest to process control applications. Design techniques examined include loop interaction analysis, frequency domain methods (Inverse Nyquist Array, Characteristic Loci and Singular Value Decomposition) feed forward control, internal model control and dynamic matrix control. Special attention is placed on the interaction of process design and process control. Most of the above methods are used to compare the relative performance of intensive and extensive variable control structures.
Prerequisites: CHE 433 or ME 433 or ECE 433

CHE 436 (ECE 436, ME 436) Systems Identification 3 Credits
The determination of model parameters from time history and frequency response data by graphical, deterministic and stochastic methods. Examples and exercises taken from process industries, communications and aerospace testing. Regression, quasilinearization and invariant imbedding techniques for nonlinear systems parameter identification included.

CHE 437 (ECE 437, ME 437) Stochastic Control 3 Credits
Prerequisites: CHE 433 or ME 433 or ECE 433

CHE 438 Process Modeling and Control Seminar 1 Credit
Presentations and discussions on current methods, approaches, and applications. Credit cannot be used for the M.S. degree.

CHE 439 (BIOE 439) Neuronal Modeling and Computation 3 Credits
This course is a graduate version of CHE 339 (BIOE 339). While the lecture content will be the same as the 300-level course, students enrolled in CHE 444 will have more advanced assignments. Closed to students who have completed CHE 344 (BIOE 344). This course is a graduate version of CHE 344 (BIOE 344). While the lecture content will be the same as the 300-level course, students enrolled in CHE 444 will have more advanced assignments. Closed to students who have completed CHE 344 (BIOE 344).

CHE 440 Chemical Engineering in the Life Sciences 3 Credits
Introduction of important topics in life sciences to chemical engineers. Topics include protein and biomolecule structures and characterization, recombinant DNA technology, immunooaffinity technology, combinatorial chemistry, metabolic engineering, bioinformatics. Must have Bachelor's degree in science or engineering.

CHE 441 (BIOE 441) Biotechnology I 3 Credits
See the course description listed for CHE 341 (BIOE 341). In order to receive 400-level credits, the student must do an additional, more advanced term project, as defined by the instructor at the beginning of the course. Closed to students who have taken CHE 341 (BIOE 341).

CHE 442 (BIOE 442) Biotechnology II 3 Credits
See the course description listed for CHE 342 (BIOE 342). In order to receive 400-level credits, the student must do an additional, more advanced term project, as defined by the instructor at the beginning of the course. Closed to students who have taken CHE 342 (BIOE 342).

CHE 444 Bioseparations 3 Credits

CHE 446 Biochemical Engineering Laboratory 3 Credits
Laboratory and pilot-scale experiments in fermentation and enzyme technology, tissue culture, and separations techniques. Closed to students who have taken CHE 346. Prerequisites: CHE 341 or CHE 444 or CHE 342 Can be taken Concurrently: CHE 342

CHE 447 (BIOE 447) Molecular Bioengineering 3 Credits
This course is a graduate version of CHE 344 (BIOE 344). While the lecture content will be the same as the 300-level course, students enrolled in CHE 444 will have more advanced assignments. Closed to students who have completed CHE 344 (BIOE 344).

CHE 448 Topics in Biochemical Engineering 3 Credits
Analysis, discussion, and review of current literature for a topical area of biotechnology. may be repeated for credit with the consent of the instructor. Consent of instructor required. Repeat Status: Course may be repeated.

CHE 449 (BIOE 449) Metabolic Engineering 3 Credits
Quantitative perspective of cellular metabolism and biochemical pathways. Methods for analyzing stoichiometric and kinetic models, mass balances, flux in reaction networks, and metabolic control. Solving problems using advanced mathematics and computer programming. Closed to students who have completed BIOE 349. Must have graduate standing in Chemical Engineering or Bioengineering.

CHE 450 Special Topics 1-12 Credits
An intensive study of some field of chemical engineering not covered in the more general courses. Credit above three hours is granted only when different material is covered.

CHE 451 Problems In Research 1 Credit
Study and discussion of optimal planning of experiments and analysis of experimental data. Discussion of more common and more difficult techniques in the execution of chemical engineering research.

CHE 452 (BIOE 452, ENGR 452, ME 452) Mathematical Methods In Engineering I 3 Credits
Analytical techniques relevant to the engineering sciences are described. Vector spaces; eigenvalues; eigenvectors. Linear ordinary differential equations; diagonalizable and non-diagonalizable systems. Inhomogeneous linear systems; variation of parameters. Non-linear systems; stability; phase plane. Series solutions of linear ordinary differential equations; special functions. Laplace and Fourier transforms; application to partial differential equations and integral equations. Sturm-Liouville theory. Finite Fourier transforms; planar, cylindrical, and spherical geometries.

CHE 453 Teaching Apprentice 1 Credit
Students will work under the guidance of individual Faculty instructors to participate in some of the following teaching tasks: Development of the course syllabus, preparation and grading of homework and exams, holding a recitation and/or lecture section. Must have graduate standing in CHE department.
Repeat Status: Course may be repeated.

CHE 454 Seminar 0-3 Credits
Critical discussion of recent advances in chemical engineering.

CHE 455 Seminar 1-3 Credits
Critical discussion of recent advances in chemical engineering. Credit above one hour is granted only when different material is covered.

CHE 456 (BIOE 456) Stochastic Processes: Theory and Applications in Biology 3 Credits
Stochastic, or probabilistic, models of cellular processes and other biological systems to describe the inherent randomness of nature. Topics covered include theory and biological applications of Markov chains, the Master Equation, white noise and stochastic integrals, the Fokker-Planck Equation, and noise in gene expression. Some minimal experience in programming and/or Mathematica/Matlab.
Prerequisites: MATH 205

CHE 460 Chemical Engineering Project 1-6 Credits
An intensive study of one or more areas of chemical engineering, with emphasis on engineering design and applications. A written report is required.
Repeat Status: Course may be repeated.
CHE 463 (BIOE 463) Numerical Methods for Scientists and Engineers 3 Credits
See the course description listed for ChE 363 (BIOE 363). This course is graduate version of ChE 363 (BIOE 363). The lecture content will be the same as ChE 363 (BIOE 363), but students enrolled in ChE 463 (BIOE 463) will have more advanced assignments. Closed to students who have taken ChE 363 (BIOE 363). Must have graduate standing or consent of the instructor.

CHE 465 Molecular Modeling and Simulation 3 Credits
See the course description listed for ChE 365. This course is graduate version of ChE 365. The lecture content will be the same as ChE 365, but students enrolled in ChE 465 will have more advanced assignments. Closed to students who have taken ChE 365. Must have graduate standing or consent of the instructor.

CHE 473 Environmental Separation and Control 3 Credits
Theory and application of adsorption, ion exchange, reverse osmosis, air stripping and chemical oxidation in water and wastewater treatment. Modeling engineered treatment processes.
Prerequisites: CEE 470

CHE 480 Research 3 Credits
Investigation of a problem in chemical engineering.

CHE 481 Research 3 Credits
Continuation of CHE 480.

CHE 482 (CHM 482, MAT 482) Mechanical Behaviors of Polymers 3 Credits

CHE 483 (CHM 483, MAT 483) Emulsion Polymers 3 Credits
Examination of fundamental concepts important in the manufacture, characterization, and application of polymer latexes. Topics to be covered will include colloidal stability, polymerization mechanisms and kinetics, reactor design, characterization of particle surfaces, latex rheology, morphology considerations, polymerization with functional groups, film formation and various application problems.

CHE 485 (CHM 485, MAT 485) Polymer Blends and Composites 3 Credits
Synthesis, morphology, and mechanical behavior of polymer blends and composites. Mechanical blends, block and graft copolymers, interpenetrating polymer networks, polymer impregnated concrete, and fiber and particulate reinforced polymers are emphasized. Must have completed any introductory course in polymers.

CHE 486 Polymer Processing 3 Credits
Application of fundamental principles of mechanics, fluid dynamics and heat transfer to the analysis of a wide variety of polymer flow processes. A brief survey of the rheological behavior of polymers is also included. Topics include pressurization, pumping, die forming, calendering, coating, molding, fiber spinning and elastic phenomena.

CHE 490 Thesis 1-6 Credits
CHE 492 (CHM 492, MAT 492) Topics in Polymer Science 3 Credits
Intensive study of topic selected from areas of current research interest such as morphology and mechanical behavior, thermodynamics and kinetics of crystallization, new analytical techniques, molecular weight distribution, non-Newtonian flow behavior, second order transition phenomena, novel polymer structures. Credit above three hours is granted only when different material is covered.
Prerequisites: CHE 392 or CHE 392 or CHM 392 or CHM 392

CHE 499 Dissertation 1-15 Credits
Repeat Status: Course may be repeated.

Civil and Environmental Engineering

CIVIL ENGINEERING
Civil engineering occupies a prominent position as one of the major fields in the engineering profession. Civil engineers are concerned with all aspects of the conception, planning, design, construction, operation, and maintenance of major physical works and facilities that are essential to modern life. Civil engineering projects are typically characterized by extreme size, complexity, durability, and cost. Examples include bridges, buildings, transportation facilities, tunnels, coastal facilities, dams, foundations, and waterways.

The Mission of our Civil Engineering Bachelor of Science degree program is to educate students in the principles and methods essential to the practice and advancement of the interdisciplinary field of civil engineering. The program is proactive and continues to incorporate new and emerging paradigms in all aspects of teaching and education while maintaining rigorous standards in traditional approaches to engineered solutions of civil problems. Our goal is to prepare students to apply and continually cultivate knowledge that will enable them to become successful practitioners, innovators and leaders in serving the needs of a complex society.

The Program Educational Objectives of our Civil Engineering Bachelor of Science program are to prepare Civil Engineering Graduates to:

1. Develop careers in civil engineering and other professionally related fields.
2. Seek additional professional training and personal development.
3. Apply their skills to develop innovative solutions and technologies.
4. Pursue professional licensure and/or certification.
5. Advance to become members of professional societies and future leaders in their profession.

To achieve the program education objectives, the civil engineering program has adopted the following seven ABET student outcomes:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. An ability to communicate effectively with a range of audiences
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

ENVIRONMENTAL ENGINEERING
Environmental Engineering is an interdisciplinary branch of the engineering profession where science and engineering principles are combined to provide healthy soil, water and air; remediate contaminated sites; and to improve the overall quality of the environment through the development of sustainable processes. Example activities include design of water and wastewater treatment facilities, detecting and modeling fate and transport of contaminants in both natural and engineered environments; developing technology-based solutions for restoring environmental quality; and developing and/or modifying industrial processes for ecological preservation and enhanced sustainability.

The Mission of our Environmental Engineering Bachelor of Science degree program is to educate students in the principles and methods essential to the practice and advancement of the interdisciplinary field of environmental engineering. The program is proactive and continues to incorporate new and emerging paradigms in all aspects of teaching and education while maintaining rigorous standards in traditional approaches to engineered solutions of environmental problems. Graduates of the program possess technical expertise required to maintain a healthy balance between societal welfare, economic growth and the environment surrounding us.
The Program Educational Objectives of our Environmental Engineering Bachelor of Science program are to prepare environmental engineering graduates to:

1. Develop careers in environmental engineering and other professionally related fields.
2. Seek additional professional training and personal development.
3. Apply their skills to develop innovative solutions and technologies.
4. Pursue professional licensure and/or certification.
5. Advance to become members of professional societies and future leaders in their profession.

To achieve the program education objectives, the environmental engineering program has adopted the following seven ABET student outcomes:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, economic, and environmental factors
3. An ability to communicate effectively with a range of audiences
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

EDUCATIONAL AND CAREER OPPORTUNITIES

In each curriculum, emphasis is placed on the development of a solid knowledge of civil or environmental engineering fundamentals. Both undergraduate programs include a strong base of mathematics, including calculus, probability and statistics, and the physical sciences, followed by a course in planning and engineering economics. A broad range of required and elective courses in engineering science, analysis and design in the areas listed above meet each set of program objectives. Elective courses in both programs extend across the areas of structural, geotechnical, hydraulic, environmental, construction, project management, and transportation engineering. Additional elective courses in the environmental program are available from chemical engineering, chemistry, biology, and earth and environmental science.

Five-year programs are available for students interested in a second bachelor’s degree in a major in the College of Arts and Sciences (see listings under Arts-Engineering (p. 360); Civil Engineering and Earth and Environmental Sciences (p. 385)).

The civil and environmental engineering programs prepare individuals for entry into the engineering profession or for entry into high-quality programs of graduate study. With proper selection of electives, students may also prepare for entrance into schools of law or medicine, or into master’s-level programs in engineering management or business administration.

For additional useful information visit our departmental website www.lehigh.edu/~incee/.

Professors. Derick G. Brown, PHD (Princeton University); Panayiotis Dimpas, PHD (University of Minnesota Twin Cities); Dan M. Frangopol, SCD (Universite de Liege); Gerard P. Lennon, PHD (Cornell University); Clay Joshua Naito, PHD (University of California, Berkeley); Sibel Pamukcu, PHD (Louisiana State University); Stephen P. Pessiki, PHD (Cornell University); James M. Ricles, PHD (University of California, Berkeley); Richard Sause, Jr., PHD (University of California, Berkeley); Arup K. Sengupta, PHD (University of Houston University Park)

Associate Professors. Paolo Bocchini, PHD (University of Bologna); Kristen Jellison, PHD (Massachusetts Institute of Technology); Peter Mueller, DSC (ETH Zurich); Shamin N. Pakzad, PHD (University of California, Berkeley); Muhamad T. Suleiman, PHD (Iowa State University)

Assistant Professors. John Thomas Fox, PHD (The Pennsylvania State University); Spencer E. Quiel, PHD (Princeton University); Yi-Chen Ethan Yang, PHD (University of Illinois at Urbana-Champaign)

Professors Of Practice. Jennifer H. Gross, MS (University of Texas at Austin); Mesut Pervizpour, PHD (Lehigh University)

Emeriti. John Hartley Daniels, PHD (Lehigh University); Hsai-Yang Fang, PHD (West Virginia Univ); John W. Fisher, PHD (Lehigh University); Robert M. Sorenson, PHD (University of California, Berkeley); David A. Van Horn, PHD (Iowa State University); Richard N. Weisman, PHD (Cornell University); John L. Wilson, PHD (University of Pittsburgh); Ben T. Yen, PHD (Lehigh University)

- Civil Engineering (p. 376)
- Environmental Engineering (p. 377)
- Technical Minor in Environmental Engineering (p. 377)

B.S. IN CIVIL ENGINEERING

Required Courses

A total of 130 credit hours are required for graduation with the degree of Bachelor of Science in Civil Engineering.

Recommended Sequence of Courses

The HSS Advanced Requirement of 13 credits is shown below as three 3-credit courses and one 4-credit course. Other options are possible.

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<tr>
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<th>Second Semester</th>
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<td>PHY 011</td>
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<td>CEE 170</td>
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<td>CEE 202</td>
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<td>CEE 159</td>
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<td>BSE Basic Science Elective</td>
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<td>CEE 262 or 264</td>
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<td>CEE 290</td>
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AE CEE Approved Electives 5
HSS Humanities/Social Sciences Elective 7
FE Free Elective 3

Total Credits: 130

1 Basic Science Elective; list of approved courses is available from CEE department.
2 Seventeen CEE elective credits approved by the CEE department; list available from department.

The selection of elective courses is to be in consultation with student’s academic adviser in the Department of Civil and Environmental Engineering.

B.S. IN ENVIRONMENTAL ENGINEERING

Required Courses

A total of 131 credit hours are required for graduation with the degree Bachelor of Science in Environmental Engineering.

Recommended Sequence of Courses

The HSS Advanced Requirement of 13 credits is shown below as three 3-credit courses and one 4-credit course. Other options are possible.

First Year

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<th>First Semester</th>
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<td>PHY 011 &amp; PHY 012</td>
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<td>ENGR 010</td>
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<td>FE Free Elective</td>
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<td>CEE 012</td>
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<td>ESR Earth Science Requirement 3</td>
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Third Year

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<tr>
<td>CEE 203</td>
<td>2</td>
<td>CEE 377</td>
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Total Credits: 131

1 HSS Advanced requirement is 13 credits, four credits of which must be an approved environmental studies course; list of approved courses is available from CEE department.
2 Nine approved elective credits to satisfy proficiency in four focus areas of water supply and resources, environmental chemistry, waste management and biological processes; approved list available from CEE department.
3 Earth Science Requirement, list of approved courses is available from CEE department.
4 Environmental Biology Requirement, list of approved courses is available from CEE department.

The selection of elective courses is to be in consultation with student’s academic adviser in the Department of Civil and Environmental Engineering.

TECHNICAL MINOR IN ENVIRONMENTAL ENGINEERING

A technical minor in Environmental Engineering is available for students outside the department. At least two of the courses must be from the CEE department.

CHM 031 Chemical Equilibria in Aqueous Systems (Prerequisite) | 4

Select three of the following required courses: 9-10

CEE 170 Introduction to Environmental Engineering
CEE 274 Environmental Water Chemistry
CEE/CHE 373 Fundamentals of Air Pollution
CEE/CHE 375 Environmental Engineering Processes

Select one additional course from the required list or from the following: 3

CEE 222 Water Resources Engineering
CEE/EES 323 Environmental Groundwater Hydrology
CEE/EES 327 Surface Water Quality Modeling
CEE 345 Geo-Environmental Engineering
CEE 370 Environmental Separation and Control
CEE 371 Reaction Kinetics in Environmental Engineering

Other courses may be selected with the minor adviser’s approval.

GRADUATE PROGRAMS

The Department of Civil and Environmental Engineering (CEE) has graduate degree programs leading to Master’s and Ph.D. degrees in: Civil Engineering, Structural Engineering, and Environmental Engineering.

The department offers advanced work in the specialty areas of structure engineering, geotechnical engineering, water resources engineering, and environmental engineering. Degrees offered are:

- M.Eng., M.S., Ph.D. in Structural Engineering
- M.Eng., M.S., Ph.D. in Civil Engineering
- M.Eng., M.S., Ph.D. in Environmental Engineering

The programs educate students through coursework and independent study and research. Our programs are designed to provide students with the knowledge and analytical problem-solving capabilities needed to lead and innovate within multi-disciplinary teams in technologically-complex environments.

Graduate studies in the department of civil and environmental engineering enable the student to build upon the broad background of
undergraduate education in preparation for professional practice at an advanced level, for research and development, or for teaching.

A graduate program leading to the M.S. normally is concentrated in one, or possibly two, of the technical specialty areas, and consists of a number of courses designed to fulfill the individual student's program objectives. Each candidate for the M.S. is required to submit a thesis representing three to six credit hours (CEE 491), or alternatively, a report based on a research course of at least three credits (CEE 429, CEE 439, CEE 449, CEE 479 or CEE 481). The balance of the program will consist of courses in the specialty area(s).

A graduate program leading to the M.Eng. degree stresses engineering applications and design. The department offers two different M.Eng. degrees. The M.Eng. in Structural Engineering focuses specifically on structural engineering. Candidates for the M.Eng. in Structural Engineering degree compete for positions as part of a 3-course design project sequence (CEE 416, CEE 417, CEE 418). The M.Eng. degrees in Civil Engineering and Environmental Engineering allow students to select courses across the various specialty areas of civil and environmental engineering. Candidates for the M.Eng. degrees in Civil Engineering and Environmental Engineering have the option to complete an individual engineering project or a research report, representing 3 to 6 credits (CEE 480), or may take 30 course credits with no project or report.

The doctoral program, which leads to the Ph.D., normally includes courses in the major field, courses in minor fields, and a dissertation presenting results of original research. Holders of master's degrees planning to become candidates for the Ph.D. take a qualifying examination. After qualification, the candidate, the candidate's departmental Ph.D. committee, and the department chair formulate the program of work. The departmental laboratories are located in the Fritz Engineering Laboratory and in the STEPS Building. The laboratories offer outstanding facilities for research and instruction in structural engineering, geotechnical engineering, water resources engineering, and environmental engineering. In particular, the structural testing equipment includes dynamic testing machines, a five-million-pound universal hydraulic testing machine, and other state-of-the-art facilities. Included in the latter are the facilities of the Center for Advanced Technology for Large Structural Systems (ATLSS center) located on the mountaintop campus. These include the largest 3-dimensional test bed in the U.S.A. and specialized earthquake testing facilities of the NSF George E. Brown, Jr. Network Earthquake Engineering Simulation (NEES). The water resources facilities include a wave tank, several flumes, a 10-cfs recirculating flow system, and two multipurpose tanks for model studies. The geotechnical facilities include state-of-the-art, fully automated triaxial compression and permeability machines for multiple simultaneous tests. The environmental facilities include state-of-the-art laboratories and analytical instrumentation for analysis of chemical, physical and microbiological systems.

In addition to departmental courses, a number of courses offered by the departments of mechanical engineering and mechanics, chemistry, chemical engineering, materials science and engineering, earth and environmental sciences, and biology may also be considered a part of the major field in civil and environmental engineering. A number of research and teaching assistantships are available to provide financial support to students of outstanding promise. The research or teaching activities required of holders of assistantships provides a valuable educational experience that supplements the formal course offerings. A very limited number of scholarships and fellowships are available to provide financial support for full-time study.

Courses

**CEE 003 Engineering Statics 3 Credits**

**Prerequisites:** PHY 011 and (MATH 022 or MATH 096)

**Can be taken Concurrently:** MATH 022, MATH 096

**CEE 010 (ARCH 010) Engineering/Architectural Graphics and Design 3 Credits**
Graphical communication of civil engineering and architectural projects using manual techniques and commercial state-of-the-art computer software. Topics include visualization and sketching; orthographic, isometric and other drawings; points, lines and planes in descriptive geometry; site design; overview of geographical information systems and 3-D applications. Teamwork on design projects with oral and graphical presentations. Open to a limited number of architecture, design arts or other students with project roles consistent with students' background. Not available to students who have taken ME 010.

**CEE 011 Surveying 1 Credit**
Theory and practice of basic engineering surveying measurements and analysis. Topics to include field note taking, datums and measurement precision, equipment and techniques for measuring distance, elevation and angles, electronic distance measurement, topographic surveys, GPS and hydrographic surveys. Hands on experience with the use of survey levels, transits/theodolites and a total station will be provided.

**CEE 012 Engineering Probability and Statistics 2 Credits**
Basic engineering statistics with a civil & environmental engineering focus. Topics to include: random variables and histograms; central tendency, dispersion and skew; probability density functions and cumulative distribution functions, basic probability concepts and selected probability models, return period analysis, linear regression and least squares, correlation analysis, propagation of errors.

**Prerequisites:** MATH 021

**CEE 059 Strength of Materials 3 Credits**
Analysis of stress and strain; Hooke's law; effect of axial load, bending moment, transverse shear, and torsion in beams of generic cross section; composite beams; inelastic bending; eccentric axial loading; shear center; Euler's instability; Mohr's circle for stress; stress combination; failure criteria.

**Prerequisites:** CEE 003 and MATH 023

**Can be taken Concurrently:** MATH 023

**CEE 104 Readings in Civil Engineering 1-4 Credits**
Study of selected technical papers, with abstracts and reports. Consent of the department chair required.

**CEE 117 Numerical Methods in Civil Engineering 2 Credits**
Techniques for computer solution of linear and non-linear simultaneous equations; eigenvalue analysis; finite differences; numerical integration; numerical solutions to ordinary differential equations. Case studies in the various branches of civil engineering.

**Prerequisites:** MATH 205

**Can be taken Concurrently:** MATH 205

**CEE 122 Fluid Mechanics 3 Credits**
Fluid properties and statics; concepts and basic equations for fluid dynamics. Forces caused by flowing fluids and energy required to transport fluids. Dynamics similitude and modeling of fluid flows. Includes laboratory experiments to demonstrate basic concepts.

**Prerequisites:** MECH 002 or MECH 003 or CEE 003

**CEE 123 Civil Engineering Materials 3 Credits**
Properties of commonly used civil engineering materials including aggregate, Portland cement concrete, asphalt, concrete, wood, metals, and polymer based synthetics. Standard test methods. Includes laboratory work and reporting of results.

**Prerequisites:** CEE 059 or MECH 012

**CEE 142 Soil Mechanics 3 Credits**
Physical properties of soils; mineralogy, composition and fabric. Phase and weight-volume relationships, consistency, gradation and classification of soils. Fluid flow through porous media. Stress-strain behavior; stresses within a soil mass, deformation behavior, measurement of stress-strain properties, shear strength of soil. Volume change in soils; compressibility, pore water pressure, consolidation and settlement. Laboratory experiments to measure physical and mechanical properties of soils.

**Prerequisites:** MECH 002 or MECH 003 or CEE 003
CEE 159 Structural Analysis I 4 Credits
Elastic analysis of statically determinate beams, frames, and trusses; deflections by the methods of virtual work and moment area; influence lines for determinate structures; modeling for structural analysis; flexibility, stiffness, and approximate methods of analysis of indeterminate structures.
Prerequisites: CEE 059

CEE 170 Introduction to Environmental Engineering 4 Credits
Prerequisites: CHM 030

CEE 171 (CHE 171, EMC 171, ES 171) Fundamentals of Environmental Technology 4 Credits
Introduction to water and air quality, water, air and soil pollution. Chemistry of common pollutants. Technologies for water purification, wastewater treatment, solid hazardous waste management, environmental remediation, and air quality control. Global changes, energy and environment. Constraints of environmental protection on technology development and applications. Constraints of economic development on environmental quality. Environmental life cycle analysis and environmental policy. Not available to students in RCEAS.

CEE 202 CEE Planning and Engineering Economics 3 Credits
The planning and management of civil engineering projects. Modeling and optimization methods, project management techniques. Financial decision-making among alternatives. Present value and discounted cash flow analysis; incremental analysis and rate-of-return criteria.

CEE 203 Professional Development 2 Credits
Elements of professionalism; professional ethics; engineering registration; continuing education; responsibilities of an engineer in industry, government, private practice; role of professional and technical societies.

CEE 205 Design Problems 1-3 Credits
Supervised individual design problems, with report. Consent of the department chair required.
Repeat Status: Course may be repeated.

CEE 207 Transportation Engineering 3 Credits
Principles of the design of transportation facilities with emphasis on highways and airports in the areas of geometric, drainage, and pavement design. Design problems.
Prerequisites: CEE 011

CEE 211 Research Problems 1-3 Credits
Supervised individual research problems, with report. Consent of the department chair required.
Repeat Status: Course may be repeated.

CEE 222 Water Resources Engineering 3 Credits
Pipe and pump hydraulics, surface and ground water hydrology, and open channel hydraulics. Laboratory experiments in applied hydraulics.
Prerequisites: CEE 122 or ME 231

CEE 242 Geotechnical Engineering 3 Credits
The principles related to analysis and evaluation of earthen infrastructure. Site characterization and in-situ testing of soils. Advanced stress-strain behavior, failure theories and stress path application. 2D fluid flow in porous media, flow nets, uplift forces, and liquefaction. Stability of earthen structures; slopes, dams and levees. Stability of retaining structures; lateral earth pressures. Introduction to shallow foundations; bearing capacity and settlement. Team project.
Prerequisites: CEE 142

CEE 258 Structural Laboratory 3 Credits
Prerequisites: CEE 262 and CEE 264

CEE 259 Structural Analysis II 3 Credits
Analysis of statically indeterminate structures, methods of slope deflection and moment distribution; consideration of side-sway and nonprismatic members. Influence lines for determinate and indeterminate structures. Flexibility and stiffness matrix methods for computerized analysis. Use of computer library programs.
Prerequisites: CEE 159

CEE 262 Fundamentals of Structural Steel Design 3 Credits
Introduction to steel structures. Behavior, strength and design of structural members, including members subjected to axial tension, axial compression, flexure and combined compression and flexure. Basic methods of joining members to form a structural system. Use of design specifications.
Prerequisites: CEE 159

CEE 264 Fundamentals of Structural Concrete Design 3 Credits
Analysis, design, and detailing of reinforced concrete members and simple systems for strength and serviceability requirements, including beams, columns, and slabs. Introduction to prestressed concrete.
Prerequisites: CEE 159

CEE 266 Construction Management 3 Credits
An overview of management and construction techniques used in engineering ventures and projects. Scheduling, estimation, construction methods, financial controls, contracts, labor relations and organizational forms. Case studies and lecturers from industry.
Prerequisites: CEE 202

CEE 272 Environmental Risk Assessment 2 Credits
Effects of chemical releases on human health; ecological risks. Application of risk assessment methodology, including hazard identification, exposure assessment, toxicity assessment, and risk characterization. Accounting for uncertainty in data during risk management, risk reduction and implementation of regulations and environmental policy.

CEE 274 Environmental Water Chemistry 3 Credits
Chemical principles and applications of those principles to the analysis and understanding of aqueous environmental chemistry in natural waters and wastewaters. The chemistry of ionic equilibria, redox reactions, precipitation/dissolution, acid-base concepts, buffer capacity, complexation, hydrolysis and biological reactions.
Prerequisites: CHM 031 or CEE 170

CEE 275 Environmental, Geotechnics and Hydraulics Laboratory 2 Credits
Applying fundamentals of soil properties, hydraulics and environmental science through appropriate laboratory experiments for solution of environmental engineering problems. Experiments will include solute transport in surface and subsurface medium; characterization of soils, slurdes and water; treatment of water and wastewater including biological processes. Illustration of techniques to generate design parameters for scale-up.
Prerequisites: CEE 170 and CEE 274
Can be taken Concurrently: CEE 274

CEE 279 Microbial Ecology 4 Credits
The role of microorganisms in the environment. Topics include: Survey of microbial classification, structure, and metabolism; study of microbes at population, community, and ecosystem levels of organization; the role of microbes in biogeochemical cycles; application of microbes to bioremediation and resource recovery problems.
Prerequisites: EES 152

CEE 281 Special Topics 1-3 Credits
A study of selected topics in civil and environmental engineering not included in other formal courses. A design project or an interdisciplinary study of a problem related to civil or environmental engineering may be included. Civil and environmental engineering students working on design projects involving students from other departments or colleges working in cross-disciplinary teams may be included. A report is required. Consent of the department chair required.
Repeat Status: Course may be repeated.
CxEE 290 CEE Design Project 3 Credits
Supervised design projects. Multidisciplinary teams applying the fundamentals of engineering science and the concepts of planning and systems analysis in the design of practical engineering works. The scope includes needs analysis, formulation of the design problem statement and evaluative criteria; analysis of alternative solutions and the generation of specifications. Includes most of the following considerations: economic, sustainability, manufacturability, ethical, social, environmental, aesthetic, political, health and safety. Practicing professional engineers are invited to serve as consultants. Written and oral reports are required. Must have senior standing in CEE department.

CxEE 301 Modeling Environmental Systems 3 Credits
Apply flow and contaminant transport models to engineered environments and surface and subsurface natural environments. Formulation of problem statements in terms of ordinary and partial differential equations, boundary conditions, and parameters. Apply finite difference techniques using contemporary software. Solution of systems of linear and nonlinear equations. Introduction to finite elements. Prerequisites: CEE 121 or MATH 205

CxEE 316 (EES 316) Hydrogeology 3,4 Credits
Water plays a critical role in the physical, chemical, and biological processes that occur at the Earth's surface. This course is an introduction to surface and groundwater hydrology in natural systems, providing fundamental concepts and a process-level understanding using the hydrologic cycle as a framework. Geochemistry will be integrated to address natural variations and the human impact on the environment. Topics covered include: watershed hydrology, regional and local groundwater flow, water chemistry, and management of water resources. Lectures and laboratory. Prerequisites: (EES 080 and EES 115 or EES 131 or EES 152) or (CEE 170) Can be taken Concurrently: EES 115, EES 131, EES 152 Attribute/Distribution: NS

CxEE 320 (EES 320) Engineering Hydrology 3 Credits

CxEE 322 Water Resources Engineering II 3 Credits
Advanced topics in fluid mechanics, free surface flows, hydraulic structures, and in pipe hydraulics including pipe network systems. Prerequisites: CEE 222

CxEE 323 (EES 323) Environmental Groundwater Hydrology 3 Credits
The study of subsurface water, its environment, distribution, and movement. Included are flow patterns, well hydraulics, and an introduction to the movement of contaminants. Design problems are included to simulate flow with analytical and numerical models, and contaminant migration using analytical models. Prerequisites: CEE 122 or CEE 316 or EES 316 or ME 231 or CHE 044

CxEE 327 (EES 327) Surface Water Quality Modeling 3 Credits
Fundamentals of modeling water quality parameters in receiving water bodies, including rivers, lakes, and estuaries. Modeling of dissolved oxygen, nutrients, temperature, and toxic substances. Emphasis on water quality control decisions as well as mechanics and model building. Prerequisites: (CEE 122 or ME 231 or CHE 044) and CEE 222

CxEE 340 Advanced Foundation Engineering 3 Credits
Current theory and practice relating to the design of deep foundations supporting buildings and other structures. Construction practices; analysis and design (bearing capacity, settlement, dynamic effects); site investigations; load-resistance-factor design (LRFD) criteria for foundations. Prerequisites: CEE 242

CxEE 341 Ground Improvement and Site Development 3 Credits
Soil stabilization; grouting and injection methods; preloading and dynamic consolidation; deep compaction; drainage and dewatering; application of geotextiles and geomembranes; soil nailing and reinforcement methods. Use of in-situ test for soil properties and site characterization; procedures and calibration methods for the basic in-situ tests - SPT, CPT, CPTU, DMT; theoretical, experimental and empirical interpretive methods for in-situ test results. Prerequisites: CEE 242

CxEE 342 Experimental Geotechnical Engineering 3 Credits
Experimental studies dealing with the measurement of soil and other particulate materials properties, and behavior in the laboratory. Test procedures, calibration, data acquisition, interpretation of apparatus limitations and potential error sources, specimen preparation, data analysis and interpretation; designing experiments. Senior standing required. Prerequisites: CEE 242

CxEE 344 Behavior of Soils as Engineering Materials 3 Credits
Soil mineralogy, bonding, crystal structure and surface characteristics; clay-water electrolyte system; soil fabric and its measurement; soil structure and physical property relationships; soil depositional and compositional characteristics; engineering properties of soils as they relate to soil mineralogy, fabric and composition: volume change behavior, intergranular stresses, shear strength and deformation behavior, conduction behavior, coupled and direct flow phenomena. Prerequisites: CEE 242

CxEE 345 Geo-Environmental Engineering 3 Credits
Principles of interaction of soil and rock with various environmental cycles. Physical and chemical properties of soil. Soil fabric and its measurement, clay-water electrolyte system, electrical double layer and DLVO theory; contaminated site characterization, groundwater flow and contaminant transport; detection and quantification technologies; waste containment systems, landfills, liner systems, leachate collection; soil and groundwater cleanup technologies. Prerequisites: CEE 242

CxEE 346 Fundamentals of Designing with Geosynthetics 3 Credits
Fundamental and current theories of designing soil structures with geosynthetics. Roads and highway applications; reinforced embankments; slope stabilization; waste containment systems; erosion control; filtration and drainage. Prerequisites: CEE 242

CxEE 347 Foundation Engineering 3 Credits
Application of theories and principles of soil mechanics to geotechnical and structural foundation design. In-situ soil testing, subsurface exploration and soil sampling. Bearing capacity, settlement, lateral earth pressure principles. Design of shallow foundations: spread footings, beams on elastic foundations, mat foundations. Introduction to retaining walls: mechanically stabilized earth, concrete and sheet pile walls, walls for excavations. Design of deep foundations: single piles, pile foundations, drilled piers and caissons. Prerequisites: CEE 242

CxEE 351 Advanced Structural Concrete Design 3 Credits
Advanced analysis, design and detailing of reinforced concrete members and systems. Topics include two-way slab systems, biaxial bending of beam-columns, slender columns, torsion, yield line analysis, strut-and-tie models. Prerequisites: CEE 264

CxEE 352 Structural Dynamics 3 Credits
Analysis of linear structural systems to time-dependent loads. Free and forced vibration. Classical and numerical methods of solution. Lumped-mass techniques, energy methods, and introduction to matrix formulation of dynamic problems. Application to design. Graduate student status required. Prerequisites: MATH 205 and CEE 159 and MECH 102
CEE 354 Sensors, Signals, and Systems 3 Credits

CEE 358 Random Vibrations 3 Credits
Review of probability theory. General characterization and models of random functions for engineering applications (seismic ground motion, wind velocity, ocean waves, mechanical vibrations). Vibration of deterministic systems under random dynamic loads; applications to wind and seismic engineering. Uncertain systems under random perturbations, simulation of random functions for numerical solutions (non-stationary, non-Gaussian, multi-variate processes, multi-dimensional fields).

Prerequisites: CEE 352
Can be taken Concurrently: CEE 352

CEE 361 Bridge Systems Design 3 Credits
Introduction to bridge structural systems in steel and concrete. Loads and specifications. Design and analysis of bridge structural components.

Prerequisites: CEE 259 and CEE 262 and CEE 264

CEE 363 Building Systems Design 3 Credits
Building structural systems in steel, reinforced concrete and composite steel and concrete. Design loads (dead, live and environmental) and methodologies. Structural systems behavior and design. Design of floor systems, beam-columns, connections, walls, and overall frames. Final design.

Prerequisites: CEE 259 and CEE 262 and CEE 264

CEE 364 Advanced Project Management 3 Credits

Prerequisites: (CEE 266)

CEE 365 Prestressed Concrete 3 Credits
Principles of prestressing. Analysis and design of basic flexural members. Instantaneous and time-dependent properties of materials. Prestress losses. Additional topics may include continuity, partial prestressing, compression members, circular prestressing, etc.

Prerequisites: CEE 264

CEE 366 Finite Element Method in Structural Engineering 3 Credits
The finite element method: fundamental concepts, theory, modeling, and computation for the analysis of structures. One, two, and three-dimensional finite elements. Isoparametric formulation and implementation for various kinds of elements. Applications to problems in the behavior of structural elements and systems including analysis of trusses, beams, plates, and frames and bridge systems. Extensions to nonlinear analysis and advanced topics. Use of contemporary commercial software.

Prerequisites: CEE 259

CEE 370 Environmental Separation and Control 3 Credits
Theory and application of adsorption, ion exchange, reverse osmosis, air stripping and chemical oxidation in water and wastewater treatment. Modeling engineered treatment processes.

Prerequisites: CEE 371

CEE 371 Reaction Kinetics in Environmental Engineering 3 Credits
Theory of reaction kinetics and its application to the design and operation of chemical, physico-chemical and biological reactions in water, wastewater, and hazardous waste treatment. Basic design equations for various types of reactors and migration of pollutants in the environment.

Prerequisites: CEE 375 or CHE 375

CEE 373 (CHE 373) Fundamentals of Air Pollution 3 Credits
Introduction to the problems of air pollution including such topics as: sources and dispersion of pollutants, sampling and analysis; technology of economics and control processes; legislation and standards. Must have senior standing in the College of Engineering and Applied Science.

CEE 375 (CHE 375) Environmental Engineering Processes 3 Credits
Processes applied in environmental engineering for air pollution control, treatment of drinking water, municipal wastewater, industrial wastes, hazardous/toxic wastes, and environmental remediation. Kinetics, reactor theory, mass balances, application of fundamental physical, chemical and biological principles to analysis and design.

Prerequisites: CEE 170

CEE 376 Environmental Biotechnology 3 Credits
Fundamentals of microbiology and biochemistry applied to natural and engineered environmental systems. Systems ecology, energetics and kinetics of microbial growth, nutrition and toxicology, use of microorganisms for pollution monitoring and control. Pathogenicity and disease transmission, water quality using biological indices.

Prerequisites: CEE 375 or CHE 375

CEE 377 Environmental Engineering Design 3 Credits
Team-oriented course to develop design skills in the area of environmental engineering. Project components typically include: air pollution, drinking water, municipal wastewater, industrial wastes, hazardous/toxic wastes, and environmental remediation. Project work typically includes: a background report, a design report, and an oral presentation. Tools used in the design process may include simulation models. Must have senior standing in CEE department.

Prerequisites: CEE 375

CEE 378 Hazardous Waste Treatment and Management 3 Credits
Regulations for collection, transportation, disposal and storage of hazardous wastes. Containment systems, monitoring, new and available technologies to minimize, transform, destroy, detoxify and eliminate the hazardous components of the wastes. Environmentally benign processes and life cycle analysis.

Prerequisites: CEE 375 or CHE 375

CEE 379 (EES 379) Environmental Case Studies 3-4 Credits
Case studies will be used to explore the impact of politics, economics, society, technology, and ethics on environmental projects and preferences. Environmental issues in both affluent and developing countries will be analyzed. Multidisciplinary student teams will investigate site characterization; environmental remediation design; environmental policy; and political, financial, social, and ethical implications of environmental projects.

Prerequisites: (EES 022 or CEE 375 or CHE 375)
Attribute/Distribution: NS

CEE 381 Special Topics 1-3 Credits
A study of selected topics in civil and environmental engineering, not included in other formal courses. A report is required. Consent of the department chair required.

CEE 385 Research Procedures Seminar 1 Credit
Planning and execution of research projects, survey of current research, elements of proposals and budgets. Literature search procedures. Presentation of data, and of written and oral reports. Guidelines for visual aids.

CEE 401 Modeling Environmental Systems 1-3 Credits
Apply flow and contaminant transport models to engineered environments and surface and subsurface natural environments. Formulation of problem statements in terms of ordinary and partial differential equations, boundary conditions, and parameters. Apply finite difference techniques using contemporary software. Solution of systems of linear and nonlinear equations. Introduction to finite elements. Students cannot receive credit for both CEE 401 and CEE 301.

Prerequisites: CEE 122 or MATH 205
CEE 404 Mechanics and Behavior of Structural Members 3 Credits

CEE 405 Analytical and Numerical Methods I 3 Credits
Prerequisites: MATH 205

CEE 406 Structural Reliability of Components and Systems 3 Credits
Probabilistic time-invariant failure analysis of structural components and systems. Statistics and probability; component time-invariant reliability analysis; system time-invariant reliability analysis; reliability-based structural design; and reliability of structural systems using Monte-Carlo simulation. Solutions suitable for practical computer implementation.

CEE 409 Finite Element Method in Structural Mechanics 3 Credits
Basic principles and equations governing the finite element method. Analysis of planar, axisymmetric, plate and articulated structures, with emphasis on analytical modeling. Accuracy and convergence studies, utilizing different discretizations and various types of elements. Case studies include application and extension to material nonlinearities, bridges, containment vessels, and soil-structure interaction. 
Prerequisites: CEE 405

CEE 412 Methodologies of Structural Design 2 Credits

CEE 414 Analysis and Design of Steel and Composite Structural Members 3 Credits
Fundamentals of limit state design. Ultimate strength analysis of steel and steel-and-concrete composite columns, beams, beam-columns, and members subjected to torsion and combined torsion and bending. Flexural and torsional instability. Background and requirements of current design codes.

CEE 415 Analysis and Design of Ductile Steel Structural Systems 3 Credits
Prerequisites: CEE 262

CEE 416 Design Project I 3 Credits
Introduction to the overall M.Eng. design project for a civil infrastructure facility. Design decision making and communication processes. Roles of various players in the execution of the project (e.g. owner, architect, engineer, fabricator, construction manager, contractor), and the mechanisms of communication of information in the design process (e.g. design drawings, shop drawings, erection drawings, as-built drawings). Roles of codes and standards. Enrollment limited to students in M.Eng. program.

CEE 417 Design Project II 3 Credits
Task-specific teams will be organized to perform preliminary designs of different design options for the overall design project. Determination of project goals, performance requirements, and functional specifications. Winnowing and selection of alternatives for final design. Professor of practice and external specialists will guide examination and evaluation of design options based on cost and performance criteria. 
Prerequisites: CEE 416

CEE 418 Design Project III 3 Credits
Comprehensive, completed design of the civil infrastructure facility. Design project teams will address life cycle issues and integrated multidisciplinary aspects of architecture, systems design, construction and management. Critical design reviews will be performed by teams of external specialists and members of the industrial advisory board.
Prerequisites: CEE 417

CEE 419 Structural Behavior Laboratory 3 Credits
Experimental study of behavior of members, assemblages and structural systems. Introduction to methods and equipment used in laboratory simulations, numerical simulations, laboratory and in-situ measurements. Planning, executing and reporting experimental studies on performance of materials and large-scale structural systems. Non-destructive evaluation and damage assessment.
Prerequisites: CEE 262 and CEE 264

CEE 420 Surface Wave Mechanics 3 Credits
Elements of hydrodynamics and wave boundary conditions; linear wave theory and wave characteristics; nonlinear wave theories and application; wind wave generation, analysis and prediction; long waves; design wave determination; laboratory investigation of surface waves. Consent of instructor required.

CEE 421 Surface Water Hydrology 3 Credits
Prerequisites: CEE 320 or EES 320

CEE 422 Hydraulic Research 1-6 Credits
Recent developments in hydromechanics and hydraulics. Topics to be selected from: wave mechanics, theory of flow through porous media, dispersion, hydrodynamic forces on structures, potential flow, free streamline theory, open channel hydraulics, computer methods. Consent of department required. 
Repeat Status: Course may be repeated. 
Prerequisites: CEE 322

CEE 423 Hydraulic Structures 3 Credits
Behavior of structural components in hydraulic environments. Design of structures subject to hydraulic forces. Analysis and design of hydraulic structures. Consent of instructor required.

CEE 424 Advanced Topics in Hydraulics 1-3 Credits
Recent developments in hydromechanics and hydraulics. Topics to be selected from: wave mechanics, theory of flow through porous media, dispersion, hydrodynamic forces on structures, potential flow, free streamline theory, open channel hydraulics, computer methods. Consent of department required. 
Repeat Status: Course may be repeated. 
Prerequisites: CEE 322

CEE 425 Design Project III 3 Credits
Design project teams will address life cycle issues and integrated multidisciplinary aspects of architecture, systems design, construction and management. Critical design reviews will be performed by teams of external specialists and members of the industrial advisory board.
Prerequisites: CEE 417

CEE 426 Design Project IV 3 Credits
Comprehensive, completed design of the civil infrastructure facility. Design project teams will address life cycle issues and integrated multidisciplinary aspects of architecture, systems design, construction and management. Critical design reviews will be performed by teams of external specialists and members of the industrial advisory board.

CEE 427 Transport of Contaminants in Groundwater 3 Credits
Theory of groundwater flow and transport of contaminants in the groundwater system. State-of-the-art groundwater flow and contaminant transport models used to solve governing equations of groundwater flow and transport of chemically reactive solutes. Selected case studies will be analyzed.
Prerequisites: CEE 323 or EES 323

CEE 429 Experimental Study of Behavior of Members, Assemblages and Structural Systems 3 Credits
Experimental study of behavior of members, assemblages and structural systems. Introduction to methods and equipment used in laboratory simulations, numerical simulations, laboratory and in-situ measurements. Planning, executing and reporting experimental studies on performance of materials and large-scale structural systems. Non-destructive evaluation and damage assessment.
Prerequisites: CEE 262 and CEE 264

CEE 431 Life-Cycle of Structural Systems 3 Credits
Assessing the life-cycle performance of new and existing structural systems, designing structures for lifetime performance, and optimizing the remaining life of existing structures, considering uncertainties in structural performance, demands placed on structural systems, structural maintenance and monitoring, and costs.
CEE 432 Structural Safety and Risk 3 Credits
Assessing safety and risk of structural systems during their specified service life, designing structures for specified safety and risk criteria for a prescribed service life, introducing Markov, queuing and availability models, statistics of extremes, time-variant safety and structural health monitoring, and optimal decision making under uncertainty based on single objective or multiple objectives.

CEE 433 Structural Optimization 3 Credits
Problem formulation, relative merit of various numerical optimization techniques, possible difficulties in applications, and how alternative formulations and methods can be combined to solve different design problems. Numerical optimization techniques are in general terms and their application to structural design.

CEE 436 Advanced Topics in Coastal Engineering 1-3 Credits
Advanced study of selected topics in coastal engineering such as: nonlinear wave theory, design of coastal structures, shore protection and stabilization, numerical solution of coastal hydrodynamics. Selection of topics will depend on particular qualifications of staff, as well as on the interests of the students.
Repeat Status: Course may be repeated.

CEE 439 Coastal Engineering Research 1-6 Credits
Individual research problems with reports.
Repeat Status: Course may be repeated.

CEE 441 Dynamic Analysis in Geotechnical Engineering 3 Credits
Vibration of elementary systems, 1D wave propagation, dynamic soil properties, analysis of response of shallow and deep foundations to dynamic loads, soil liquefaction and earthquake problems; laboratory tests, geophysical methods and non-destructive tests of foundation systems; dynamic analysis of pile driving. Consent of department chair.

Prerequisites: CEE 347

CEE 443 Advanced Soil Mechanics 3 Credits
Characterization of particulate media; particle-fluid interaction; load deformation, thermoelastic and viscoelastic behavior; elastic waves in particulate media; electromagnetic properties; empirical and analytical models. Must have completed a course in soil mechanics.

CEE 445 Advanced Foundation Engineering 3 Credits
Current theory and practice relating to the design of deep foundations supporting buildings and other structures. Construction practices; analysis and design (bearing capacity, settlement, dynamic effects); site investigations; load-resistance-factor design (LRFD) criteria for foundations. This course, a version of CEE 340 for graduate students, requires advanced assignments. Credit will not be given for both CEE 340 and CEE 445.

CEE 447 Advanced Topics in Geotechnical Engineering 1-3 Credits
Advanced studies in selected subjects related to geotechnical engineering. The general areas may include: stress-strain-time relationships of soils, colloidal phenomena in soils, ground water flow and see page, soil dynamics, soil plasticity, numerical methods applied to soil mechanics, earth dam design, theories of layered systems and their application to pavement design, rock mechanics. The studies specifically undertaken in any particular semester depend on the availability of staff and the interest of students. Consent of department chair required.
Repeat Status: Course may be repeated.

CEE 448 Constitutive Laws in Soil Mechanics 3 Credits
Basic methods and constitutive laws used for the analysis of boundary value problems in soil mechanics. Linear elasticity, nonlinear elastic, linear elastic-perfectly plastic and non-linear elastoplastic models; critical state soil mechanics; application of select computational models. Consent of instructor required.

CEE 449 Geotechnical Research 1-6 Credits
Individual research problems relating to soil engineering, with report. Must have completed a course in soil mechanics.

CEE 450 Advanced Structural Analysis I 3 Credits

Prerequisites: CEE 259

CEE 452 Fatigue and Fracture of Structures - An Interdisciplinary View 3 Credits
This course examines the fatigue and fracture characteristics of steel structures from metallurgical, mechanical and structural engineering views. Both theory and experimental background are provided and applied to case studies and code development.

CEE 453 Nonlinear Analysis of Structural Components and Systems 3 Credits
Nonlinear analysis of structural components and systems, considering the effects of material and geometric nonlinearities. Solution strategies; material constitutive models; nonlinear member section analysis; computational plasticity; nonlinear beam-column element formulations; second order analysis; structural stability; and nonlinear time history analysis of structural dynamic systems.

Prerequisites: CEE 352 and CEE 404 and CEE 450

CEE 454 Sensors, Signals, and Systems 3 Credits

CEE 455 Advanced Structural Dynamics 3 Credits
Analysis and design of structures to resist wind, earthquake, and blast loading. Matrix methods and computer applications. Non-linear and elasto-plastic response. Damping characteristics of structures and structural components, spectral analysis, dynamic instability. Characteristics of aerodynamic and seismic forces and explosions. Introduction to vibration of three-dimensional structural systems.

Prerequisites: (CEE 352 or MECH 406) and CEE 405 and CEE 450

CEE 456 Behavior and Design of Earthquake Resistant Structures 3 Credits

Prerequisites: CEE 352

CEE 457 Behavior and Design of Blast Resistant Structures 3 Credits
Design and assessment of structures subject to blast demands generated from accidental or intentional detonation of high explosives. Topics include determination of blast demands, characterization of pressure distributions on structural systems and components, estimation of the response of systems to dynamic pressure demands, modeling techniques for structural components, dynamic time history analysis of systems, determination of allowable response limits and stand-off requirements for facilities, and design structures to resist the effects of close-in detonation of high explosives and the impact of ballistic fragments.
CEE 458 Random Vibrations 3 Credits
Review of probability theory. General characterization and models of random functions for engineering applications (seismic ground motion, wind velocity, ocean waves, mechanical vibrations). Vibration of deterministic systems under random dynamic loads; applications to wind and seismic engineering. Uncertain systems under random perturbations, simulation of random functions for numerical solutions (non-stationary, non-Gaussian, multi-variate processes, multi-dimensional fields). Students cannot receive credit for both CEE 385 and CEE 458.
Prerequisites: CEE 352

CEE 459 Advanced Topics in Plastic Theory 3 Credits
Fundamentals of the mathematical theory of plasticity; the general theorems of limit analysis and their applications to beams under combined loading, arches, space frames, plates and shells. Limit analysis of two- and three-dimensional problems in soil, concrete, rock, and metal. Current developments.
Prerequisites: CEE 404

CEE 461 Advanced Bridge Engineering 3 Credits
Students in CEE 461 cover the same topics described under CEE 361, but in more depth. In addition each student conducts an intensive study of a bridge-related topic of his or her choice. A short written technical report on the findings of this study is required.
Prerequisites: CEE 262 and CEE 264

CEE 462 Stability of Structural Systems 3 Credits
Stability analysis of structures systems, including moment-resisting and braced frames, trusses, and plate and box girders. Bracing requirements. Elastic and inelastic second-order analysis. Design considerations. Special topics.
Prerequisites: CEE 404

CEE 463 Advanced Mechanics of Reinforced Concrete 3 Credits
Consistent mechanics for the design of reinforced concrete with or without prestress. Limit theorems of the theory of plasticity and their application to beams, slabs, and disturbed regions. Applications may include beams in flexure and combined flexure, axial load, and torsion; slabs (strip method, yield line analysis); corbels, deep beams, and other disturbed regions (truss models, strut-and-tie models, and associated failure mechanisms).
Prerequisites: CEE 404

CEE 464 Condition Assessment of Existing Structures 3 Credits
Assessment of existing structures for strength and serviceability. Materials evaluation and testing. Overview of material degradation mechanisms. Nondestructive and destructive evaluation test methods. Basics of field instrumentation. Load tests. Planning condition assessment programs. Focus on steel, concrete and masonry structures. Presentation of case studies including buildings, bridges, foundations, dams, tunnels and other structures. May include some laboratory and / or field work.

CEE 465 Structural Fire Engineering 3 Credits
Design and assessment of structural systems subjected to fire. Emphasizes a 3-phase approach to structural-fire engineering: (1) fire modeling, (2) heat transfer modeling, and (3) structural modeling. Includes approaches to simulate combustion and heat release for indoor and outdoor fires. Heat transfer modeling focuses on calculating the temperature increase of fire-exposed structural elements. Mechanics of structural elements and assemblies consider thermal expansion and weakening due to increasing temperature. Design approaches to mitigate the effects of fire are introduced.

CEE 466 Advanced Finite Element Methods 3 Credits
Review of linear elastic Finite Element (FE) method and weak formulation of equilibrium. Implementation of a liner elastic FE code. Special topics including shear locking, reduced integration, non-homogeneous essential conditions, and imposed strains. Dynamic FE analysis: theory and implementation of modal and time-history analyses. Techniques to model structural masses and damping. Stochastic FE analysis: theory and implementation of methods to analyze uncertain structures. Examples using scientific and commercial software to highlight practical modeling issues. Lab-sessions and student projects are included.
Prerequisites: CEE 366

CEE 467 Advanced Topics in Structural Engineering 1-3 Credits
Advanced study of selected topics in structural mechanics and engineering, such as: finite element methods, suspension system; space frames; stability of nonlinear systems; coldformed and lightweight construction; optimization and reliability; second-order phenomena in structures; interaction of structures with the environment; structural use of plastics; composite construction, etc. Selection of topics will depend on particular qualifications of the staff, as well as on the interests of the students. Consent of department chair required.
Repeat Status: Course may be repeated.

CEE 468 Stability of Elastic Structures 3 Credits
Prerequisites: MATH 205

CEE 470 Reaction Kinetics in Environmental Engineering 3 Credits
Theory of reaction kinetics and its application to the design and operation of chemical, physico-chemical and biological reactors in water and wastewater treatment. Basic design equations for various types of reactors and migration of pollutants in the environment. Students cannot receive credit for both CEE 371 and CEE 470.

CEE 471 Environmental Risk Assessment 3 Credits
Effects of chemical releases on human health; ecological risks. Application of risk assessment methodology, including hazard identification, exposure assessment, toxicity assessment, and risk characterization. Accounting for uncertainty in data during risk management, risk reduction and implementation of regulations and environmental policy. Term project.

CEE 472 Water and Wastewater Treatment Facilities 3 Credits
Theory and design of water and wastewater treatment facilities. Physical, chemical, and biological treatment processes for water and wastewater treatment.
Prerequisites: CEE 375 or CHE 375

CEE 473 Environmental Separation and Control 3 Credits
Theory and application of adsorption, ion exchange, reverse osmosis, air stripping and chemical oxidation in water and wastewater treatment. Modeling engineered treatment processes. Students cannot receive credit for both CEE 473 and CEE 370.
Prerequisites: CEE 470

CEE 474 Aquatic Chemistry 3 Credits
Applying basic principles of aqueous chemistry for quantifying complex, environmental systems. Specific examples of air-water-soil interactions and consequent effects. Heterogeneous equilibria with more than one solid phase. Kinetics and thermodynamics of some important ionic and biological reactions.
Prerequisites: CEE 274

CEE 475 Advanced Topics in Environmental Engineering 1-3 Credits
Advanced concentrated study of a selected topic in environmental engineering such as non-point source pollution control, water reuse systems, new concepts in treatment technology, toxic substance control, etc. The instructor and student select topic. s may include specialized laboratory research, literature review, and specialty conference attendance. Consent of department chair required.
Repeat Status: Course may be repeated.

CEE 476 Environmental Biotechnology 3 Credits
Fundamentals of microbiology and biochemistry applied to natural and engineered environmental systems. Systems ecology, energetics and kinetics of microbial growth; nutrition and toxicity, use of microorganisms for pollution monitoring and control. Pathogenicity and disease transmission, water quality using biological indices.
Prerequisites: CEE 375 or CHE 375
Electives that are cross-listed with EES courses how many credits in the EES are satisfied by taking CEE Approved
A total of 173 credit hours are needed for both degrees depending on
3-credit courses and one 4-credit course. Other options are possible.

Required courses and major electives for the different EES B.S. degree
resolve conflicts or if a specified course is not offered that semester.

Interest students should consult with the
respective departmental advisors to create a schedule of courses to
for either B.S. degree. Interested students should consult with the

This program is designed for students interested in combining programs
in two departments: Civil & Environmental Engineering and Earth &
Environmental Science, leading to two bachelor of science degrees, one
in Civil Engineering or Environmental Engineering and the other in Earth
and Environmental Sciences. Both degrees would be awarded at the
end of the fifth year. This program is one of the dual degree programs
mentioned in the Five-Year Programs section. The student will have a
primary advisor in the P.C. Rossin College of Engineering and Applied
Sciences and a secondary advisor in the Arts and Sciences College.
The program provides alternatives for students who may decide not to
complete the dual-degree program. Students who make this decision
prior to the beginning of the fourth year may qualify at the end of that
year for the bachelor of science in civil or environmental engineering,
as well as a minor in earth and environmental sciences. Also, if a student
decides after two years to pursue only a bachelor of science degree in
the EES department, it is possible to complete the requirements in
four years. If the decision to work toward this degree is made during
the fourth year, at least one additional semester is required to qualify
for either B.S. degree. Interested students should consult with the
respective departmental advisors to create a schedule of courses to
resolve conflicts or if a specified course is not offered that semester.
Required courses and major electives for the different EES B.S. degree
programs are listed in the catalog entry for EES. Cross-listed EES/CEE
courses used to satisfy Civil Engineering Approved Electives can reduce
the individual semester and total program credits when chosen to satisfy
EES program requirements. Additional useful information can be found
on the web sites (www.lehigh.edu/~incee/ and www.ees.lehigh.edu).

REQUIRED COURSES FOR B.S. IN ENVIRONMENTAL SCIENCE AND
B.S. IN CIVIL ENGINEERING

Recommended Sequence of Courses
The HSS Advanced Requirement of 13 credits is shown below as three
3-credit courses and one 4-credit course. Other options are possible.
A total of 173 credit hours are needed for both degrees depending on
how many credits in the EES are satisfied by taking CEE Approved
Electives that are cross-listed with EES courses.
### REQUIRED COURSES FOR B.S. IN ENVIRONMENTAL SCIENCE AND B.S. IN ENVIRONMENTAL ENGINEERING

The HSS Advanced Requirement of 13 credits is shown below as three 3-credit courses and one 4-credit course. Other options are possible.

**Recommended Sequence of Courses**

A total of 173 credit hours are needed for both degrees. Some EES requirements are simultaneously satisfied by taking Environmental EngineeringTechnical Electives that are cross-listed with EES courses.

#### First Year

<table>
<thead>
<tr>
<th>First Semester</th>
<th>CR</th>
<th>Second Semester</th>
<th>CR</th>
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<tbody>
<tr>
<td>ENGL 001</td>
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<td>ENGL 002</td>
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<tr>
<td>MATH 021</td>
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<td>MATH 022</td>
<td>4</td>
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<tr>
<td>CHM 030</td>
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<td>PHY 011 &amp; PHY 012</td>
<td>5</td>
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<tr>
<td>ENGR 005</td>
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<td>ENGR 010</td>
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<tr>
<td>HSS Humanities/ Social Science Elective</td>
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<td>EES Gateway Elective</td>
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#### Second Year

<table>
<thead>
<tr>
<th>First Semester</th>
<th>CR</th>
<th>Second Semester</th>
<th>CR</th>
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<tbody>
<tr>
<td>MATH 023</td>
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<td>MATH 205</td>
<td>3</td>
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<tr>
<td>CEE 003, MECH 002, or MECH 003</td>
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<td>PHY 021 &amp; PHY 022</td>
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<td>CHM 110 &amp; CHM 111</td>
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<td>CEE 170</td>
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<td>EBR Environmental Biology Requirement</td>
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<td>EES 080</td>
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<tr>
<td>HSS Humanities/ Social Sciences Elective</td>
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#### Third Year

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<tr>
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<th>Second Semester</th>
<th>CR</th>
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<tbody>
<tr>
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<td>CEE 274</td>
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<td>CEE 375</td>
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<td>CHE 280</td>
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<td>EES 100-300</td>
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<td>EES 200</td>
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<tr>
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<tr>
<td>CHE 031</td>
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<td>ECO 001</td>
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#### Fourth Year

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<tr>
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<td>CEE 121</td>
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<td>CEE 142</td>
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<td>CEE 222</td>
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<td>CEE 378</td>
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<td>CEE 272</td>
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<tr>
<td>EES 100-300</td>
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<td>CEE 275</td>
<td>2</td>
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<tr>
<td>EES 100-300</td>
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<td>EES 100-300</td>
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#### Fifth Year

<table>
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<tr>
<td>CEE 203</td>
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<td>CEE 377</td>
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<tr>
<td>EES 380</td>
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<td>AE Approved electives</td>
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<td>EES 100-300</td>
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<td>EES 100-300</td>
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<td>EES 100-300</td>
<td>4</td>
</tr>
<tr>
<td>HSS Humanities/ Social Sciences Elective</td>
<td>4</td>
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<td></td>
</tr>
</tbody>
</table>

Total Credits: 173

1. HSS advanced requirement is 13 credits, four credits of which must be CEE approved Environmental Studies (ES) course.
2. 9 approved elective credits to satisfy proficiency in three focus areas of water supply and resources, environmental chemistry, and hazardous waste management; approved list available from CEE department.
3. Earth Science Requirement, list of approved courses are available from CEE department.
4. Environmental Biology Requirement, list of approved courses are available from CEE department.
5. At least four of the EES electives must be at the 300 level. Up to 8 credits of EES internship (EES 093, EES 293) and EES research (EES 393) may be used as major electives (no more than 4 of which can be EES 093/EES 293).
6. For more information on the EES field requirement see the EES catalog entry (p. 117).

### Computer Engineering

Computer Engineering deals with the design and analysis of intelligent systems that have become indispensable in today's world. Because it requires expertise in both hardware and software areas, the Computer Engineering program is offered jointly by the department of Computer Science and Engineering (CSE) and the department of Electrical and Computer Engineering (ECE).
UNDERGRADUATE PROGRAMS

Mission Statement
The mission of the computer engineering program is to prepare computer engineers to meet the challenges of the future; to promote a sense of scholarship, leadership and service among our graduates; to instill in the students the desire to create, develop, and disseminate new knowledge; and to provide international leadership to the computer engineering profession. The mission is attained through the following program educational objectives.

Program Educational Objectives in Computer Engineering
The objective of the Computer Engineering program is to produce students within 5-10 years after graduation will:

- Meet expectations of the employers of computer engineers.
- Pursue diverse career paths if they so desire.
- Become leaders in their chosen careers.

BACHELOR OF SCIENCE IN COMPUTER ENGINEERING
The required courses for this degree include the fundamentals of electronic circuits, signal theory, logic design, computer architecture, digital systems, structured programming, data structures, software engineering, operating systems and discrete mathematics. A strong foundation in the physical sciences and in mathematics is required. Approved technical electives, chosen with the advisor’s consent, are selected in preparation for graduate study or entry into industry according to individual interests. The program totals 133 credit hours. The Computer Engineering program is accredited by the Engineering Commission of ABET, www.ABET.org.

The recommended sequence of courses follows:

<table>
<thead>
<tr>
<th>First Year</th>
<th>First Semester</th>
<th>Credits</th>
<th>Second Semester</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 001</td>
<td>3 ENGL 002</td>
<td>3</td>
<td>MATH 021</td>
<td>4</td>
</tr>
<tr>
<td>MATH 021</td>
<td>4 MATH 022</td>
<td>4</td>
<td>ENGR 005</td>
<td>2</td>
</tr>
</tbody>
</table>

Select one of the following:

<table>
<thead>
<tr>
<th>Credits</th>
<th>ECO 001</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-6</td>
<td></td>
</tr>
</tbody>
</table>

- CHM 030 & ENGR 010
- HSS Elective
- PHYS 001 & PHYS 012
- Select one of the following
- 5-6
- CHM 030 & ENGR 010
- PHYS 011 & PHYS 012

| Total Credits: 14-15 | 16-17 |

Second Year

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Credits</th>
<th>Second Semester</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ECE 081</td>
<td>4 CSE 002</td>
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<td></td>
</tr>
<tr>
<td>MATH 023</td>
<td>4 ECE 123 &amp; ECE 121</td>
<td>5</td>
<td></td>
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<tr>
<td>ECE 033</td>
<td>4 MATH 205</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>PHY 021 &amp; PHY 022</td>
<td>5 HSS Elective</td>
<td>4</td>
<td></td>
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</tbody>
</table>

Select one of the following
- 3-4
- ECO 001
- HSS Elective

| Total Credits: 17 | 17-18 |

Third Year

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Credits</th>
<th>Second Semester</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ECE 182</td>
<td>1 CSE 109</td>
<td>4</td>
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</tr>
<tr>
<td>ECE 108</td>
<td>4 ECE 138</td>
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<td></td>
</tr>
<tr>
<td>CSE 017</td>
<td>3 ECE 201</td>
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</tbody>
</table>

Approved technical electives:

| 3 CSE 140 |

Free electives:

| 3 free elective |

| Total Credits: 17 | 18 |

Fourth Year

<table>
<thead>
<tr>
<th>First Semester</th>
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<th>Second Semester</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CREG 257</td>
<td>3 CREG 258</td>
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</tr>
<tr>
<td>ECE 319</td>
<td>3 Approved technical electives</td>
<td>12</td>
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<tr>
<td>CSE 303</td>
<td>3 HSS Elective</td>
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<tr>
<td>CSE 216</td>
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</tr>
<tr>
<td>HSS Elective</td>
<td>3-4</td>
<td></td>
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</tr>
</tbody>
</table>

| Total Credits: 15-16 | 18 |

1 Required natural science courses, one taken fall semester and the other taken in spring 2 Approved technical electives (15 credits) are subjects in the area of science and technology. Except for one elective, they are restricted to the offerings in the ECE and CSE departments. One elective must be an engineering science elective from a department other than ECE and CSE. CSE 042, CSE 130, and CSE 252 are not approved technical electives.

GRADUATE PROGRAMS
Graduate programs of study provide a balance between formal classroom instruction and research and are tailored to the individual student’s professional goals. The programs appeal to individuals with backgrounds in computer or information science, in computer engineering, in electrical engineering, in mathematics, or in the physical science. Research is an essential part of the graduate program.

The research topics are listed in the departmental descriptions for Computer Science and Engineering (CSE) and Electrical and Computer Engineering (ECE) which jointly administers the Computer Engineering program. Individual courses are listed in the catalog descriptions of the CSE and ECE departments.

The Master of Science degree requires the completion of 30 credit hours of work and may include a six credit hour thesis for Computer Engineering degree. A program of study must be submitted in compliance with the graduate school regulations. An oral presentation of the thesis is required.

The Master of Engineering degree requires the completion of 30 credit hours of work, which includes design-orientated courses and an engineering project. A program of study must be submitted in compliance with the college rules. An oral presentation of the project is required.

The Ph.D. degree in computer engineering requires the completion of 42 credit hours of work (including the dissertation) beyond the master’s degree (48 hours if the master’s degree is not from Lehigh), the passing of a departmental qualifying examination appropriate to each degree within one year after entrance into the degree program, the passing of a general examination in the candidate’s area of specialization, the admission into candidacy, and the writing and defense of a dissertation. Competence in a foreign language is not required.

The program has a core curriculum requirement for graduate students. The purpose of this requirement is to guarantee that all students pursuing graduate studies in the program acquire an appropriate breadth of knowledge of their discipline. To satisfy the core curriculum requirements in Computer Engineering, students need to complete at least two courses in the computer hardware/architecture area, at least two courses in a second area, and at least one course in a third area. In each of the three areas at least one course must be at the 400 level. The areas are: computer software systems, signal processing and communications, computer software applications, and circuits and systems. See www.compe.lehigh.edu for details about these areas.

Courses from other universities or undergraduate studies may be used to satisfy these requirements, by petition, at the discretion of
the program faculty. Additional graduate program information may be obtained from the program's graduate coordinator.

Most courses in the Computer Engineering curriculum are listed in the Computer Science and Engineering (p. 388) (CSE) and Electrical and Computer Engineering (p. 398) (ECE) departments.

**Courses**

**CREG 257 Senior Lab Project I 3 Credits**

With CREG 257, provides a complete design experience for Electrical and Computer Engineers. Students are expected to identify essential project aspects crucial to success and to perform in-depth engineering evaluation and testing demonstrating that desired results can be achieved with the proposed implementation. Instruction in technical writing, product development, ethics and professional engineering, and presentation of design and research. Two three hour sessions and one additional two hour lecture per week. Must have senior status.

**CREG 258 Senior Lab Project II 2 Credits**

Continuation of CREG 257 Complete design, construction, and testing of projects selected and developed in CREG 257. Final design reviews and project presentations; final written report; development issues, including manufacturability, patents, and ethics. Department approval.

**Prerequisites:** CREG 257

**Computer Science and Engineering**

The department of computer science and engineering (CSE) offers undergraduate and graduate programs of study in computer science, computer science and business, and computer engineering, along with research opportunities in these fields. Computer science is the study of computer algorithms, software systems, and the effective use of computers to solve real-world problems and to develop new applications. Computer engineering is the study of how to develop new computer systems and how to integrate computers with electronic devices. Lehigh's majors prepare students for graduate school or for any of the different careers in computer science, computer engineering or computer systems analysis. Computer science and computer engineering and their related careers represent, in the US workplace, the largest field of engineering larger than all others, including electrical engineering, combined. More discussion on the career potential, as well as the most up to date course offerings can be found on our departmental web site, engineering.lehigh.edu/cse

Lehigh University offers a bachelor of science degree in computer science from the P. C. Rossin College of Engineering and Applied Science; the bachelor of science degree in computer science, and the bachelor of arts degree with a major in computer science, from the College of Arts and Sciences; and a bachelor of science in Computer Science and Business, jointly supported by the P.C. Rossin College of Engineering and Applied Science and the College of Business. A minor in computer science is available except to students majoring in computer engineering, computer science or computer science and business. Graduate study in the department leads to the degrees of master of science and doctor of philosophy (Ph.D.) in computer science. In conjunction with the department of Electrical and Computer Engineering (ECE), a master of science and Ph.D. degrees in computer engineering are also offered in the P.C. Rossin College of Engineering and Applied Science. In conjunction with the College of Business, the CSE department also takes part in the masters of business and engineering (MB&E) program and in the integrated business and engineering major.

The undergraduate programs emphasize the fundamental aspects of their respective areas, with extensive hands-on experiences for the students. Electives permit students to tailor their programs according to their interests and goals, whether they be in preparation for graduate study or entry into industry. The department highly recommends that students give focus to their electives by following one of the tracks (https://engineering.lehigh.edu/cse/academics/undergraduate/computer-science-ba-bs-cas/cse-tracks) listed in the department website. Students have the opportunity to synthesize and apply their knowledge in a senior design project. Students are encouraged to become involved in the many research projects within the department, and may use independent study courses and their senior project as a way to participate while receiving course credit.

The graduate programs enable students to deepen their professional knowledge, understanding, and capability within their subspecialties. Each graduate student develops a program of study in consultation with his or her graduate advisor. Key thrust areas in the department include:

**Computer Systems Engineering:** computer architecture, sensor networks, robotics, mobile and wearable computing, and networking.

**Software Systems Engineering:** software architectures, parallel and distributed computing, object-oriented soft ware, middleware, Web-based systems and networked software systems.

**Information Systems Engineering:** database, data mining, bioinformatics, computer graphics, optimization, multimedia systems, expert systems, artificial intelligence, and computer vision.

Both graduate and undergraduate research are encouraged. The department maintains a number of computer laboratories in support of computer science and computer engineering. The department has research laboratories in robotics, networking, image processing, artificial intelligence, security, and web mining. These laboratories and their associated research activities are described more completely in the departmental web site, engineering.lehigh.edu/cse. While these laboratories are research oriented, they are also used for undergraduate projects.

Computer laboratory usage is an essential part of the student's education. The primary department resources include a network of more than 60 workstations, file servers, and compute servers running the Unix operating system. These systems provide an array of software tools for our students and researchers including programming languages (C, C++, Java, Perl, Python, Ruby, Matlab, etc.), software development tools, software and hardware simulators, and computer-aided design packages. One of our teaching labs contains workstations specifically designed for flexibility in running different operating systems so that students can become system administrators, network defenders, or designers of high-performance code utilizing graphical processing units (GPUs) within a controlled environment.

The department's computers are connected via gigabit Ethernet to the university's backbone network. The university is connected through multiple high-capacity connections to the Internet as well as a connection to Internet2. Neither the department nor the university requires a student to own a personal computer. In addition to the departmental resources, the university provides campus-wide wireless network access, public sites containing hundreds of PCs and Macintoshes, multiple large-capacity compute servers, and most classrooms are equipped with a PC and a video projection system.

**Professors.** Mooi Choo Chuah, PHD (University of California, San Diego); Henry F. Korth, PHD (Princeton University); Daniel P. Lopresti, PHD (Princeton University); Hector Munoz-Avila, PHD (Technische Universitat Kaiserslautern); Jeffrey C. Trinkle, PhD (University of Pennsylvania)

**Associate Professors.** Brian Y Chen, PHD (Rice University); Liang Cheng, PHD (Rutgers University); Brian D. Davison, PhD (Rutgers University); Jeffrey D. Helfin, PhD (University of Maryland, College Park); Michael F. Spear, PhD (University of Rochester)

**Assistant Professors.** Eric P.S. Baumer, PhD (University of California Irvine); Dominic J DiFranzo, PhD (Rensselaer Polytechnic Institute); Lifang He, PhD (South China University of Tech.); Roberto Palmieri, PhD (Sapienza University di Roma); David Saldana, PhD (Universidade Federal de Minas Gerais); Sihong Xie, PhD (University of Illinois at Chicago)

**Professors Of Practice.** Arielle Katherine Carr, MS (Virginia Polytechnic Institute and State University); Mark Alan Erle, PhD (Lehigh University); James A Femister, PhD (Lehigh University); Sharon M. Kalafut, MS (The Pennsylvania State University); Corey I. Montella, PhD (Lehigh University); Houriou Oudghiri, PhD (Mcgill University); William O. Phillips, PhD (NJ Inst of Tech)

**Emeriti.** Henry S. Baird, PhD (Princeton University); Glenn D. Blank, PhD (University Wisconsin-Madison); Edwin J Kay, PhD (Lehigh University); Roger N. Nagel, PhD (University of Maryland)
UNDERGRADUATE PROGRAMS

Mission Statement for the Computer Science and Engineering Programs

The mission of the computer science and computer science and business programs is to prepare computer scientists to meet the challenges of the future; to promote a sense of scholarship, leadership and service among our graduates; to instill in the students the desire to create, develop, and disseminate new knowledge; and to provide international leadership to the computer science and engineering professions.

Program Educational Objectives in Computer Science

Graduates of the Bachelor of Science in Computer Science Programs will:

- Apply their education in computer science to the analysis and solution of scientific, business, and industrial problems.
- Account for ethical and social issues when solving scientific, business, and industrial problems.
- Function effectively in a collaborative team and effectively communicate with members of the team.
- Engage in continued education in their field of expertise.
- Attain positions of expertise in their chosen field.

BACHELOR OF SCIENCE IN COMPUTER SCIENCE AND BUSINESS

See catalog entry for Computer Science and Business (p. 437).

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

Bachelor of Science in Computer Science degree programs are available to students through either the College of Arts and Sciences or the P. C. Rossin College of Engineering and Applied Science. Both programs are accredited by the Computing Accreditation Commission of ABET (http://www.abet.org). The two programs are identical in the fundamental requirements in mathematics and computer science, and the programs are appropriate for entry into management or industrial positions. They are also appropriate for continued graduate study, though students considering graduate study are strongly encouraged to consider taking part in a research project during their junior year. The two BS programs differ in their non-computer science content in that the students must fulfill the distribution requirements of the respective college.

The required courses for the degrees contain the fundamentals of discrete mathematics, structured programming, algorithms, computer architecture, compiler design, operating systems, and programming languages. A strong foundation in mathematics is required. Because many courses are frequently offered, there are many sequences in which courses may be taken to satisfy the requirements. Below are the requirements for the B.S. degrees. See engineering.lehigh.edu/cse for links to sample sequences and for a list of all CSE courses, their prerequisites, and when they are offered.

P. C. ROSSIN COLLEGE OF ENGINEERING AND APPLIED SCIENCE

Bachelor of Science in Computer Science

Total required credit hours: 128

Required Computer Science courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSE 002</td>
<td>Fundamentals of Programming</td>
<td>2</td>
</tr>
<tr>
<td>CSE 017</td>
<td>Programming and Data Structures</td>
<td>3</td>
</tr>
<tr>
<td>CSE 109</td>
<td>Systems Software</td>
<td>4</td>
</tr>
<tr>
<td>CSE 202</td>
<td>Computer Organization and Architecture</td>
<td>3</td>
</tr>
<tr>
<td>CSE 216</td>
<td>Software Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CSE 262</td>
<td>Programming Languages</td>
<td>3</td>
</tr>
<tr>
<td>CSE 140</td>
<td>Foundations of Discrete Structures and Algorithms</td>
<td>3</td>
</tr>
<tr>
<td>CSE 280</td>
<td>Capstone Project I</td>
<td>3</td>
</tr>
<tr>
<td>CSE 281</td>
<td>Capstone Project II</td>
<td>2</td>
</tr>
<tr>
<td>CSE 303</td>
<td>Operating System Design</td>
<td>3</td>
</tr>
<tr>
<td>CSE 340</td>
<td>Design and Analysis of Algorithms</td>
<td>3</td>
</tr>
</tbody>
</table>

Required Math and Science courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHM 030</td>
<td>Introduction to Chemical Principles</td>
<td>4</td>
</tr>
</tbody>
</table>

Required approved electives

Technical electives: Any CSE course of 200-level or above unless explicitly excluded by the department

Science and technology courses, chosen by the student with the approval of the student’s advisor

Humanities and Social Science (HSS) requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 001</td>
<td>Critical Reading and Composition</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 002</td>
<td>Research and Argument</td>
<td>3</td>
</tr>
<tr>
<td>ECO 001</td>
<td>Principles of Economics</td>
<td>4</td>
</tr>
<tr>
<td>CSE 252</td>
<td>Computers, the Internet, and Society</td>
<td>3</td>
</tr>
</tbody>
</table>

BS programs that satisfy the Engineering College “breadth and depth” requirements

Electives

Free Electives | 9
Total Credits | 128

1 The department highly recommends that students give focus to their approved electives by following one of the tracks listed in the department website at www.cse.lehigh.edu/TRACKS

COLLEGE OF ARTS AND SCIENCES

Bachelor of Science in Computer Science

See the distribution requirements (p. 53) of the College of Arts and Sciences.

Required Computer Science courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSE 001</td>
<td>Breadth of Computing</td>
<td>2</td>
</tr>
<tr>
<td>CSE 002</td>
<td>Fundamentals of Programming</td>
<td>2</td>
</tr>
<tr>
<td>CSE 017</td>
<td>Programming and Data Structures</td>
<td>3</td>
</tr>
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<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 021</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 022</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 023</td>
<td>Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>MATH 205</td>
<td>Linear Methods</td>
<td>3</td>
</tr>
<tr>
<td>MATH 231</td>
<td>Probability and Statistics</td>
<td>3</td>
</tr>
</tbody>
</table>

Required approved electives

Technical electives: Any CSE course of 200-level or above unless explicitly excluded by the department

Science and technology courses, chosen by the student with the approval of the student’s advisor

Humanities and Social Science (HSS) requirements
MINOR IN COMPUTER SCIENCE

The minor in computer science provides a basic familiarity with software development and programming, computer organization, and essential elements of computer science. This minor is not available to students majoring in Computer Engineering, Computer Science and Computer Science and Business. The minor requires 17 credit hours, consisting of the following:

- CSE 002 Fundamentals of Programming 2
- CSE 017 Programming and Data Structures 3
- CSE courses EXCEPT CSE 042, CSE 130, CSE 252 12

Total Credits 17

MINOR IN DATA SCIENCE

Virtually every discipline collects data to gain a deeper understanding of their discipline and to make better decisions. The technical challenges associated with collecting, storing, processing, communicating, visualizing, analyzing, and interpreting the huge quantities of data that have become available today are far from trivial. The courses of the minor in Data Science help prepare students to develop computational solutions to analyze data and provide insights of value.

The minor is open to undergraduates from all colleges, and requires a minimum of 16 credit hours, consisting of the following:

Three required courses (10-11 credits)

- CSE 160 Introduction to Data Science 3
- CSE 017 Programming and Data Structures 3-4
- CSE 109 Systems Software
- MATH 312 Statistical Computing and Applications 4

Total Credits 10-11

One approved applied data mining / analytics course at the 200/300 level (3 credits)

- CSE 326 Fundamentals of Machine Learning 3
- CSE 347 Data Mining 3
- ISE 364 Introduction to Machine Learning 3
- ISE 367 Mining of Large Datasets 3
- MKT 325 Consumer Insights through Data Analysis
- MKT 326 Marketing Analytics in a Digital Space 3
- BIS 348 Predictive Analytics in Business 3
- ECO 247 Sabermetrics 3
- ECO 325 Consumer Insights through Data Analysis
- ECO 360 Time Series Analysis 3

The department may approve additional applied data mining / analytics courses.

One or more approved electives related to data science including, but not limited to an additional applied data mining/analytics course from above, or the following (3-4 credits)

- CSE 241 Database Systems and Applications 3
- CSE 341 Database Systems, Algorithms, and Applications
- CSE 327 Artificial Intelligence Theory and Practice
- CSE 337 Reinforcement Learning 3
- CSE 345 WWW Search Engines 3
- CSE 375 Principles of Practice of Parallel Computing
- ISE 111 Engineering Probability 3
- ISE 121 Applied Engineering Statistics 3
- ISE 224 Information Systems Analysis and Design

Total Credits 3-4

The department highly recommends that students give focus to their approved electives by following one of the tracks listed in the department website at www.cse.lehigh.edu/TRACKS.
The program director may approve additional data science-related electives. Many of the courses that apply to the minor have prerequisites. These prerequisites do not count toward the minor, and students attempting to complete the minor are not recused from these prerequisites.

P. C. ROSSIN COLLEGE OF ENGINEERING AND APPLIED SCIENCE
Graduate Programs
Note: For information about graduate degrees in Computer Engineering, see the catalog entry for Computer Engineering. (p. 386)

Graduate programs of study provide a balance between formal classroom instruction and research and are tailored to the individual student's professional goals. The programs appeal to individuals with backgrounds in computer or information science, in computer engineering, in electrical engineering, in mathematics, or in the physical sciences. Research is an essential part of the graduate program. The research topics were listed earlier in the departmental description.

The Master of Science degree requires the completion of 30 credit hours of work and may include a three credit hour thesis. A program of study must be submitted in compliance with the graduate school regulations. An oral presentation of the thesis is required.

The Master of Engineering degree requires the completion of 30 credit hours of work, which includes design-oriented courses and an engineering project. A program of study must be submitted in compliance with the college rules. An oral presentation of the program is required.

The Ph.D. degree in computer science requires the completion of 42 credit hours of work (including the dissertation) beyond the master's degree (48 hours if the master's degree is not from Lehigh), the passing of departmental qualifying requirements appropriate to each degree within one year after entrance into the degree program, the admission into candidacy, the passing of a general examination in the candidate's area of specialization, and the writing and defense of a dissertation. Competence in a foreign language is not required.

The CSE department has a core curriculum requirement for graduate students in each of the degree programs. The purpose of this requirement is to guarantee that all students pursuing graduate studies in the department acquire an appropriate breadth of knowledge of their discipline.

Computer Science PhD students must satisfy a "Graduate Breadth" requirement which involves taking, in addition to the four mandated first-year courses, another four regular graduate-level courses in Computer Science and Engineering or a closely related subject. Courses appropriate to the student's educational objectives should be selected in consultation with the student's advisor. The plan must be approved by the advisor, the Director of Graduate Studies for CSE, and the Chair of the CSE Department. To satisfy the requirement, courses must be at the 400-level and may not be research, independent study, experimental, or special topics courses (for example, courses numbered CSE 450 or CSE 49X will not satisfy the requirement).

Courses from other universities or undergraduate studies may be used to satisfy these requirements, by petition, at the discretion of the department faculty. Additional graduate program information may be obtained from the department's graduate coordinator.

Courses
CSE 001 Breadth of Computing 2 Credits
Broad overview of computer science, computer systems, and computer applications. Interactive Web page development. Includes laboratory. Not available to students who have taken CSE 012 or ENGR 010.

CSE 002 Fundamentals of Programming 2 Credits
Problem-solving and object-oriented programming using Java. Includes laboratory. No prior programming experience needed.

CSE 003 Introduction to Programming, Part A 2 Credits
Covers the same material as the first half of CSE 007. Designed to allow more class and laboratory time for each topic. No prior programming experience needed. Cannot be taken by students who have completed CSE 007.

CSE 004 Introduction to Programming, Part B 2 Credits
Covers the same material as the second half of CSE 007. Designed to allow more class and laboratory time for each topic. Cannot be taken by students who have completed CSE 007.

Prerequisites: CSE 003

CSE 007 Introduction to Programming 4 Credits
Problem-solving using the Java programming language. Data types, control flow, methods, arrays, objects, inheritance, breadth of computing. Includes laboratory. If credit is given for CSE 007 then no credit will be given for CSE 003 nor CSE 004.

CSE 012 Survey of Computer Science 3 Credits
Fundamental concepts of computing and "computational thinking"; problem analysis, abstraction, algorithms, digital representation of information, and networks. Applications of computing and communication that have an impact on society. Concepts of software development using a scripting language such as Python, Perl, or Ruby. Not available to students who have taken CSE 015 or CSE 001.

CSE 017 Programming and Data Structures 3 Credits
Algorithmic design and implementation in a high level, object oriented language, such as Java. Classes, subclasses, recursion, searching, sorting, linked lists, trees, stacks, queues.

Prerequisites: CSE 002 and (CSE 001 or CSE 012 or ENGR 010)
Can be taken Concurrently: CSE 001, CSE 012, ENGR 010
Attribute/Distribution: MA

CSE 042 (EMC 042) Game Design 3 Credits
Modern topics in game design: Finite State Machines, iterative design process, systems and interactivity, designing rules for digital games, emergence in games, games as Schemas of Uncertainty, games as Information Theory Schemas, games as Information Systems, games as Cybertnetic Systems. The course does not count as a technical elective for majors in Computer Science, Computer Science and Business, or Computer Engineering.

CSE 109 Systems Software 4 Credits
Advanced programming and data structures, including dynamic structures, memory allocation, data organization, symbol tables, hash tables, B-trees, data files. Object-oriented design and implementation of simple assemblers, loaders, interpreters, compilers, and translators. Practical methods for implementing medium-scale programs.

Prerequisites: CSE 017 or CSE 018

CSE 127 (COGS 127) Survey of Artificial Intelligence 3 Credits
An introduction to artificial intelligence (AI) intended for non-majors. AI concepts, systems, and history. Credit will not be given for both CSE/COGS 127 and CSE/COGS 327.

Prerequisites: CSE 002 or CSE 004 or CSE 007

CSE 130 Technical Presentation 1 Credit
Oral and written communication of information in computer science. Technical writing; structure, style, and delivery of oral presentations; use of visual aids.

Prerequisites: CSE 017 or CSE 018
Can be taken Concurrently: CSE 017, CSE 018

CSE 140 Foundations of Discrete Structures and Algorithms 3 Credits

Prerequisites: (MATH 021 or MATH 031 or MATH 051 or MATH 076) and (CSE 001 or CSE 002 or CSE 012)

CSE 160 Introduction to Data Science 3 Credits
Data Science is a fast-growing interdisciplinary field, focusing on the computational analysis of data to extract knowledge and insight. Collection, preparation, analysis, modeling, and visualization of data, covering both conceptual and practical issues. Examples from diverse fields and hands-on use of statistical and data manipulation software.

Prerequisites: CSE 002 or CSE 012 or BIS 335
CSE 190 Special Topics 1-3 Credits
Supervised reading and research. Consent of department required.

CSE 202 Computer Organization and Architecture 3 Credits
Interaction between low-level computer architectural properties and high-level program behaviors: instruction set design; digital logic and assembly language; processor organization; the memory hierarchy; multicores and GPU architectures; and processor interrupt/exception models. Credit will not be given for both CSE 201 and CSE 202.
Prerequisites: CSE 017 or CSE 018

CSE 216 Software Engineering 3 Credits
The software lifecycle; lifecycle models; software planning; testing; specification methods; maintenance. Emphasis on team work and large-scale software systems, including oral presentations and written reports.
Prerequisites: CSE 017

CSE 241 Database Systems and Applications 3 Credits
Design of large databases: Integration of databases and applications using SQL and JDBC; transaction processing; performance tuning; data mining and data warehouses. Not available to students who have credit for CSE 341 or IE 224.
Prerequisites: CSE 017 or CSE 018

CSE 252 (EMC 252, STS 252) Computers, the Internet, and Society 3 Credits
An interactive exploration of the current and future role of computers, the Internet, and related technologies in changing the standard of living, work environments, society and its ethical values. Privacy, security, depersonalization, responsibility, and professional ethics; the role of computer and Internet technologies in changing education, business modalities, collaboration mechanisms, and everyday life.
Attribute/Distribution: SS

CSE 261 (MATH 261) Discrete Structures 3 Credits
Topics in discrete structures chosen for their applicability to computer science and engineering. Sets, propositions, induction, recursion; combinatorics; binary relations and functions; ordering, lattices and Boolean algebra; graphs and trees; groups and homomorphisms. Various applications.
Prerequisites: (MATH 021 or MATH 031 or MATH 051 or MATH 076)
Attribute/Distribution: MA

CSE 262 Programming Languages 3 Credits
Use, structure and implementation of several programming languages.
Prerequisites: CSE 017 or CSE 018

CSE 264 Web Systems Programming 3 Credits
Practical experience in designing and implementing modern Web applications. Concepts, tools, and techniques, including: HTTP, HTML, CSS, DOM, JavaScript, Ajax, PHP, graphic design principles, mobile web development. Not available to students who have credit for IE 275.
Prerequisites: CSE 017
Attribute/Distribution: ND

CSE 265 System and Network Administration 3 Credits
Overview of systems and network administration in a networked UNIX-like environment. System installation, configuration, administration, and maintenance; security principles; ethics; network, host, and user management; standard services such as electronic mail, DNS, and WWW; file systems; backups and disaster recovery planning; troubleshooting and support services; automation, scripting; infrastructure planning.
Prerequisites: CSE 017 or CSE 018

CSE 271 Programming in C and the Unix Environment 3 Credits
C language syntax and structure. C programming techniques. Emphasis on structured design for medium to large programs. Unix operating system fundamentals. Unix utilities for program development, text processing, and communications.
Prerequisites: CSE 109

CSE 280 Capstone Project I 3 Credits
First of a two semester capstone course sequence that involves the design, implementation, and evaluation of a computer science software project. Conducted by small student teams working from project definition to final documentation. Each student team has a CSE faculty member serving as its advisor. The first semester emphasis is on project definition, planning and implementation. Communication skills such as technical writing, oral presentations, and use of visual aids are also emphasized. Project work is supplemented by weekly seminars.
Prerequisites: CSE 216
Can be taken Concurrently: CSE 216

CSE 281 2 Credits
Second of a two semester capstone course sequence that involves the design, implementation, and evaluation of a computer science software project; conducted by small student teams working from project definition to final documentation; each student team has a CSE faculty member serving as its advisor; The second semester emphasis is on project implementation, verification & validation, and documentation requirements. It culminates in a public presentation and live demonstration to external judges as well as CSE faculty and students.
Prerequisites: CSE 280
Attribute/Distribution: ND

CSE 300 Apprentice Teaching 1-4 Credits

CSE 302 Compiler Design 3 Credits
Principles of artificial language description and design. Sentence parsing techniques, including operator precedence, bounded-context, and syntax-directed recognizer schemes. The semantic problem as it relates to interpreters and compilers. Dynamic storage allocation, table grammars, code optimization, compiler-writing languages.
Prerequisites: (CSE 109)

CSE 303 Operating System Design 3 Credits
Process and thread programming models, management, and scheduling. Resource sharing and deadlocks. Memory management, including virtual memory and page replacement strategies. I/O issues in the operating system. File system implementation. Multiprocessing. Computer security as it impacts the operating system.
Prerequisites: ECE 201 or (CSE 201 or CSE 202) and CSE 109

CSE 307 (BIOE 307) Structural Bioinformatics 3 Credits
Computational techniques and principles of structural biology used to examine molecular structure, function, and evolution. Topics include: protein structure alignment and prediction; molecular surface analysis; statistical modeling; QSAR; computational drug design; influences on binding specificity; protein-ligand, -protein, and -DNA interactions; molecular simulation, electrostatics. Tutorials on UNIX systems and research software support an interdisciplinary collaborative project in computational structural biology. Credit will not be given for both CSE 307 and CSE 407. Must have junior standing or higher.
Prerequisites: BIOS 120 or CSE 109 or CHM 113 or MATH 231

CSE 308 (BIOE 308) Bioinformatics: Issues and Algorithms 3 Credits
Computational problems and their associated algorithms arising from the creation, analysis, and management of bioinformatics data. Genetic sequence comparison and alignment, physical mapping, genome sequencing and assembly, clustering of DNA microarray results in gene expression studies, computation of genomic rearrangements and evolutionary trees. Credit will not be given for both CSE 308 (BIOE 308) and CSE 408 (BIOE 408). No prior background in biology is assumed.
Prerequisites: CSE 017 or CSE 018

CSE 313 Computer Graphics 3 Credits
Computer graphics for animation, visualization, and production of special effects: displays, methods of interaction, images, image processing, color, transformations, modeling (primitives, hierarchies, polygon meshes, curves and surfaces, procedural), animation (keyframing, dynamic simulation), rendering and realism (shading, texturing, shadows, visibility, ray tracing), and programmable graphics hardware.
Prerequisites: CSE 109 and (MATH 043 or MATH 205 or MATH 242)
CSE 318 Introduction to the Theory of Computation 3 Credits
Provides a deep understanding of computation, its capabilities and its limitations. The course uses discrete formal methods to (1) formulate precise definitions of three kinds of finite-state machines (finite automata, pushdown automata, and Turing machines); (2) prove properties of these machines by studying their expressiveness (i.e., the kinds of problems that can be solved with these machines), and (3) study computational problems that cannot be solved with algorithms.
Prerequisites: CSE 261 or MATH 261

CSE 319 Image Analysis and Graphics 3 Credits
State-of-the-art techniques for fundamental image analysis tasks: feature extraction, segmentation, registration, tracking, recognition, search (indexing and retrieval). Related computer graphics techniques: modeling (geometry, physically-based, statistical), simulation (data-driven, interactive), animation, 3D image visualization, and rendering.
Credit will not be given for both CSE 319 and CSE 419.
Prerequisites: CSE 313

CSE 320 (BIOE 320) Biomedical Image Computing and Modeling 3 Credits
Biomedical image modalities, image computing techniques, and imaging informatics systems. Understanding, using, and developing algorithms and software to analyze biomedical image data and extract useful quantitative information: Biomedical image modalities and formats; image processing and analysis; geometric and statistical modeling; image informatics systems in biomedicine. Credit will not be given for both CSE 320 and CSE 420.
Prerequisites: (MATH 205 or MATH 043) and CSE 017
Attribute/Distribution: ND

CSE 325 Natural Language Processing 3 Credits
Overview of modern natural language processing techniques: text normalization, language model, part-of-speech tagging, hidden Markov model, syntactic and dependency parsing, semantics, word sense, reference resolution, dialog agent, machine translation. Design, implementation and evaluation of classic NLP algorithms. Credit will not be given for both CSE 325 and CSE 425.
Prerequisites: (MATH 205 or ECO 045) and CSE 017
Can be taken Concurrently: MATH 231, ECO 045, CSE 017

CSE 326 Fundamentals of Machine Learning 3 Credits
Bayesian decision theory and the design of parametric and nonparametric classification and regression: linear, quadratic, nearest-neighbors, neural nets. Boosting, bagging. Credit will not be given for both CSE 326 and CSE 426.
Prerequisites: (CSE 002 or CSE 012) and (MATH 205 or MATH 043) and (MATH 231 or ISE 121 or ECO 045)

CSE 327 (COGS 327) Artificial Intelligence Theory and Practice 3 Credits
Detailed analysis of a broad range of artificial intelligence (AI) algorithms and systems. Problem solving, knowledge representation, reasoning, planning, uncertainty and machine learning. Applications of AI to areas such as natural language processing, vision, and robotics. Credit will not be given for both CSE/COGS 127 and CSE/COGS 327.
Prerequisites: CSE 017 and CSE 140

CSE 331 User Interface Systems and Techniques 3 Credits
Principles and practice of creating effective human-computer interfaces. Design and user evaluation of user interfaces; design and use of interface building tools. Programming projects using a variety of interface building tools to construct and evaluate interfaces.
Prerequisites: CSE 017

CSE 332 Multimedia Design and Development 3 Credits
Analysis, design and implementation of multimedia software, primarily for e-learning courses or training. Projects emphasize user interface design, content design with storyboards or scripts, creation of graphics, animation, audio and video materials, software development using high level authoring tools. Consent of instructor.
Prerequisites: CSE 012 or CSE 015 or ENGR 001

CSE 334 Software System Security 3 Credits
Survey of common software vulnerabilities: buffer overflows, format string attacks, cross-site scripting, and botnets. Discussion of common defense mechanisms: static code analysis, reference monitors, language-based security, secure information flow, and others. Credit will not be given for both CSE 334 and CSE 434.
Prerequisites: CSE 109 and CSE 262

CSE 335 Topics on Intelligent Decision Support Systems 3 Credits
Intelligent decision support systems (IDSSs). AI techniques that are used to build IDSSs: case-based reasoning, decision trees and knowledge representation. Applications of these techniques: help-desk systems, e-commerce, and knowledge management. Credit will not be given for both CSE 335 and CSE 435.
Prerequisites: CSE 327 or CSE 109

CSE 336 (ECE 336) Embedded Systems 3 Credits
Prerequisites: CSE 017 or CSE 018

CSE 337 Reinforcement Learning 3 Credits
Algorithms for automated learning from interactions with the environment to optimize long-term performance. Markov decision processes, dynamic programming, temporal-difference learning, Monte Carlo reinforcement learning methods. Credit will not be given for both CSE 337 and CSE 437.
Prerequisites: MATH 231 and CSE 019

CSE 340 (MATH 340) Design and Analysis of Algorithms 3 Credits
Algorithms for searching, sorting, manipulating graphs and trees, finding shortest paths and minimum spanning trees, scheduling tasks, etc.: proofs of their correctness and analysis of their asymptotic runtime and memory demands. Designing algorithms: recursion, divide-and-conquer, greediness, dynamic programming. Limits on algorithm efficiency using elementary NP-completeness theory.
Prerequisites: (MATH 021 or MATH 031 or MATH 076) and CSE 109 and CSE 017

CSE 341 Database Systems, Algorithms, and Applications 3 Credits
Design of large databases; normalization; query languages (including SQL); Transaction-processing protocols; Query optimization; performance tuning; distributed systems. Not available to students who have credit for CSE 241.
Prerequisites: CSE 017

CSE 342 Fundamentals of Internetworking 4 Credits
Architecture and protocols of computer networks. Protocol layers; network topology; data-communication principles, including circuit switching, packet switching and error control techniques; sliding window protocols, protocol analysis and verification; routing and flow control; local and wide area networks; network interconnection; client-server interaction; emerging networking trends and technologies; topics in security and privacy.
Prerequisites: CSE 109

CSE 343 Network Security 3 Credits
Overview of network security threats and vulnerabilities. Techniques and tools for detecting, responding to and recovering from security incidents. Fundamentals of cryptography. Hands-on experience with programming techniques for security protocols. Credit will not be given for both CSE 343 and CSE 443.
Prerequisites: CSE 265 or CSE 303 or CSE 342

CSE 345 WWW Search Engines 3 Credits
Study of algorithms, architectures, and implementations of WWW search engines; Information retrieval (IR) models; performance evaluation; properties of hypertext crawling, indexing, searching and ranking; link analysis; parallel and distributed IR; user interfaces. Credit will not be given for both CSE 345 and CSE 445.
Prerequisites: CSE 109
CSE 347 Data Mining 3 Credits
Overview of modern data mining techniques: data cleaning; attribute and subset selection; model construction, evaluation and application. Fundamental mathematics and algorithms for decision trees, covering algorithms, association mining, statistical modeling, linear models, neural networks, instance-based learning and clustering covered. Practical design, implementation, application, and evaluation of data mining techniques in class projects. Credit will not be given for both CSE 347 and CSE 447.
Prerequisites: CSE 017 and (CSE 160 or CSE 326) and (MATH 231 or ECO 045 or ISE 121)

CSE 348 AI Game Programming 3 Credits
Contemporary computer games: techniques for implementing the program controlling the computer component; using Artificial Intelligence in contemporary computer games to enhance the gaming experience: pathfinding and navigation systems; group movement and tactics; adaptive games, game genres, machine scripting language for game designers, and player modeling. Credit will not be given for both CSE 348 and CSE 448.
Prerequisites: CSE 327 or CSE 109

CSE 350 Special Topics 3 Credits
Selected topics in the field of computer science not included in other courses.
Repeat Status: Course may be repeated.
Prerequisites: MATH 205

CSE 360 Introduction to Mobile Robotics 3 Credits
Algorithms employed in mobile robotics for navigation, sensing, and estimation. Common sensor systems, motion planning, robust estimation, bayesian estimation techniques, Kalman and Particle filters, localization and mapping. Credit will not be given for both CSE 360 and CSE 460.
Prerequisites: MATH 205 or MATH 023 or MATH 231

CSE 363 Network Systems Design 3 Credits
Design principles and issues of network systems. Traditional protocol processing systems and latest network processor/processing technologies. Packet processing, protocol processing, classification and forwarding, switching fabrics, network processors, and network systems design tradeoffs.
Prerequisites: CSE 342

CSE 371 Principles of Mobile Computing 3 Credits
Fundamental concepts and technology underlying mobile computing. Current research in these areas. Examples drawn from a variety of application domains such as health monitoring, energy management, commerce, and travel. Issues of system efficiency will be studied, including efficient handling of large data such as images and effective use of cloud storage. Recent research papers will be discussed. Credit will not be given for both CSE371 and CSE471.
Prerequisites: (CSE 109 and (CSE 202 or ECE 201), )

CSE 375 Principles of Practice of Parallel Computing 3 Credits
Parallel computer architectures, parallel languages, parallelizing compilers and operating systems. Design, implementation, and analysis of parallel algorithms for scientific and data-intensive computing. Credit is not given for both CSE 375 and CSE 475.
Prerequisites: (ECE 201 or CSE 201) or CSE 303 or CSE 202
Can be taken Concurrently: ECE 201, CSE 201, CSE 303, CSE 202

CSE 379 Senior Project 3 Credits
Design, implementation, and evaluation of a computer science capstone project conducted by student teams working from problem definition to testing and implementation; written progress reports supplemented by oral presentations. Must have senior standing.

CSE 389 Honors Project 1-8 Credits
CSE 392 Independent Study 1-3 Credits
An intensive study, with report, of a topic in computer science which is not treated in other courses. Consent of instructor required.
Repeat Status: Course may be repeated.

CSE 401 (ECE 401) Advanced Computer Architecture 3 Credits
Design, analysis and performance of computer architectures; high-speed memory systems; cache design and analysis; modeling cache performance; principle of pipeline processing, performance of pipelined computers; scheduling and control of a pipeline; classification of parallel architectures; systolic and data flow architectures; multiprocessor performance; multiprocessor interconnections and cache coherence.

CSE 403 Advanced Operating Systems 3 Credits
Principles of operating systems with emphasis on hardware and software requirements and design methodologies for multi-programming systems. Global topics include the related areas of process management, resource management, and file systems.
Prerequisites: CSE 303

CSE 404 (ECE 404) Computer Networks 3 Credits
Study of architecture and protocols of computer networks. The ISO model; network topology; data-communication principles, including circuit switching, packet switching and error control techniques; sliding window protocols, protocol analysis and verification; routing and flow control; local area networks; network interconnection; topics in security and privacy.

CSE 405 Advanced Programming Languages 3 Credits
Basic ideas behind modern programming language design, with a focus on functional languages: type systems, modularity, operational semantics, and others. Students need to have some mathematical maturity, including familiarity with proof techniques such as induction.

CSE 406 Research Methods 3 Credits
Technical writing, reading the literature critically, analyzing and presenting data, conducting research, making effective presentations, and understanding social and ethical responsibilities. Topics drawn from probability and statistics, use of scripting languages, and conducting large-scale experiments. Must have first-year status in either the CS or CompE Ph. D. program.

CSE 407 (BIOE 407) Structural Bioinformatics 3 Credits
Computational techniques and principles of structural biology used to examine molecular structure, function, and evolution. Topics include: protein structure alignment and prediction; molecular surface analysis; statistical modeling; QSAR; computational drug design; influences on binding specificity; protein-ligand, -protein, and –DNA interactions; molecular simulation, electrostatics. This course, a version of 307 for graduate students, requires advanced assignments and a collaborative project. Credit will not be given for both CSE 307 and 407. Consent of instructor required.

CSE 408 (BIOE 408) Bioinformatics: Issues and Algorithms 3 Credits
Computational problems and their associated algorithms arising from the creation, analysis, and management of bioinformatics data. Genetic sequence comparison and alignment, physical mapping, genome sequencing and assembly, clustering of DNA microarray results in gene expression studies, computation of genomic rearrangements and evolutionary trees. This course, a version of 308 for graduate students requires advanced assignments. Credit will not be given for both BIOE 308 (CSE 308) and BIOE 408 (CSE 408). No prior background in biology is assumed.
Prerequisites: CSE 017 or CSE 018

CSE 409 Theory of Computation 3 Credits
Finite automata. Pushdown automata. Relationship to definition and parsing of formal grammars. Credits will not be given for both CSE318 and CSE409.
Prerequisites: CSE 318 or CSC 318

CSE 411 Advanced Programming Techniques 3 Credits
Deeper study of programming and software engineering techniques. The majority of assignments involve programming in contemporary programming languages. Topics include memory management, GUI design, testing, refactoring, and writing secure code.

CSE 418 Theory of Computation 3 Credits
Finite automata. Pushdown automata. Relationship to definition and parsing of formal grammars. Credit may be given for only one of the following: CSE318 and CSE409 and CSE418.
CSE 419 Image Analysis and Graphics 3 Credits
State-of-the-art techniques for fundamental image analysis tasks; feature extraction, segmentation, registration, tracking, recognition, search (indexing and retrieval). Related computer graphics techniques: modeling (geometry, physically-based, statistical), simulation (data-driven, interactive), animation, 3D image visualization, and rendering. This course, a graduate version of CSE 319, requires additional advanced assignments. Credit will not be given for both CSE 319 and CSE 419.

CSE 420 (BIOE 420) Biomedical Image Computing and Modeling 3 Credits
Biomedical image modalities, image computing techniques, and imaging informatics systems. Understanding, using, and developing algorithms and software to analyze biomedical image data and extract useful quantitative information: Biomedical image modalities and formats; image processing and analysis; geometric and statistical modeling; image informatics systems in biomedicine. This course, a graduate version of BIOE 320, requires additional advanced assignments. Credit will not be given for both BIOE 320 and BIOE 420.

Prerequisites: MATH 205 and CSE 109
Attribute/Distribution: ND

CSE 424 Advanced Communication Networks 3 Credits
Current and emerging research topics in communication networks: network protocols, network measurement, internet routing, network security, adhoc and sensor networks, disruption tolerant networks. Lecture, readings, and discussion, plus a project.

Prerequisites: CSE 342 or CSE 303 or CSE 404

CSE 425 Natural Language Processing 3 Credits
Overview of modern natural language processing techniques: text normalization, language model, part-of-speech tagging, hidden Markov model, syntactic and dependency parsing, semantics, word sense, reference resolution, dialog agent, machine translation. Three projects to design, implement and evaluate classic NLP algorithms. Credit will not be given for both CSE 325 and CSE 425.

Prerequisites: (MATH 231 or ECO 045) and CSE 017

CSE 426 Fundamentals of Machine Learning 3 Credits
Bayesian decision theory and the design of parametric and nonparametric classification and regression: linear, quadratic, nearest-neighbors, neural nets. Boosting, bagging. This course, a version of CSE 326 for graduate students requires advanced assignments. Credit will not be given for both CSE 326 and CSE 426.

CSE 428 Semantic Web Topics 3 Credits
Theory, architecture and applications of the Semantic Web. Issues in designing distributed knowledge representation languages, ontology development, knowledge acquisition, scalable reasoning, integrating heterogeneous data sources, and web-based agents.

CSE 431 Intelligent Agents 3 Credits
Principles of rational autonomous software systems. Agent theory; agent architectures, including logic-based, utility-based, practical reasoning, and reactive; multi-agent systems; communication languages; coordination methods including negotiation and distributed problem solving; applications.

CSE 432 Object-Oriented Software Engineering 3 Credits
Design and construction of modular, reusable, extensible and portable software using statically typed object-oriented programming languages (Eiffel, C++, Objective C). Abstract data types; genericity, multiple inheritance; use and design of software libraries; persistence, and object-oriented databases; impact of object-oriented programming on the software life cycle.

CSE 434 Software System Security 3 Credits
Survey of common software vulnerabilities: buffer overflows, format string attacks, cross-site scripting, and botnets. Discussion of common defense mechanisms: static code analysis, reference monitors, language-based security, secure information flow, and others. The graduate version differs from the undergraduate version by requiring advanced assignments and projects. Credit will not be given for both CSE 334 and CSE 434. Must have graduate standing in Computer Science or consent of instructor.

CSE 435 Topics on Intelligent Decision Support Systems 3 Credits
AI techniques used to build IDSSs: case-based reasoning, decision trees and knowledge representation. Applications: helpdesk systems, e-commerce, and knowledge management. This course, a version of CSE 335 for graduate students, requires research projects and advanced assignments. Credit will not be given for both CSE 335 and CSE 435.

CSE 437 Reinforcement Learning and Markov Decision Processes 3 Credits
Formal model based on Markov decision processes for automated learning from interactions with stochastic, incompletely known environments. Markov decision processes, dynamic programming, temporal-difference learning, Monte Carlo reinforcement learning methods. Credit will not be given for both CSE 337 and CSE 437. Must have graduate standing in Computer Science or have consent of instructor.

CSE 440 Advanced Algorithms 3 Credits
Average-case runtime analysis of algorithms. Randomized algorithms and probabilistic analysis of their performance. Analysis of data structures including hash tables, augmented data structures with order statistics. Amortized analysis. Elementary computational geometry. Limits on algorithm space efficiency using PSPACE-completeness theory. Credit will not be given for both CSE 440 and CSE 441.

Prerequisites: CSE 340 or MATH 340

CSE 441 (MATH 441) Advanced Algorithms 3 Credits
Algorithms for searching, sorting, manipulating graphs and trees, scheduling tasks, finding shortest path, matching patterns in strings, cryptography, matroid theory, linear programming, max-flow, etc., and their correctness proofs and analysis of their time and space complexity. Strategies for designing algorithms, e.g. recursion, divide-and-conquer, greediness, dynamic programming. Limits on algorithm efficiency are explored through NP completeness theory. Quantum computing is briefly introduced. Credit will not be given for both CSE 441 (MATH 441) and CSE 443.

CSE 443 Network Security 3 Credits
Overview of network security threats and vulnerabilities. Techniques and tools for detecting, responding to and recovering from security incidents. Fundamentals of cryptography. Hands-on experience with programming techniques for security protocols. This course, a version of CSE 343 for graduate students, requires research projects and advanced assignments. Credit will not be given for both CSE 343 and CSE 443.

Prerequisites: (CSE 404 or ECE 404) or CSE 265 or CSE 303 or CSE 426

CSE 445 WWW Search Engines 3 Credits
Study of algorithms, architectures, and implementations of WWW search engines. Information retrieval (IR) models; performance evaluation; properties of hypertext crawling, indexing, searching and ranking; link analysis; parallel and distributed IR; user interfaces. This course, a version of CSE 345 for graduate students, requires research projects and advanced assignments. Credit will not be given for both CSE 345 and CSE 445.

CSE 447 Data Mining 3 Credits
Modern data mining techniques: data cleaning; attribute and subset selection; model construction, evaluation and application. Algorithms for decision trees, covering algorithms, association rule mining, statistical modeling, model and regression trees, neural networks, instance-based learning and clustering covered. This course, a version of CSE 347 for graduate students, requires research projects and advanced assignments, and expects students to have a background in probability, statistics, and programming. Credit will not be given for both CSE 347 and CSE 447.

Prerequisites: CSE 326

CSE 450 Special Topics 3 Credits
Selected topics in computer science not included in other courses.
Repeat Status: Course may be repeated.
CSE 460 Mobile Robotics 3 Credits
Algorithms employed in mobile robotics for navigation, sensing, and estimation. Common sensor systems, motion planning, robust estimation, Bayesian estimation techniques, Kalman and particle filters, localization and mapping. This course, a version of CSE 360 for graduate students will require an independent project to be presented in class. Credit will not be given for both CSE 360 and CSE 460.
Prerequisites: MATH 023 and MATH 205 and MATH 231
Can be taken Concurrently: MATH 231

CSE 471 Principles of Mobile Computing 3 Credits
Course topics include fundamental concepts and technology underlying mobile computing and current research in these areas. Examples drawn from a variety of application domains such as health monitoring, energy management, commerce, and travel. Issues of system efficiency will be studied, including efficient handling of large data such as images and effective use of cloud storage. Recent research papers will be discussed. The graduate version of CSE 371 requires additional effort. Credit will not be given for both CSE 371 and CSE 471.
Prerequisites: CSE 109 and CSE 202 or CSE 303

CSE 475 Principles and Practice of Parallel Computing 3 Credits
Parallel computer architectures, parallel languages, parallelizing compilers and operating systems. Design, implementation, and analysis of parallel algorithms for scientific and data-intensive computing. This is a graduate version of CSE 375. As such, it will require additional assignments. Credit is not given for both CSE 375 and CSE 475.

CSE 490 Thesis 1-6 Credits
Thesis.
Repeat Status: Course may be repeated.

CSE 491 Research Seminar 1-3 Credits
Regular meetings focused on specific topics related to the research interests of department faculty. Current research will be discussed. Students may be required to present and review relevant publications. Consent of instructor required.
Repeat Status: Course may be repeated.

CSE 492 Independent Study 1-3 Credits
An intensive study, with report of a topic in computer science that is not treated in other courses. Consent of instructor required.
Repeat Status: Course may be repeated.

CSE 499 Dissertation 1-15 Credits
Cooperative Graduate Education
The P.C. Rossin College of Engineering and Applied Science permits graduate students to spend part of their research experience in industry, business, or a government agency. In general, the external research experience should be complementary to their graduate studies at Lehigh University and can count towards their degree program through ENGR 400 Engineering Co-op for Graduate Students (see Graduate tab). Permission of the department chair is required in order to participate in this program.

Subject to university/federal regulations, when enrolled in courses at Lehigh University, a student can work for a maximum of 20 hours at the company/laboratory (co-op partner). If not enrolled in courses other than ENGR 400, a student will be permitted to work full time at the co-op partner. Full time employment over the summer may also be permitted. Maintenance of full-time status, however, requires that during the semester students must be registered for the minimum number of credit hours as listed in R&P or meet the qualifications to be certified as a full-time student.

MS/MENG CO-OP PROGRAMS
- ENGR 400 can be taken for a maximum of 6 credits, with at most 3 credits in any registration period.
- Minimum of 18 course credit hours, excluding ENGR 400 and Thesis (ENGR 490) must be obtained through Lehigh University

PH.D. PROGRAM
- 9 credits of ENGR 400 can be taken throughout a student’s entire graduate study at Lehigh, with at most 3 credits in any registration period.

Courses
ENGR 400 Engineering Co-op for Graduate Students 1-3 Credits
Supervised cooperative work assignment to obtain practical experience in field of study. Requires consent of department chairperson. When on a cooperative assignment, the student must register for this course to maintain continuous student status. Limit to at most three credits per registration period. No more than six credits may be applied towards a master’s program and no more than nine credits may be used throughout a student’s entire graduate study at Lehigh.
Repeat Status: Course may be repeated.

ENGR 401 Teaching/Presentation Skills 1 Credit
Development of teaching and presentation skills for scientific professionals. Presentation effectiveness, teaching/presentation methodologies, classroom management, course development/content preparation, lecture/presentation development and lecture/presentation delivery. Individualized undergraduate course specific modules selected by student. Enrollment limited to Rossin Doctoral Fellows.

ENGR 402 Preparing for the Professoriate 1 Credit
Overview of the job search, research program development and service skills for graduate students entering academic careers. Transition from graduate student to faculty responsibilities, the post-doctoral experience, time management, CV/resume preparation, faculty search process, tenure and promotion, research leadership and program development, research proposal preparation and research sponsorship. Enrollment limited to Rossin Doctoral Fellows.

ENGR 430 Technical Writing for Engineering and the Sciences 1 Credit
Formal composition and technical writing skills for advanced non-native English writers in Engineering and the Sciences. Instructor and peer review of writing, self-editing strategies, how to incorporate technical vocabulary and formulas, advanced sentence structure, and appropriate citation of research. Field-specific readings, which students must compile, critique, and model in their own writing. Designed for international graduate students who are writing or preparing to write publishable quality articles, theses, or dissertations.

ENGR 452 (BIOE 452, CHE 452, ME 452) Mathematical Methods In Engineering I 3 Credits
Analytical techniques relevant to the engineering sciences are described. Vector spaces; eigenvalues; eigenvectors. Linear ordinary differential equations; diagonalizable and non-diagonalizable systems. Inhomogeneous linear systems; variation of parameters. Non-linear systems; stability; phase plane. Series solutions of linear ordinary differential equations; special functions. Laplace and Fourier transforms; application to partial differential equations and integral equations. Sturm-Liouville theory. Finite Fourier transforms; planar, cylindrical, and spherical geometries.

ENGR 490 Thesis (Moc) 1 Credit
ENGR 499 Dissertation (Moc) 1 Credit
Electrical Engineering and Engineering Physics
This dual-degree curriculum is particularly well suited for students seeking thorough preparation in the field of electronic device physics. It is a combination of the basic electrical engineering and engineering physics curricula and requires 162 credit hours, distributed over five years. The student will earn two degrees: B.S. in electrical engineering and B.S. in engineering physics.
Two alternative course sequences are listed below. Students who follow the EE-EP (EE first) course sequence will complete 135 credit hours, including all of the required electrical engineering courses, by the end of the fourth year and the remaining credit hours at the end of the fifth year. Since 134 credit hours are required for the electrical engineering degree, the student will complete the requirements for that degree at the end of the fourth year, and the requirements for the engineering physics degree at the end of the fifth year.
In the alternative EP-EE (EP first) course sequence, the student completes 133 credit hours by the end of the fourth year, including all the required physics courses, and the remaining credits at the end of the fifth year. Since 131 credit hours are required for the engineering physics degree, the student will complete the requirements for that
degree at the end of the fourth year, and the requirements for the electrical engineering degree at the end of the fifth year.

Students interested in a dual-degree program combining physics (rather than engineering physics) and electrical engineering should consult the Physics section of this catalog. That program allows the student to earn the B.S. in physics and the B.S. in electrical engineering.

Students interested in either dual-degree program should contact Prof. Jerome Licini, Department of Physics.

THE RECOMMENDED SEQUENCES OF COURSES FOR THE TWO DIFFERENT EEEP SEQUENCES

### EE-EP

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Total Credits: 164
Credits in 4 yrs [135]

The EP-approved electives must include at least three courses from the following:

- PHY 363  
  Physics of Solids  
  3
- PHY 369  
  Quantum Mechanics I  
  3
- PHY 352  
  Modern Optics  
  3
- or PHY 355  
  Nonlinear Optics  
  3
- PHY 348  
  Plasma Physics  
  3
- or PHY 365  
  Physics Of Fluids  
  3
- PHY 380  
  Introduction to Computational Physics  
  3

The ECE-approved electives must be approved by the student’s advisor.

### EP-EE

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Total Credits: 163
Credits in 4 yrs [133]
The EP-approved electives must include at least three courses from the following:

- PHY 363: Physics of Solids 3
- PHY 369: Quantum Mechanics I 3
- PHY 352: Modern Optics 3
- or PHY 355: Nonlinear Optics 3
- PHY 348: Plasma Physics 3
- or PHY 365: Physics Of Fluids 3
- PHY 380: Introduction to Computational Physics 3

The ECE-approved electives must be approved by the student’s advisor.

**Electrical and Computer Engineering**

The department of electrical and computer engineering (ECE) offers undergraduate and graduate programs of study along with supporting research for students interested in the field of electrical engineering. It also jointly supports undergraduate and graduate programs in computer engineering with the computer science and engineering (CSE) department. Graduate study leads to the degrees, master of science, master of engineering, and doctor of philosophy in electrical engineering, and the master of science and doctor of philosophy in computer engineering.

The undergraduate programs emphasize the fundamental aspects of their respective areas. Engineering design concepts are introduced early in the curriculum, and required instructional laboratories introduce design as a hands-on activity. Electives permit students to tailor their programs according to their interests and goals, whether they be in preparation for graduate study or entry into industry. Students are free to select courses offered by other departments and are encouraged to do so when appropriate. In this way they can prepare themselves for activities which straddle departmental boundaries or for entry into professional schools such as medicine or management. Students synthesize and apply their knowledge in a senior design project. Students may use the senior design project as a way to participate in the various research projects in the department.

The department maintains a number of laboratories in support of its curricular programs. These laboratories include the sophomore and junior lab, electronic circuits and systems laboratory, microcomputer laboratory, electromechanics laboratory, digital signal processing laboratory, digital systems laboratory and senior projects laboratories.

The department has research laboratories in computer architectures, wireless communications, optoelectronics, compound semiconductors, electron device physics, microelectronics fabrication, signal processing, and communications. These laboratories, among others, are available for undergraduate projects.

The graduate programs allow students to deepen their professional knowledge, understanding, and capability within their subspecialties. Each graduate student develops a program of study in consultation with his or her graduate advisor. Key research thrust areas in the department include:

1. Microelectronics and Nanotechnology.
2. Wireless Communications and Networking.
3. Optoelectronics.

Graduate research is encouraged in these and other areas.

Computers and computer usage are an essential part of the student’s learning experience. The university provides a distributed network of about 75 high-performance workstations and over 300 PC-compatible microcomputers in public sites throughout the campus. The ECE department has state-of-the-art systems to augment and extend the generally available university systems. There are approximately 90 Workstations running the Microsoft and Linux platforms that are located in various ECE Teaching Labs. Additionally, there is an ECE Teaching Lab Linux Platform with over 40 workstations and servers that are used both for graduate research and to augment classroom learning. The systems provide an array of software for students and researchers, such as Cadence, Synopsys, Silvaco, Keysight Advanced Design System, Keysight SystemVue, Matlab, LabView, Xilinx, and many open source applications. The workstations and servers are connected via high-speed ethernet, which are in turn connected to the university's backbone network, and to the external world through the internet.

2. Students are not required by the department, nor the university, to own a personal computer, but many find such a tool a valuable asset.

A detailed description of the curricular programs follows with a listing of the required courses and with a listing of the departmental course offerings. The departmental courses carry the prefix ECE for electrical and computer engineering. Courses given by the Computer Science and Engineering department have the prefix CSE. Students are urged to search both listings for courses appropriate to their career goals.

**Professors.** Filbert J. Bartoli, PHD (Catholic University of America); Rick S. Blum, PHD (University of Pennsylvania); Stephen Paul DeWeeth, PHD (California Institute of Technology); Douglas R Frey, PHD (Lehigh University); Miltiadis K. Hatalis, PHD (Carnegie Mellon University); James C. Hwang, PHD (Cornell University); Shalinee Kishore, PHD (Princeton University); Mayuresh V. Kothare, PHD (California Institute of Technology); Alan J. Snyder, PHD (The Pennsylvania State University); Nelson Tansu, PHD (University Wisconsin-Madison); Svetlana Tatic-Lucic, PHD (California Institute of Technology); Chengshang Xiao, PHD (University of Sydney); Zhiyuan Yan, PHD (University of Illinois at Urbana-Champaign); Yahong Rosa Zheng, PHD (Carleton University)

**Associate Professors.** Yevgeny Berdichevsky, PHD (University of California, San Diego); Sushil Kumar, PHD (Massachusetts Institute of Technology); Jing Li, PHD (Texas A&M University); Wenxin Liu, PHD (University Missouri Rolla); Karl H Norian, PHD (University of London); Parv Venkitasubramanian, PHD (Cornell University); Jonathan J. Wierer, PHD (University of Illinois at Urbana-Champaign); Chao Zhou, PHD (University of Pennsylvania)

**Assistant Professors.** Xiaochen Guo, PHD (University of Rochester); Wuje Wen, PHD (University of Pittsburgh)

**Professor Of Practice.** Ramesh (Rudy) Shankar, PHD (University of Delaware)

**Emeriti.** David Richard Decker, PHD (Lehigh University); Bruce D. Fritchman, PHD (Lehigh University); Frank H. Hielscher, PHD (University of Illinois at Urbana-Champaign); Carl S. Holzinger, PHD (Lehigh University); Alastair D. McAulay, PHD (Carnegie Mellon University); Donald L. Talhelm, MS (Leigh University); Eric D. Thompson, PHD (Massachusetts Institute of Technology); Kenneth Kai-Ming Tzeng, PHD (University of Illinois at Urbana-Champaign); Meghanad D. Wagh, PHD (Indian Institute of Technology Bombay); George D. Watkins, PHD (Harvard University); Marvin H. White, PHD (Ohio State University)

**UNDERGRADUATE PROGRAMS**

**Mission Statement for the Electrical Engineering and Computer Engineering Programs**

The mission of the electrical engineering and computer engineering programs is to prepare engineers to meet the challenges of the future, to promote a sense of scholarship, leadership, and service among our graduates, to instill in the students the desire to create, develop, and disseminate new knowledge, and to provide international leadership to the electrical engineering and computer engineering professions.

**Program Educational Objectives in Electrical Engineering and Computer Engineering**

It is expected that our alumni will:

1. Be valued as dependable and technically proficient electrical engineers across a wide variety of fields, industries, non-profit organizations, national laboratories, entrepreneurial endeavors or in the pursuit of graduate education;
2. Pursue life-long learning and professional development to advance their knowledge and skills for successful and rewarding careers;
3. Function and communicate effectively individually and in a team environment, contribute to multi-disciplinary projects, and attain leadership positions in their chosen profession, communities, and the global society, and;
4. Function as responsible members of society with an awareness of the professional responsibilities and the global, social and the ethical ramifications associated with their work.
BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING

The required courses for this degree contain the fundamentals of linear circuits, systems and control theory, electronic circuits, signal theory, physical electronics, electromagnetic theory, energy conversion, digital systems, and computing techniques. A strong foundation in the physical sciences and in mathematics is required. Approved electives, chosen with the advisor’s consent, are selected in preparation for graduate study or entry into industry according to individual interests. The program requires a minimum of 134 credit hours. The recommended sequence of courses follows:

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### Required Courses

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<thead>
<tr>
<th>First Year</th>
<th>Credits</th>
<th>Second Semester Credits</th>
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<td>MATH 022</td>
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<tr>
<td>ENGR 005</td>
<td>2</td>
<td>HSS Elective or ECO 001</td>
</tr>
</tbody>
</table>

Select one of the following:

- CHM 030 & ENGR 010
- PHY 011 & PHY 012

**First Semester**

- ENGR 001 3
- MATH 021 4
- ENGR 005 2

**Second Semester**

- Select one of the following:
  - PH 257
  - CHM 030 & ENGR 010
  - PHY 011 & PHY 012

- Required Courses:
  - ENGR 005 2
  - HSS Elective 3

Total Credits: 133-139

1. Required natural science courses, one taken fall semester and the other taken in spring

2. Approved technical electives are subjects in the area of science and technology. Students must select a minimum of four courses (totaling at least 12 credits) from the ECE or CSE course listings, with a minimum of two courses in one of the technical areas described in the following list. Students must also choose at least one engineering elective in either materials, mechanics, thermodynamics, fluid mechanics or physical chemistry, and at least one science elective in physics, chemistry or biology. For students interested in solid-state electronics, quantum mechanics is recommended for the science elective.

**Approved Technical Electives for Electrical Engineering**

**Breadth Requirement**

Minimum of 4 ECE or CSE elective courses spanning more than one technical area below.

**Depth Requirement**

Minimum of 2 courses in one of the technical areas described below.

**Solid-State Circuits**

- ECE 308 Physics and Models of Electronic Devices
- ECE 332 Design of Linear Electronic Circuits
- ECE 333 Medical Electronics
- ECE 337 Introduction to Micro- and Nanofabrication
- ECE 355 Mixed Signal Circuits
- ECE 361 Introduction to VLSI Circuits

**Signal Processing and Communications**

- ECE 212 Control Theory
- ECE 339 Graphical Signal Processing
- ECE 341 Fundamentals of Wireless Communications
- ECE 342 Communication Theory
- ECE 343 Digital Signal Processing
- ECE 344 Statistical Signal Processing
- ECE 364 Introduction to Cryptography and Network Security
- ECE 387 Digital Control
- ECE 389 Control Systems Laboratory

**Microwaves and Lightwaves**

- ECE 310 Wireless Circuits
- ECE 325 Semiconductor Lasers I
- ECE 326 Semiconductor Lasers II
- ECE 338 Quantum Electronics
- ECE 347 Introduction to Integrated Optics
- ECE 348 Optoelectronics Physics and Lightwave Technology
- ECE 371 Optical Information Processing
- ECE 372 Optical Networks

**Computers**

- ECE 201 Computer Architecture
- ECE 319 Digital System Design
- ECE/CSE 336 Embedded Systems

Note: Special Topics (3) (The area of each course must be evaluated individually)

**MINOR IN ELECTRICAL ENGINEERING**

The purpose of the Electrical Engineering minor is to enable students to supplement their major with knowledge and skills that increase their ability to realize their multi-disciplinary goals and/or make them more marketable upon graduation.

**Required Courses**

- ECE 081 Principles of Electrical Engineering
- ECE 083 Introduction to Electrical Engineering and Electrical Laboratory
- ECE 108 Signals and Systems
- ECE 121 Electronic Circuits Laboratory
GRADUATE PROGRAMS

Graduate programs of study provide a balance between formal classroom instruction and research and are tailored to the individual student’s professional goals. The programs appeal to individuals with backgrounds in electrical or computer engineering, mathematics, or the physical sciences. Research is an essential part of the graduate program. Major research areas include:

**Microelectronics Devices, Integrated Circuits, VLSI Design**
Mixed Signal design, Silicon integrated circuit technology, processing, fabrication and testing. Semiconductor device physics, nano scale devices, CMOS VLSI logic design and verification, computer-aided design (CAD), VLSI chip architectures, computer architecture including embedded systems and systems-on-a-chip. New sensors, actuators and novel microsystems, ranging from micro-electromechanical-systems (MEMS) to chemical microreactors and Biochips.

**Optoelectronics and Photonics**
Fiber optic communications and networks, applications of nonlinear optics, optical switching, novel devices, and optical computing. Freespace optical communication systems. Terahertz generation, amplification, detection, and applications, nanostructures and nanodevices. Biophotonics.

The Master of Science degree requires the completion of 30 credit hours of work that may include a six credit hour thesis for the EE and CompE degrees. A program of study must be submitted in compliance with the graduate school regulations. An oral presentation of the thesis is required.

The Master of Engineering degree requires the completion of 30 credit hours of work, which includes design-oriented courses and an engineering project. A program of study must be submitted in compliance with the college rules. An oral presentation of the project is required.

The Ph.D. degree in electrical engineering requires the completion of 42 credit hours of work (including the dissertation) beyond the master’s degree (48 hours if the master’s degree is non-Lehigh), the passing of a departmental qualifying examination appropriate to each degree within one year after entrance into the degree program, the passing of a general examination in the candidate’s area of specialization, the admission into candidacy, and the writing and defense of a dissertation. Competence in a foreign language is not required.

The ECE Department has a core curriculum requirement for graduate students in each of the degree programs. The purpose of this requirement is to guarantee that all students pursuing graduate studies in the department acquire an appropriate breadth of knowledge of their discipline.

**Electrical Engineering**
To satisfy the core curriculum requirements in Electrical Engineering:

Select three courses from the following five different areas:

<table>
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<tr>
<th>Course</th>
<th>Description</th>
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<tbody>
<tr>
<td>ECE 401</td>
<td>Advanced Computer Architecture</td>
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<tr>
<td>ECE 402</td>
<td>Advanced Electromagnetics</td>
</tr>
<tr>
<td>ECE 441</td>
<td>Fundamentals of Wireless Communications</td>
</tr>
<tr>
<td>ECE 420</td>
<td>Advanced Circuits and Systems</td>
</tr>
<tr>
<td>ECE 451</td>
<td>Physics of Semiconductor Devices</td>
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</tbody>
</table>

**Computer Engineering**
See catalog entry for Computer Engineering (p. 386).

**M.S. in Photonics**
The Masters of Science degree in Photonics is an interdisciplinary degree that is designed to provide students with a broad training experience in the various aspects of photonics, including topics in Physics, Electrical Engineering and Materials Science and Engineering. It covers both theoretical and practical topics in areas such as fiber optics, integrated optics, lasers, nonlinear optics and optical materials to prepare the students to work in industry directly after graduation. The program is also designed so as to make it possible for students who wish to continue on for a Ph.D. to still satisfy the requirements of their individual departments for the more advanced degree. For details on this program, see the separate catalog section under Interdisciplinary Graduate Study and Research.

**M. S. in Wireless Communications and Network Engineering**
The Master of Science degree in Wireless Communications and Network Engineering at Lehigh University is designed to prepare the next generation of engineers for the communications and networking industries. The curriculum aims to produce graduates that can contribute to the design and analysis of communication systems in the broadest context. To accommodate the student’s study of various aspects of wireless communications and networking, we have limited the number of required core courses to allow maximum flexibility in pursuing specific interests.

**Required Core Courses**

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<th>Course</th>
<th>Description</th>
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<td>ECE 342</td>
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<tr>
<td>ECE 441</td>
<td>Fundamentals of Wireless Communications</td>
<td>3</td>
</tr>
<tr>
<td>ECE 404</td>
<td>Computer Networks</td>
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</table>

**Advanced Courses**

1. ECE 342 must be the first course taken and the core courses should precede advanced courses.
2. In addition to the core courses, the students will take advanced courses that are aimed to furnish the student with a deeper knowledge of more specific types and aspects of information networks.

**DEPARTMENTAL COURSES**
Courses are listed under the prefixes ECE and CSE. Generally, electrical engineering courses carry the ECE prefix and appear in the following listing. Computer science courses carry the CSE prefix. Computer engineering courses are found under either prefix. The CSE courses are listed in the Computer Science and Engineering department section in this catalog. The reader should consult both listings.
Courses

**ECE 033 Introduction to Computer Engineering 4 Credits**
Analysis, design and implementation of small digital circuits. Boolean algebra. Minimization techniques, synchronous sequential circuit design, number systems and arithmetic. Microcomputer architecture and assembly level programming.
**Prerequisites:** CSE 017 or ENGR 010 or ENGR 097

**ECE 081 Principles of Electrical Engineering 4 Credits**
Circuit elements and laws. Behavior of simple linear networks, include equivalent circuits and solution techniques. Solution of DC circuits and AC circuits using phasor techniques. Introduction to operational amplifiers. Steady state and transient response of simple circuits. Includes a weekly session for review and discussion. May not be taken with ECE 083 for credit.
**Prerequisites:** (MATH 022 or MATH 096) and PHY 021
**Can be taken Concurrently:** PHY 021

**ECE 083 Introduction to Electrical Engineering 3 Credits**
Circuit elements and laws. Behavior of simple linear networks. Characteristics of electronic circuits and modeling. Introduction to functional circuits, such as operational amplifiers, instrumentation amplifiers, and power systems. Introduction to basic filters and data converters. May not be taken with ECE 081 for credit.
**Prerequisites:** MATH 022 and PHY 021
**Can be taken Concurrently:** PHY 021

**ECE 108 Signals and Systems 4 Credits**
Continuous and discrete signal and system descriptions using signal space and transform representations. Includes Fourier series, continuous and discrete Fourier transforms, Laplace transforms, and z-transforms. Introduction to sampling.
**Prerequisites:** ECE 081

**ECE 121 Electronic Circuits Laboratory 2 Credits**
One lecture and one laboratory per week. Experiments illustrating the principles of operation of electronic devices and their circuit applications. Basic electronic instrumentation and measurement techniques.
**Prerequisites:** ECE 081

**ECE 123 Electronic Circuits 3 Credits**
Methods for analyzing and designing circuits containing electronic devices. Topics include device models, basic amplifier configurations, operating point stabilization, frequency response analysis, and computer-aided analysis of active circuits.
**Prerequisites:** ECE 081

**ECE 125 Circuits and Systems 3 Credits**
**Prerequisites:** ECE 108

**ECE 126 Fundamentals of Semiconductor Devices 3 Credits**
Introduction to the physics of semiconductors in terms of atomic bonding and electron energy bands in solids. Charge carriers in semiconductors and carrier concentration at thermal equilibrium. Principles of electron and hole transport, drift and diffusion currents, generation and recombination processes, continuity. Treatment of semiconductor devices including P-n junctions, bipolar junction transistors and field effect transistors.
**Prerequisites:** ECE 081

**ECE 136 Electromechanics 0-3 Credits**
Two lectures and one laboratory per week. An experimental introduction to electromechanical energy conversion. Basic concepts of magnetic fields and forces and their application to electrical apparatus including electromechanical transducers, transformers, AC and DC machines.
**Prerequisites:** ECE 081

**ECE 138 Digital Systems Laboratory 2 Credits**
Implementation issues and techniques for digital logic design. Combinational and sequential logic design using standard integrated circuits. I/O and interrupt processing. Design and implementation of real-time complex digital logic using microprocessor systems.
**Prerequisites:** ECE 033

**ECE 162 Electrical Laboratory 1 Credit**
Experiments on circuits, machines, and electronic devices. Elementary network theory. Survey laboratory for students not majoring in electrical or computer engineering.
**Prerequisites:** ECE 081 or ECE 083
**Can be taken Concurrently:** ECE 081, ECE 083

**ECE 182 Junior Laboratory 1 Credit**
Experiments designed to exploit the students understanding of basic circuits and filters. Experiments designed to help students understand basic things and systems concepts such as time-frequency domain duality, power measurement, modulation, sampling and data conversion. Students are introduced to a variety of integrated circuits including multipliers, analog switches, digital electronics, S/H, A/D, and D/A converters. Computer software design aids, especially Spice and LabView, are used throughout the semester. One three-hour laboratory per week.
**Prerequisites:** ECE 033 and ECE 121 and ECE 123

**ECE 201 Computer Architecture 3 Credits**
**Prerequisites:** ECE 033

**ECE 202 Introduction to Electromagnetics 3 Credits**
Elements of vector analysis, Coulomb’s law, Biot-Savart’s and Ampere’s laws, Lorentz Forces, Laplace’s, and Maxwell’s equations, boundary conditions, methods of solution in static electric and magnetic fields, including finite element numerical approach. Quasistationary fields, inductance.
**Prerequisites:** MATH 205 and PHY 021

**ECE 203 Introduction to Electromagnetic Waves 3 Credits**
Uniform plane waves in free space and in materials, skin effect. Waves in transmission lines and waveguides, including optical fibers. Energy and power flow, Poynting’s theorem. Reflection and refraction. Resonators. Radiation and diffraction.
**Prerequisites:** ECE 202

**ECE 212 Control Theory 3 Credits**
**Prerequisites:** ECE 125

**ECE 256 Honors Project 1 Credit**
Open by invitation only to students who have completed ECE 257, Senior Project. Selection is based upon the quality of the senior project with regard to ingenuity, design approach and completeness. The objective of this course is to carry the successful senior projects forward to completion of a technical paper suitable for publication or submission to a technical conference. A written report and oral presentation are required by mid-semester. Oral presentations will be made before an appropriate public forum. Enrollment limited.

**ECE 257 Senior Lab I 3 Credits**
With ECE 258, provides a complete design experience for Electrical and Computer Engineers. Students are expected to identify essential project aspects crucial to success and to perform in-depth engineering evaluation and testing demonstrating that desired results can be achieved with the proposed implementation. Instruction in technical writing, product development, ethics and professional engineering, and presentation of design and research. Two three hour sessions and one additional two plus hour lecture per week. Must have senior status.

**ECE 258 Senior Lab II 2 Credits**
Continuation of ECE 257. Complete design, construction, and testing of projects selected and developed in ECE 257. Present final design reviews and project presentations. Submit a final written report. Discuss development issues, including manufacturability, patents, and ethics. Two three-hour sessions per week.
**Prerequisites:** ECE 257
ECE 300 Apprentice Teaching 1-4 Credits
ECE 308 Physics and Models of Electronic Devices 3 Credits
Prerequisites: ECE 126
Physics of metal-semiconductor junction, p-n junctions, and MOS capacitors. Models of Schottky barrier and p-n junction diodes, JFET, MOSFET, and bipolar transistors.

ECE 310 Wireless Circuits 3 Credits
Prerequisites: ECE 126
Theory and design of high-frequency circuits for wireless communications. Transmission lines and microwave networks. Types of circuits explored include filters, amplifiers, mixers, voltage controlled oscillators (VCOs), phase locked loops (PLLs), synthesizers, modulators and demodulators, and antennae. Design using scattering parameters, Smith chart and RF/microwave CAD programs for simulation. System performance analysis based on noise figure, antenna gain and the Friis equation will be developed. Modulation techniques of AM, FM, PM, and QPSK systems will be compared based on bit error rates (BER) calculated from system parameters.

ECE 313 Power Electronics 3 Credits
Introduction to power semiconductor devices, circuits, and applications. Diodes, thyristors, bipolar and MOS transistors, IGBTs, and other emerging types, and their use in typical power conversion circuits such as rectifiers, buck and boost converters, and dc-dc, dc-ac, and ac-ac inverters and converters. Application examples in motor drives, power supplies and HVDC transmission.

ECE 319 Digital System Design 3 Credits
Design techniques at the register transfer level. Control strategies for hardware architectures. Implementation of microprogramming, intersystem communication and peripheral interfacing. Hardware design languages and their use in design specification, verification and simulation.

ECE 321 Introduction to Power Systems 3 Credits
Power systems engineering relating to generation, transmission, distribution and utilization of electric power. This course introduces basic yet critical concepts of large-scale power systems. Topics include power system modeling, power flow, symmetrical faults, unsymmetrical faults, transient stability, and optimal power flow. Subject material is useful to students who pursue careers or research in electric power systems.

ECE 322 Introduction to Photovoltaic Energy Systems 3 Credits

ECE 325 Semiconductor Lasers I 3 Credits

ECE 326 Semiconductor Lasers II 3 Credits
Continuation of Semiconductor Lasers I. Topics covered include: Gain and current relations; dynamic effects; perturbation and coupled-mode theory; dielectric waveguides; and photonic integrated circuits. Credit will not be given for both ECE 326 and ECE 426.

ECE 328 (ECO 328) Electricity Economics 3 Credits
The course is intended primarily for students who are interested in a exploration of the electricity market, its operation and the main considerations to implement it, in the wake of a smart grid implementation, with basic college-level calculus.
Repeat Status: Course may be repeated.
Prerequisites: ECO 001 and MATH 023 or ECO 146
Attribute/Distribution: SS

ECE 332 Design of Linear Electronic Circuits 3 Credits
Introduction to a variety of linear design concepts and topologies, with audio networks providing many of the concrete examples. Topics include preamplifiers, equalizers and filters, multipliers, voltage-controlled amplifiers, level detectors, and power amplifiers.
Prerequisites: ECE 123 and ECE 125
Can be taken Concurrently: ECE 125

ECE 333 Medical Electronics 3 Credits
Bioelectric events and electrical methods used to study and influence them in medicine, electrically excitable membranes, action potentials, electrical activity of muscle, the heart and brain, bi amplifiers, pulse circuits and their applications.
Prerequisites: ECE 123

ECE 336 (CSE 336) Embedded Systems 3 Credits
Prerequisites: CSE 017

ECE 337 Introduction to Micro- and Nanofabrication 3 Credits
Survey of the standard IC fabrication processes, such as photolithography, dry and wet etching, oxidation, thin-film deposition and chemical mechanical polishing. In-depth analysis of MEMS-specific processes such as wafer bonding, wet anisotropic etching, photolithography using thick photoresists, and deep reactive ion etching of silicon. The basics of nanofabrication techniques. The fundamentals of MEMS design will be outlined. A wide variety of MEMS and NEMS devices will be discussed.
Prerequisites: (MAT 033 and MATH 231) or ECE 351

ECE 338 Quantum Electronics 3 Credits
Prerequisites: ECE 203

ECE 339 Graphical Signal Processing 3 Credits
Application of graphical programming to mathematical principles in data analysis and signal processing. Review of digital signal processing, use of structures, arrays, charts, building virtual instruments, graphical programming for linear algebra, curve fitting, solving differential and difference equations, signal generation, DFT and FFT analysis, windowing and filtering.
Prerequisites: ECE 108

ECE 341 Fundamentals of Wireless Communications 3 Credits
Prerequisites: ECE 108
ECE 342 Communication Theory 3 Credits
Theory and application of analog and digital modulation. Sampling theory with application to analog-to-digital and digital-to-analog conversion techniques. Time and frequency division multiplexing. Introduction to random processes including filtering and noise problems. Introduction to statistical communication theory with primary emphasis on optimum receiver principles.
Prerequisites: ECE 125 and (MATH 309 or MATH 231)

ECE 343 Digital Signal Processing 3 Credits
Study of orthogonal signal expansions and their discrete representations, including the Discrete Fourier Transform and Walsh-Hadamard Transform. Development of fast algorithms to compute these, with applications to speech processing and communication. Introduction to the z-transform representation of numerical sequences with applications to input/output analysis of discrete systems and the design of digital filters. Analysis of the internal behavior of discrete systems using state variables for the study of stability, observability and controllability.
Prerequisites: ECE 108

ECE 344 Statistical Signal Processing 3 Credits
Introduction to random processes, covariance and spectral density, time average, stationarity, and ergodicity. Response of systems to random inputs. Sampling and quantization of random signals. Optimum filtering, estimation, and hypothesis testing.
Prerequisites: (ECE 108) and (MATH 231 or MATH 309)

ECE 345 Fundamentals of Data Networks 3 Credits
Analytical foundations in the design and evaluation of data communication networks. Fundamental mathematical models underlying network design with their applications in practical network algorithms. Layered network architecture, queueing models with applications in network delay analysis, Markov chain theory with applications in packet radio networks and dynamic programming with applications to network routing algorithms. Background on stochastic processes and dynamic programming will be reviewed. Prereq: MATH 231 and ECE125.
Prerequisites: MATH 231 and ECE 125

ECE 347 Introduction to Integrated Optics 3 Credits
Prerequisites: (ECE 202 and ECE 203)

ECE 348 Lightwave Technology 3 Credits
Concepts of signal generation, modulation, transmission, isolation, detection, and switching in current optical fiber networks. Classical and quantum properties of radiation and matter in optoelectronic devices. Physics of light propagation in optical waveguides, and of light generation and detection in optoelectronic devices. Fundamentals of operation of common types of discrete and integrated optical components such as light-emitting diodes and lasers, photodetectors, modulators, and optical couplers. Credit will not also be given for ECE 448. Prereq: ECE 203.
Prerequisites: ECE 203

ECE 350 Special Topics 3 Credits
Selected topics in the field of electrical and computer engineering not included in other courses.
Repeat Status: Course may be repeated.

ECE 355 Mixed Signal Circuits 3 Credits
Analysis and design of contemporary mixed signal electronic circuits, including phase-locked loops, A/D and D/A converters, sigma-delta converters, and switching power supplies. Continuous and discrete time simulation of mixed signal systems starting with operational amplifiers as a prototype feedback system using Spice and Matlab.
Prerequisites: ECE 108 and ECE 123

ECE 361 Introduction to VLSI Circuits 3 Credits
The design of Very Large Scale Integrated (VLSI) Circuits, with emphasis on CMOS Standard Cell design. Topics include MOS transistor physics, device behavior and device modeling, MOS technology and physical layout, design of combinational and sequential circuits, static and dynamic memories, and VLSI chip organization. The course includes a design project using CAE tools for layout, design rule checking, parameter extraction, and SPICE simulations for performance prediction. Two one-hour lectures and three hours of laboratory per week.
Prerequisites: ECE 123

ECE 364 Introduction to Cryptography and Network Security 3 Credits
Introduction to cryptography, classical cipher systems, cryptanalysis, perfect secrecy and the one time pad, DES and AES, public key cryptography covering systems based on discrete logarithms, the RSA and the knapsack systems, and various applications of cryptography. May not be taken with ECE 464 for credit. Must have junior or senior standing.

ECE 366 (BIOE 366) Neural Engineering 3 Credits
Neural system interfaces for scientific and health applications. Basic properties of neurons, signal detection and stimulation, instrumentation and microfabricated electrode arrays. Fundamentals of peripheral and central neural signals and EEG, and applications such as neural prostheses, implants and brain-computer interfaces. Closed to students who have taken BIOE 366, BIOE 466, and ECE 468.
Prerequisites: ECE 081

ECE 368 (BIOE 368) Introduction to Biophotonics and Optical Biomedical Imaging 3 Credits
Optical principles, techniques, and instruments used in biomedical research and clinical medicine. Fundamental concepts of optical imaging and spectroscopy systems, and details of light-tissue interaction. Commercial devices and instruments, as well as novel optical imaging technologies in development. Closed to students who have taken ECE 468, BIOE 368, or BIOE 468.
Prerequisites: ECE 202 or PHY 212

ECE 371 Optical Information Processing 3 Credits
Introduction to optical information processing and applications. Interference and diffraction of optical waves. 2D optical matched filters that use lenses for Fourier transforms. Methods and devices for modulating light beams for information processing, communications, and optical computing. Construction and application of holograms for optical memory and interconnections.
Prerequisites: (ECE 108 and ECE 202)

ECE 372 Optical Networks 3 Credits
Study the design of optical fiber local, metropolitan, and wide area networks. Topics include: passive and active photonic components for optical switching, tuning, modulation and amplification; optical interconnection switches and buffering; hardware and software architectures for packet switching and wavelength division multiplex access systems. The class is supported with a laboratory.
Prerequisites: (ECE 081 and ECE 202)

ECE 387 (CHE 387, ME 387) Digital Control 3 Credits
Sampled-data systems; z-transforms; pulse transfer functions; stability in the z-plane: root locus and frequency response design methods; minimal prototype design; digital control hardware; discrete state variables; state transition matrix; Liapunov stability; state feedback control.
Prerequisites: CHE 386 or ECE 212 or ME 343

ECE 389 (CHE 389, ME 389) Control Systems Laboratory 2 Credits
Experiments on a variety of mechanical, electrical and chemical dynamic control systems. Exposure to state of the art control instrumentation: sensors, transmitters, control valves, analog and digital controllers. Emphasis on comparison of theoretical computer simulation predictions with actual experimental data. Lab teams will be interdisciplinary.
Prerequisites: CHE 386 or ECE 212 or ME 343

ECE 392 Independent Study 1-3 Credits
An intensive study, with report of a topic in electrical and computer engineering which is not treated in other courses. Consent of instructor required.
Repeat Status: Course may be repeated.
ECE 401 (CSE 401) Advanced Computer Architecture 3 Credits
Design, analysis and performance of computer architectures; high-speed memory systems; cache design and analysis; modeling cache performance; principle of pipeline processing, performance of pipelined computers; scheduling and control of a pipeline; classification of parallel architectures; systolic and data flow architectures; multiprocessor performance; multiprocessor interconnections and cache coherence. 
Prerequisites: ECE 201

ECE 402 Advanced Electromagnetics 3 Credits
Prerequisites: (ECE 202 and ECE 203)

ECE 404 (CSE 404) Computer Networks 3 Credits
Study of architecture and protocols of computer networks. The ISO model; network topology; data-communication principles, including circuit switching, packet switching and error control techniques; sliding window protocols, protocol analysis and verification; routing and flow control; local area networks; network interconnection; topics in security and privacy.

ECE 411 Information Theory 3 Credits
Introduction to information theory. Topics covered include: development of information measures for discrete and continuous spaces study of discrete-stochastic information courses, derivation of noiseless coding theorems, investigation of discrete and continuous memoryless channels, development of noisy channel coding theorems.

ECE 413 Power Electronics 3 Credits
Introduction to power semiconductor devices, circuits, and applications. Diodes, thyristors, bipolar and MOS transistors, IGBTs, and other emerging types, and their use in typical power conversion circuits such as rectifiers, buck and boost converters, and dc-dc, dc-ac, and ac-ac inverters and converters. Application examples in motor drives, power supplies and HVDC transmission. This course, a version of ECE 313 for graduate students, requires research projects and advanced assignments. Credit will not be given for both ECE 313 and ECE 413. 
Prerequisites: ECE 081

ECE 414 Machine Learning and Statistical Decision Making 3 Credits
Overview of Machine Learning. Overview of decision making based on data. Overview of discovery of unknown quantities based on data. Description of the popular algorithms for decision making and for discovery of unknown quantities based on data. Performance analysis via comparison to optimum methods and bounds on optimum performance for assumed models. The emphasis is on statistical analysis of various algorithms using well established statistical theory. Exposure to probability and random process theory is assumed. 
Prerequisites: ECE 108 and MATH 231 or MATH 309

ECE 416 VLSI Signal Processing 3 Credits
The fundamentals of performance-driven VLSI systems for signal processing. Analysis of signal processing algorithms and architectures in terms of VLSI implementation. VLSI design methodology. Includes a design project which requires use of a set of tools installed on SUN workstations for behavioral simulation, structural simulation, circuit simulation, layout, functional simulation, timing and critical path analysis, functional testing, and performance measurement.

ECE 420 Advanced Circuits and Systems 3 Credits
Review of the fundamentals of Circuits and Systems theory, including the time and frequency domain response of linear time-invariant circuits. Equation formulation for general lumped circuits, including node voltage and loop current analysis. Basic graph theoretic properties of circuits including Tellegen’s Theorem. Discussion of passivity and reciprocity including multiport network properties. State space formulation and solution of general circuits (and systems). Modern filter concepts, including synthesis techniques for active filters and externally linear filters, such as Log Domain filters. Techniques for the analysis of weakly nonlinear systems, as time permits. Must have graduate standing. 
Prerequisites: ECE 125

ECE 421 Introduction to Power Systems 3 Credits
Power systems engineering relating to generation, transmission, distribution and utilization of electric power. This course introduces basic yet critical concepts of large-scale power systems. Topics include power system modeling, power flow, symmetrical faults, unsymmetrical faults, transient stability, and optimal power flow. This course, a version of ECE 321 for graduate students, requires research projects and advanced assignments. ECE 321 and ECE 421 may not both be taken for credit. 
Prerequisites: ECE 123

ECE 422 Introduction to Photovoltaic Energy Systems 3 Credits
Basic principles for design, installation, and operation of photovoltaic energy systems. Properties of sunlight and physics of photovoltaic cells. Photovoltaic cells, modules, and arrays. Inverters and other system components. Site assessment. Design and installation of grid-connected and stand-alone PV systems. Systems operation. Maintenance, performance, and economic analysis. Relevant design and simulation tools are introduced. This course, a version of ECE 321 for graduate students, requires research projects and advanced assignments. Credit not given for both ECE322 and ECE422. 
Prerequisites: ECE 081

ECE 425 Semiconductor Lasers I 3 Credits
Review of elementary solid-state physics. Relationships between Fermi energy and carrier density and leakage. Introduction to optical waveguiding in simple doubleheterostructures. Density of optical modes, Blackbody radiation and the spontaneous emission factor. Modal gain, modal loss, and confinement factors. Einstein’s approach to gain and spontaneous emission. Periodic structures and the transmission matrix. Ingredients. A phenomenological approach to diode lasers. Mirrors and resonators for diode lasers. Gain and current relations. This course, a version of ECE 325 for graduate students, requires research projects and advanced assignments. Credit will not be given for both ECE 325 and ECE 425. 
Prerequisites: ECE 203

ECE 426 Semiconductor Lasers II 3 Credits
Continuation of Semiconductor Lasers I. Topics covered include: Gain and current relations; dynamic effects; perturbation and coupled-mode theory; dielectric waveguides; and photonics integrated circuits. This course, a version of ECE326 for graduate students, requires research projects and advanced assignments. Credit will not be given for both ECE 326 and ECE 426. 
Prerequisites: ECE 203

ECE 432 Spread Spectrum and CDMA 3 Credits
Fading and dispersive channel model, direct sequence spread spectrum, frequency hopping spread spectrum, DS-CDMA, FH-CDMA, spread sequences and their properties, multi-user detection, PN code acquisition, wireless communication systems, industrial standards (IS-95, WCDMA, CDMA2000).

ECE 433 (CHE 433, ME 433) Linear Systems and Control 3 Credits
This course covers the following topics in linear systems and control theory: review of fundamental concepts in linear algebra, state-space representation of linear systems, linearization, time-variance and linearity properties of systems, impulse response, transfer functions and their state-space representations, solution to LTI and LTV state equations, Jordan form, Lyapunov stability, input-output stability, controllability, stabilizability, observability, detectability, Canonical forms, minimal realizations, introduction to optimal control theory, Linear Quadratic Regulator (LQR), Algebraic Riccati Equation (ARE), frequency domain properties of LQR controllers. 
Prerequisites: ME 343 or ECE 212 or CHE 386

ECE 434 (CHE 434, ME 434) Multivariable Process Control 3 Credits
A state-of-the-art review of multivariable methods of interest to process control applications. Design techniques examined include loop interaction analysis, frequency domain methods (Inverse Nyquist Array, Characteristic Loci and Singular Value Decomposition) feed forward control, internal model control and dynamic matrix control. Special emphasis is placed on the interaction of process design and process control. Most of the above methods are used to compare the relative performance of intensive and extensive variable control structures. 
Prerequisites: CHE 433 or ME 433 or ECE 433
ECE 435 Error-Correcting Codes 3 Credits
Error-correcting codes for digital computer and communication systems. Review of modern algebra concentrating on groups and finite fields. Structure and properties of linear and cyclic codes for random or burst error correction covering Hamming, Golay, Reed-Muller, BCH and Reed-Solomon codes. Decoding algorithms and implementation of decoders.

ECE 436 (CHE 436, ME 436) Systems Identification 3 Credits
The determination of model parameters from time-history and frequency response data by graphical, deterministic and stochastic methods. Examples and exercises taken from process industries, communications and aerospace testing. Regression, quasilinearization and invariant-embedding techniques for nonlinear system parameter identification included.
Prerequisites: ECE 433 or ME 433 or ECE 435

ECE 437 (CHE 437, ME 437) Stochastic Control 3 Credits
Prerequisites: ME 433 or CHE 433 or ECE 433

ECE 438 Quantum Electronics 3 Credits
Electromagnetic fields and their quantization. propagation of optical beams in homogeneous and lens-like media. Modulation of optical radiation. Coherent interactions of radiation fields and atomic systems. Introduction to nonlinear optics-second-harmonic generation. Parametric amplification, oscillation, and fluorescence. Third-order optical nonlinearities. This course, a version of ECE 338 for graduate students, requires research projects and advanced assignments. Credit will not be given for both ECE 338 and ECE 438.

ECE 441 Fundamentals of Wireless Communications 3 Credits
Characterization of mobile radio channels. Wireless information transmission: modulation/demodulation, equalization, diversity combining, coding/decoding, multiple access methods. Overview of cellular concepts and wireless networking. This course, a version of ECE 341 for graduate students, requires research projects and advanced assignments. Credit will not be given for both ECE 341 and ECE 441.
Prerequisites: ECE 342 or ECE 342

ECE 443 RF Power Amplifiers for Wireless Communications 3 Credits
Review of linear power amplifier design. Discussion of major nonlinear effects, such as high-efficiency amplifiers modes, matching network design for reduced conduction angle, overdrive and limiting effects, and switching mode amplifiers. Discussion of other nonlinear effects, efficiency enhancement and linearization techniques. Companion course to ECE 463.

ECE 448 Lightwave Technology 3 Credits
Overview of optical fiber communications. Optical fibers, structures and waveguiding fundamentals. Signal degradation in fibers arising from attenuation, intramodal and intermodal dispersion. Optical sources, semiconductor lasers and LEDs. Rate equations and frequency characteristics of a semiconductor laser. Coupling efficiency of laser diodes and LEDs to single-mode and multimode fibers. PIN and avalanche photodetectors. Optical receiver design. Transmission link analysis. The course is an extension of ECE 348 for graduate students and it will include research projects and advanced assignments.

ECE 450 Special Topics 1-3 Credits
Selected topics in electrical and computer engineering not covered in other courses.
Repeat Status: Course may be repeated.

ECE 451 Physics of Semiconductor Devices 3 Credits
Crystal structure and space lattices, crystal binding, lattice waves and vibrations, electrons and atoms in crystal lattices. Quantum mechanics and energy band theory, carrier statistics, Boltzmann transport theory, interaction of carriers with scattering centers, electronic and thermal conduction. Magnetic effects. Generation and recombination theory. Application to p-n junctions.
Repeat Status: Course may be repeated.
Prerequisites: ECE 126

ECE 454 Turbo Codes and Iterative Decoding 3 Credits

ECE 455 Theory of Metal Semiconductor and Heterojunction Transistors 3 Credits

ECE 460 Engineering Project 3-6 Credits
Project work in an area of student and faculty interest. Selection and direction of the project may involve interaction with industry. Consent of department required.

ECE 463 Design of Microwave Solid State Circuits 3 Credits
Equivalent circuit modeling and characterization of microwave semiconductor devices, principles of impedance matching, noise properties and circuit interaction, introduction to the design of high power and non-linear circuits.

ECE 464 Introduction to Cryptography and Network Security 3 Credits
Introduction to cryptography, classical cipher systems, cryptanalysis, perfect secrecy and the one time pad, DES and AES, public key cryptography covering systems based on discrete logarithms, the RSA and the knapsack systems, and various applications of cryptography. This graduate version of ECE 364 requires additional work. May not be taken with ECE 364 for credit. Must have graduate student status.

ECE 465 VLSI Implementation of Error Control Coding 3 Credits
Error control coding, finite field arithmetic, encoding and decoding of BCH and Reed-Solomon codes, efficient iterative decoders for convolutional and Turbo codes, message passing and high performance decoders for low-density parity-check codes.
Prerequisites: ECE 435

ECE 466 (BIOE 466) 3 Credits
Neural system interfaces for scientific and health applications. Basic properties of neurons, signal detection and stimulation, instrumentation and microfabricated electrode arrays. Fundamentals of peripheral and central neural signals and EEG, and applications such as neural prostheses, implants and brain-computer interfaces. Closed to students who have taken BIOE 366, ECE 366, or BIOE 466. Students enrolled in the course at the 400-level must complete additional advanced assignments, as defined by the course instructor.

ECE 468 (BIOE 468) Introduction to Biophotonics and Optical Biomedical Imaging 3 Credits
Optical principles, techniques, and instruments used in biomedical research and clinical medicine. Fundamental concepts of optical imaging and spectroscopy systems, and details of light-tissue interaction. Commercial devices and instruments, as well as novel optical imaging technologies in development. Closed to students who have taken BIOE 468, ECE 368, or ECE 468. Students enrolled in the course at the 400-level must complete additional advanced assignments, as defined by the course instructor.

ECE 471 Optical Information Processing 3 Credits
Introduction to optical information processing and applications. Interference and diffraction of optical waves. 2D optical matched filters that use lenses for Fourier transforms. Methods and devices for modulating light beams for information processing, communications, and optical computing. Construction and application of holograms for optical memory and interconnections. The course is an extension of ECE 371 for graduate students and it will include research projects and advanced assignments.
Prerequisites: (ECE 108)
The basic 30 credit hour course sequence consists of:

**ECE 472 Optical Networks 3 Credits**  
Study the design of optical fiber local, metropolitan, and wide area networks. Topics include: passive and active photonic components for optical switching, tuning, modulation and amplification; optical interconnection switches and buffering; hardware and software architectures for packet switching and wavelength division multiaccess systems. This class is supported with a laboratory. The course is an extension of ECE 372 for graduate students and it will include research projects and advanced assignments.  
**Prerequisites:** ECE 081

**ECE 485 Heterojunction Materials and Devices 3 Credits**  
Material properties of compound semiconductor heterojunctions, quantum wells and superlattices. Strained layer epitaxy and band-gap engineering. Theory and performance of novel devices such as quantum well lasers, resonant tunneling diodes, high electron mobility transistors, and heterojunction bipolar transistors. Complementary to ECE 452.  
**Prerequisites:** ECE 451

**ECE 490 Thesis 1-6 Credits**

**ECE 491 Research Seminar 1-3 Credits**  
Regular meetings focused on specific topics related to the research interests of department faculty. Current research will be discussed. Students may be required to present and review relevant publications. Consent of instructor required.  
**Repeat Status:** Course may be repeated.

**ECE 492 Independent Study 1-3 Credits**  
An intensive study, with report, of a topic in electrical and computer engineering which is not treated in other courses. Consent of instructor required.  
**Repeat Status:** Course may be repeated.

**ECE 493 Solid-State Electronics Seminar 3 Credits**  
Discussion of current topics in solid-state electronics. Topics selected depend upon the interests of the staff and students and are allied to the research programs of the Sherman Fairchild Laboratory for Solid State Studies. Student participation via presentation of current research papers and experimental work. Consent of instructor required.  
**Repeat Status:** Course may be repeated.

**ECE 499 Dissertation 1-15 Credits**  
**Repeat Status:** Course may be repeated.

**Energy Systems Engineering**

**MASTER OF ENGINEERING IN ENERGY SYSTEMS ENGINEERING**

For students with B.S. degrees in engineering, physics, computer science, mathematics, and related fields, Lehigh's 10-month, 30-credit professional Master's program in energy systems engineering helps students develop into organizational and technical leaders in the energy and power industries. Learning takes place in an environment where potential employers actively guide curricular development and student research endeavors. Graduates of this program emerge with the skills and confidence to tackle the grand challenges facing the global energy infrastructure and its associated effect on the environment.

The hallmark of the program is student immersion in hands-on, industry-driven projects. Each student will apply advanced technical knowledge and skills and work collaboratively with a team of faculty, fellow students, and representatives from sponsor firms to complete a project of impact and significance in the field — a real project as conceptualized by the project's sponsoring researcher or industry concern. The development of targeted research projects serves as an entry point into the field for talented young innovators, and a source for firms to explore new skill sets and solutions required for success with emerging technologies and approaches.

The basic 30 credit hour course sequence consists of:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESE Core Courses</td>
<td>12</td>
</tr>
<tr>
<td>ESE Technical Electives</td>
<td>12-15</td>
</tr>
<tr>
<td>ESE Industry Project</td>
<td>3-6</td>
</tr>
<tr>
<td><strong>Total credits</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

Students typically begin this 10 month program in Summer Session II and will graduate spring of the following year with a Master of Engineering degree in energy systems engineering.

Further information can be obtained from: www.lehigh.edu/esei  
Program Director  
Energy Systems Engineering  
P.C. Rossin College of Engineering & Applied Science (610) 758-3529

Program Coordinator  
Energy Systems Engineering  
P.C. Rossin College of Engineering and Applied Science (610) 758-3650

**Recommended sequence of courses in the ESE M.Eng. program**

**Summer Session II (Late June/August)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ESE 403 Energy and the Environment</td>
<td>3</td>
</tr>
<tr>
<td>ESE 405 Energy Systems Project Management</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Credits: 6**

**Fall Semester**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESE 401 Energy Generation</td>
<td>3</td>
</tr>
<tr>
<td>ESE 460 Energy Systems Engineering Project</td>
<td>3</td>
</tr>
<tr>
<td><strong>Technical</strong></td>
<td><strong>6</strong></td>
</tr>
</tbody>
</table>

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<tr>
<th>Electives (2)</th>
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</thead>
</table>

**Total Credits: 12**

**Spring Semester**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ESE 402 Transmission and Distribution</td>
<td>3</td>
</tr>
<tr>
<td>ESE 460 Energy Systems Engineering Project *</td>
<td>3</td>
</tr>
<tr>
<td><strong>Technical</strong></td>
<td><strong>6</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electives (2)*</th>
</tr>
</thead>
</table>

**Total Credits: 12**

*Student may choose to take a third technical elective instead of ESE 460 in the Spring semester with the approval of the program Director.

Students acquire a level of specialized knowledge and experience through the completion of four to five technical electives courses. The electives should reflect the student's career interest. Below is the list of departments from which the technical electives are drawn from. The full list of technical electives for each department listed below is available online at: www.lehigh.edu/esei/electives. Other electives may be considered with the approval of the program Director.

- Two (2) electives must be 400 level courses and
- Three (3) electives must be in the P.C. Rossin College of Engineering and Applied Science.

**Technical Elective Department List:**

**Engineering**

- Chemical Engineering
- Civil & Environmental Engineering
- Computer Science & Engineering
• Electrical & Computer Engineering
• Industrial & Systems Engineering
• Materials Science & Engineering
• Mechanical Engineering & Mechanics

**Business and Science**
• Chemistry
• Earth & Environmental Science
• Economics
• Environmental Studies
• International Relations
• Physics
• Political Science

### Courses

**ESE 401 Energy Generation 3 Credits**
This course provides an overview of the different methods of generating electricity, such as turbine driven electrochemical generators, fuel cells, photovoltaics, and thermoelectric devices. Topics include the combustion of fossil fuels (coal, natural gas, and oil), nuclear fission and fusion, and renewable resources (solar, wind, hydro, tidal, and geothermal sources). Sustainability, energy efficiency issues, as well as public interest and policy drivers are also addressed.

**ESE 402 Transmission & Distribution: Smart Grid 3 Credits**
This course provides an overview of modern power transmission and distribution systems. Topics include transformer technology, transmission grids, load management, distribution optimization, power supply reliability, and infrastructure systems. Security and deregulation issues are also addressed.

**ESE 403 Energy And The Environment 3 Credits**
This course provides an overview of the direct and indirect impact of energy generation and transmission technologies on the environment. Topics include global climate change, clean energy technologies, energy conservation, air pollution, water resources, and nuclear waste issues.

**ESE 405 Energy Systems Project Management 3 Credits**
This course introduces students to the basics of project management in the field of energy systems, which includes the broad spectrum of empirical, theoretical and policy issues of managing the electric power grid, its generation facilities and equipment. This focuses on the key elements of case studies in engineering that focus on the effective project management of tomorrow's intelligent energy system.

**ESE 460 Energy Systems Engineering Project 3-6 Credits**
A collaborative and intensive study in an area of energy systems engineering, with an emphasis on direct industrial applications. A written report plus a poster presentation or oral presentation is required. Students typically begin this 10 month program in Summer Session II and will graduate spring of the following year with a Master of Engineering degree in energy systems engineering.

### Engineering

See additional information on the P.C. Rossin College of Engineering and Applied Science (p. 357).

**ENGINEERING MINOR**
See additional information on the Engineering Minor under the heading of the P.C. Rossin College of Engineering and Applied Science (p. 357).

**Core Prerequisites to begin the program**

<table>
<thead>
<tr>
<th>Course</th>
<th>Prerequisite</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 051</td>
<td>Survey of Calculus I (or equivalent)</td>
<td>1</td>
</tr>
<tr>
<td>PHY 005</td>
<td>Concepts In Physics (or equivalent)</td>
<td>1</td>
</tr>
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</table>

**Required Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC 001</td>
<td>Macro and Micro View of Engineering</td>
<td>3</td>
</tr>
<tr>
<td>EMC 002</td>
<td>Engineering Practicum</td>
<td>3</td>
</tr>
</tbody>
</table>

**Electives**

Select three of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC 105</td>
<td>Engineering Structures and Motion</td>
<td>3</td>
</tr>
<tr>
<td>EMC 110</td>
<td>Energy Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

**Group A - Engineering Fundamentals**

<table>
<thead>
<tr>
<th>Course</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC 115</td>
<td>Engineering Materials and Electronics</td>
<td>3</td>
</tr>
<tr>
<td>EMC 120</td>
<td>Systems Engineering</td>
<td>3</td>
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</tbody>
</table>

**Group B - Integrated Engineering**

<table>
<thead>
<tr>
<th>Course</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>EMC/CSE 042</td>
<td>Game Design</td>
<td>3</td>
</tr>
<tr>
<td>EMC 150</td>
<td>Information and Knowledge Engineering</td>
<td>3</td>
</tr>
<tr>
<td>EMC 155</td>
<td>Enterprise Engineering</td>
<td>3</td>
</tr>
<tr>
<td>EMC 156</td>
<td>Embedded Systems</td>
<td>3</td>
</tr>
<tr>
<td>EMC 160</td>
<td>Computer Aided Engineering and Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>EMC/ISE 168</td>
<td>Production Analysis</td>
<td>3</td>
</tr>
<tr>
<td>EMC 170</td>
<td>Software Engineering and Collaborative Environments</td>
<td>3</td>
</tr>
<tr>
<td>EMC/CHE/CEE/ES 171</td>
<td>Fund of Environmental Technology</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total Credits** 15

1. May be taken concurrently with EMC 001 and EMC 002.
2. Three electives are required and must include one from the Engineering Fundamentals course group and one from the Integrated Engineering course group. The student is free to choose the third elective from either group.

Number of credits to fulfill minor is 15 credits.

**Note:** The Minor in Engineering is not open to RCEAS students.

### Engineering Minor Course Courses

**EMC 001 Macro and Micro View of Engineering 3 Credits**
A course designed to be exciting and stimulate a student’s further interest in the engineering minor. Hands-on experience with engineering problem solving, modeling, simulation, and analysis tools. Macro view of what engineering is and what engineers do. Interaction with practicing engineers; visits to local engineering facilities.

**EMC 002 Engineering Practicum 3 Credits**
Techniques and processes used in the creation of engineered products. Exposure to engineering tasks and processes in a hands-on laboratory; mechanical and electronic manufacturing and fabrication techniques. Disassembly and reassembly of common engineered products to assess how they work and are manufactured.

**EMC 042 (CSE 042) Game Design 3 Credits**
From the early text-based, one-player computer games to the modern 3D games with thousands of gamers sharing the same virtual gaming world simultaneously, computer games have gone through a remarkable evolution. Despite this evolution, principles of computer game design are not well understood. In this course we will study the broad issue of game design, particularly tailored towards video games. We will present an experimental model for game design and analyze various modern computer games from the perspective of this model.

**EMC 105 Engineering Structures and Motion 3 Credits**
Practical limits imposed on stationary or moving structures; why exceeding these limits can lead to failure. Basic principles governing both stationary structures; e.g. buildings and bridges, and things that move, e.g. cars and satellites, and how these principles apply in engineering practice. How a stationary structure effectively supports both its own weight and the weight of its users and why a structure will undergo deflections and deformations during use. How forces and energy are associated with a moving structure and how these affect the motion of the structure.

**EMC 110 Energy Engineering 3 Credits**
The amount of energy used by a modern society is quite staggering, and a clear understanding of energy processes and constraints is essential knowledge for every citizen. The basics of energy, its measurement, principles governing its use and conversion, methods of production, and the associated consequences on the environment. Fossil, nuclear, and renewable, energy sources. Energy utilization developed in a simple form and employed to examine the use of energy in large and small engineering systems and products, from power plants to air conditioners.
EMC 115 Engineering Materials and Electronics 3 Credits
“Materials” are the “stuff” from which we build TV’s, cell phones, cars, skyscrapers, etc., and affect design, performance, costs, and environmental impacts. How electronics, communications, and structures depend on advances in materials engineering: materials behavior, modeling and simulation of materials properties and performance; methods and databases for materials selection; and engineering processes to control material composition and structure.

EMC 120 Systems Engineering 3 Credits
Systems approach to problem solving in fields such as environmental planning, large-scale infrastructure systems, manufacturing, telecommunication, and delivery of services. Systems analysis concepts and their relation to the determination of preferred plans and designs of complex, large-scale engineering systems. Performance and cost in project engineering decisions that balance resource investments across the major stages of life of an engineering system. Development of functional requirements and satisfactory designs.

EMC 150 Information and Knowledge Engineering 3 Credits
How computers manage information for making decisions automatically or for advising decision makers. Characterization of database systems, of web technologies, of multimedia, and of the relationships among them. Representations of knowledge and the use of artificial intelligence techniques. Automated help-desk systems and computer generation of project plans.

EMC 155 Enterprise Engineering 3 Credits
The key elements of modeling and engineering the corporation. Enterprise engineering, decision analysis, application of quantitative methods to facilities planning, engineering economy, production planning and control, forecasting, material requirements planning, and agile business practices.
Prerequisites: EMC 001 or EMC 002
Can be taken Concurrently: EMC 001, EMC 002

EMC 156 Embedded Systems 3 Credits
Prerequisites: EMC 001 or EMC 002
Can be taken Concurrently: EMC 001, EMC 002

EMC 160 Computer Aided Engineering and Control Systems 3 Credits
Use of computer-based technologies to design and manufacture products. The design cycle to create product concepts. Analysis of product design. Specifications for the control of manufacturing processes. How control systems are used in creating agile manufacturing environments: discrete and analog signals, analog to digital conversion, and application case studies. Hands-on application(s) and sample exercises from real world examples.

EMC 168 (ISE 168) Production Analysis 3 Credits
A course for students not majoring in industrial engineering. Engineering economy; application of quantitative methods to facilities analysis and planning, operations planning and control, work measurement, and scheduling.

EMC 170 Software Engineering and Collaborative Environments 3 Credits
Discover why building large software systems is very different from using large databases, or designing products such as automobiles with CAD, etc. Design and implementation of a large team project involving complex data management in a collaborative environment. Learn why and how collaborative environments are becoming essential to modern engineering projects and require the tools and techniques of software engineering to succeed.
Prerequisites: EMC 001 or EMC 002
Can be taken Concurrently: EMC 001, EMC 002

EMC 171 (CEE 171, CHE 171, ES 171) Fund of Environmental Technology 4 Credits

EMC 174 Process Engineering 3 Credits
Semiconductor process engineering, including technology to process raw silicon wafer to electronics integrated circuits (ICs). Crystal growth, thin film deposition, photolithography, doping technology.
Prerequisites: EMC 001 or EMC 002
Can be taken Concurrently: EMC 001, EMC 002

EMC 252 (CSE 252, STS 252) Computers, the Internet, and Society 3 Credits
An interactive exploration of the current and future role of computers, the Internet, and related technologies in changing the standard of living, work environments, society and its ethical values. Privacy, security, depersonalization, responsibility, and professional ethics; the role of computer and Internet technologies in changing education, business modalities, collaboration mechanisms, and everyday life.
Attribute/Distribution: SS

EMC 300 Apprentice Teaching 1-3 Credits
Repeat Status: Course may be repeated.

Engineering Courses
ENGR 005 Introduction to Engineering Practice 2 Credits
First year practical engineering experience; introduction to concepts, methods and principles of engineering practice. Problem solving, design, project planning, communication, teamwork, ethics and professionalism; innovative solution development and implementation. Introduction to various engineering disciplines and degree programs. Mandatory for and open only for first year RCEAS students.

ENGR 010 Applied Engineering Computer Methods 2 Credits
Introduction to programming for engineering tasks. Use of Matlab to program and solve engineering problems. Interfacing sensors and actuators to a microcontroller board and programming to interact with the world. Computer lab setting. Final project controls engineering equipment.
Attribute/Distribution: ND

ENGR 050 Directed Study 1-3 Credits
Engineering project work either as an individual or team member. Projects directed by faculty within the Rossin College of Engineering and Applied Science with possible interaction from outside consultants, community and industry leaders. Written report required. RCEAS permission required.
Repeat Status: Course may be repeated.

ENGR 130 Engineering Communications 1 Credit
Experience and theory in oral and written communications preparing students for their first Co-Op work assignments. Required of all Engineering Co-Op students.
Prerequisites: ENGR 200 or ENGR 198
Can be taken Concurrently: ENGR 200, ENGR 198

ENGR 160 Engineering Internship 1-3 Credits
Offers students who have attained at least Jr2 standing an opportunity to complement coursework with a work experience. Detailed rules can be obtained from the Associate Dean of Engineering. Report required. P/F grading.

ENGR 200 Engineering Co-op 3 Credits
Supervised cooperative work assignment to obtain practical experience. Must have acceptance into the program. P/F grading.
Repeat Status: Course may be repeated.
ENGR 300 Apprentice Teaching 1-3 Credits
ENGR 400 Engineering Co-op for Graduate Students 1-3 Credits
Supervised cooperative work assignment to obtain practical experience in field of study. Requires consent of department chairperson. When on a cooperative assignment, the student must register for this course to maintain continuous student status. Limit to at most three credits per registration period. No more than six credits may be applied towards a master's program and no more than nine credits may be used throughout a student's entire graduate study at Lehigh.
Repeat Status: Course may be repeated.
ENGR 401 Teaching/Presentation Skills 1 Credit
Development of teaching and presentation skills for scientific professionals. Presentation effectiveness, teaching/presentation methodologies, classroom management, course development/content preparation, lecture/presentation development and lecture/presentation delivery. Individualized undergraduate course specific modules selected by student. Enrollment limited to Rossin Doctoral Fellows.
ENGR 402 Preparing for the Professoriate 1 Credit
Overview of the job search, research program development and service skills for graduate students entering academic careers. Transition from graduate student to faculty responsibilities, the post-doctoral experience, time management, CV/resume preparation, faculty search process, tenure and promotion, research leadership and program development, research proposal preparation and research sponsorship. Enrollment limited to Rossin Doctoral Fellows.
ENGR 430 Technical Writing for Engineering and the Sciences 1 Credit
Formal composition and technical writing skills for advanced non-native English writers in Engineering and the Sciences. Instructor and peer review of writing, self-editing strategies, how to incorporate technical vocabulary and formulas, advanced sentence structure, and appropriate citation of research. Field-specific readings, which students must compile, critique, and model in their own writing. Designed for international graduate students who are writing or preparing to write publishable quality articles, theses, or dissertations.
ENGR 452 (BIOE 452, CHE 452, ME 452) Mathematical Methods In Engineering 1 Credit
Analytical techniques relevant to the engineering sciences are described. Vector spaces; eigenvalues; eigenvectors. Linear ordinary differential equations; diagonalizable and non-diagonalizable systems. Inhomogeneous linear systems; variation of parameters. Non-linear systems; stability; phase plane. Series solutions of linear ordinary differential equations; special functions. Laplace and Fourier transforms; application to partial differential equations and integral equations. Sturm-Liouville theory. Finite Fourier transforms; planar, cylindrical, and spherical geometries.
ENGR 490 Thesis (Moc) 1 Credit
ENGR 499 Dissertation (Moc) 1 Credit
Healthcare Systems Engineering
The Masters of Engineering in Healthcare Systems Engineering (HSE) program produces graduates with strong fundamental skills in industrial and systems engineering and a strong background in healthcare delivery systems and processes. Graduates will be ideally positioned for skilled professional management roles aimed at improving quality, streamlining processes and improving efficiency in healthcare systems. This concentrated degree program is designed to prepare graduate students for engineering and management careers in firms engaged in delivering healthcare and health related products and services. The need for professionals in this area is strong and growing due to the aging of the population and a national crisis of rapidly increasing healthcare costs. Graduates will be well positioned for employment in the following types of organizations
  • Healthcare delivery organizations such as hospitals and clinics
  • Healthcare finance organizations such as insurance companies and HMOs
  • Healthcare product suppliers such as pharmaceutical companies and manufacturers of Healthcare products
  • Management and benefits consulting firms
  • Policy organizations at various levels of government and trade associations
Students seeking to enroll to the program should have a bachelor’s degree in engineering, mathematics, science, or business. Students should be quantitatively oriented and have completed a calculus based probability and statistics course at the level of ISE 328. A candidate lacking certain background may be required to take background courses.
The program consists of 30 credit hours of course work including a 3-credit HSE capstone project. Full-time in-residence students can complete the program in a fall-spring-summer semester sequence as shown in the table below.

Recommended sequence of courses in the HSE M.Eng. program

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall</th>
<th>CR</th>
<th>Spring</th>
<th>CR</th>
<th>Summer</th>
<th>CR</th>
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<tbody>
<tr>
<td>ISE 470</td>
<td>3</td>
<td></td>
<td>ISE 426</td>
<td>3</td>
<td>ISE 474</td>
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</tr>
<tr>
<td>ISE 471</td>
<td>3</td>
<td></td>
<td>ISE 473</td>
<td>3</td>
<td>Technical Elective</td>
<td>3</td>
</tr>
<tr>
<td>ISE 410</td>
<td>3</td>
<td></td>
<td>ISE 472</td>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>Technical Elective</td>
<td>3</td>
<td>ISE 404 or 339</td>
<td>3</td>
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</tbody>
</table>

Total Credits: 30

Additional Elective Courses
ISE 475 Healthcare Systems Project 1-3 Credits
Intensive study of an area of healthcare systems engineering with emphasis upon design and application. Written report is required.

ISE 328 and ISE 357 are designed to be remedial courses for students in the program. Although a grade earned in those course will appear in the student's transcript, they will not count toward the 30 credit program requirement. Elective courses come from various sectors of systems and engineering as well as accounting, business, and economics. The pool of elective courses is listed below.

  • Accounting Information Systems
  • Financial Accounting
  • Cost Accounting
  • Project Management
  • Human Resource Management
  • Strategic Supply Management
  • Technology, Operations, and Competitive Strategy
  • Managerial Economics
  • Econometrics
  • Health Economics
  • Management of Information Systems
  • Quality Control
  • Data Communications Systems
  • Systems Engineering Design
  • Queuing Systems
  • Advanced Database Analysis and Design
  • Advanced Data Communications Systems
  • Analysis and Design
  • Discrete Event Dynamic Systems
  • Financial Optimization
  • Game Theory
  • Healthcare Systems Project

The HSE Program Director must approve all course work including technical electives. No more than 9 credit hours may be taken from the College of Business.

Additional information about the program may be obtained by calling the HSE Program at (610) 758-5867 or from the HSE program website: http://lehigh.edu/hse
Mission Statement

To pursue excellence and national prominence in the areas of manufacturing, operations research, information technology and related fields of industrial and systems engineering through innovative teaching, distinguished research and scholarship, and active professional leadership. Building on its unique strength and national reputation in undergraduate education and industrial research, the department strives for leadership in educational innovation, multidisciplinary research, and industrial partnership. Our ultimate mission is to produce leaders who have learned to think critically and analytically, have the skills and techniques to comprehend and create new knowledge, and are willing to serve and inspire others.

Physical Facilities

The industrial and systems engineering department is located in the Harold S. Mohler Laboratory at 200 West Packer Avenue at the northwest corner of the Lehigh University Asa Packer campus. The Mohler Lab building contains the classrooms, laboratories, and faculty offices of the department. Labs in the Mohler Laboratory building include:

- Computational Optimization Research @ Lehigh (COR@L) Lab. The COR@L lab consists of high performance computer workstations, each equipped with state-of-the-art commercial and noncommercial software for large-scale numerical optimization. COR@L is used for both research and instruction.
- Enterprise Systems Center Laboratories. The ESC Laboratories contain a variety of computer systems and software in support of agility in Computer Integrated Manufacturing (CIM) and in engineering logistics and distribution problem solving, including: Computer Aided Design (CAD) and Engineering (CAE), discrete event simulation, linear and nonlinear optimization, Finite Element Analysis (FEA), facilities design, process design, process control, and analytics software, such as the SAS software suite.
- Manufacturing Technology Laboratory (MTL). The MTL contains equipment for instruction and research in manufacturing processes, numerical control (NC), NC part programming, material handling and storage, industrial control systems, and metrology.
- Automation and Robotics Laboratory. This lab is located in the MTL, it contains a variety of industrial robots and other automated systems to provide students with hands-on experience in the planning and use of this kind of equipment.
- Work Systems Laboratory. This classroom/laboratory affords the opportunity for undergraduate students to analyze and plan human work activities for individual workstations and worker team situations. A full scale manual assembly line is available for study.
- ISE Computer Laboratories. Considerable use is made of university computer facilities in ISE coursework. ISE/computing center PC laboratories containing 38 and 16 PCs, respectively, are located in the Mohler Laboratory building.

Professors. Theodore K. Ralpis, PHD (Cornell University); Lawrence V Snyder, PHD (Northwestern University); Robert H. Storer, PHD (Georgia Institute of Technology); Tamás Terfaky, PHD (Eotvos Lorand University); Luis Nunes Vicente, PHD (Rice University); Emory W. Zimmers, Jr., PHD (Lehigh University)

Associate Professors. Frank E. Curtis, PHD (Northwestern University); Alberto Lamadrid, PHD (Cornell University); Eugene Perevalov, PHD (University of Texas at Austin); Louis J. Plebani, Jr., PHD (Lehigh University); Daniel P. Robinson, PHD (University of California, San Diego); Gregory L. Tonkay, PHD (The Pennsylvania State University); George R. Wilson, PHD (The Pennsylvania State University); Luis Zuluaga, PHD (Carnegie Mellon University)

Assistant Professors. Boris Defourny, PHD (Universite de Liege); Martin Takac, PHD (University of Edinburgh); Xiu Yang, PHD (Brown University)

Emeriti. John W. Adams, PHD (University of North Carolina at Chapel Hill); Keith M Gardiner, PHD (Manchester College); Mikell P. Groover, PHD (Lehigh University); John C Wighton, PHD (Carnegie Mellon University); Szu-Yung D. Wu, PHD (The Pennsylvania State University)

B.S. in Industrial & Systems Engineering

Industrial & Systems Engineering (ISE) is concerned with the analysis, design, and implementation of integrated systems of people, materials, information, and equipment to accomplish useful work.

Career Opportunities

ISE graduates are sought by nearly all industrial corporations as well as government agencies and other service institutions. Major employers of our graduates include management consulting firms, manufacturing companies, banks, hospitals, railroads, the postal service, and transportation/logistics services. A typical career path of an industrial and systems engineer is to start in an entry level engineering position or as a technical analyst and to progress through various management positions in the firm or institution. Significant numbers of industrial and systems engineers ultimately become chief executive officers, chief operating officers, and chief technology officers in their respective organizations.

Production Systems Career Opportunities

The discipline of industrial & systems engineering is applicable in nearly all industries, whether the industry involves manufacturing of a product or delivery of a service. Job functions performed by ISEs include: systems analysis, cost estimation, capital equipment selection, engineering economy, facilities planning, production planning and scheduling, inventory control, quality control, project management, operations management, engineering management, as well as methods analysis and work measurement. Manufacturing systems engineering (MSE) is a specialty field associated with industrial and systems engineering that emphasizes functions and technologies such as process planning, plant layout design, manufacturing resource planning, production management, product design, automation, robotics, flexible manufacturing systems, and computer integrated manufacturing.

Information Systems Career Opportunities

The Industrial & Systems Engineering program can also produce graduates who understand the complex facets of modern information systems, and the integration of these systems in industrial, service and financial organizations. The ISE student has an opportunity to focus on three important areas that are key to a successful information systems-oriented career. (1) Information Economics, (2) Quantitative Systems Analysis, and (3) Information Technology. These areas are coupled with general engineering and business background courses. Information economics studies the formulation, structure, and operational dynamics of information-centric systems in the context of industrial organizations, service sector economics, and financial institutions. Quantitative systems analysis studies operations research and computational tools for analyzing complex systems and their information components. Information technology and applications studies computer and communication technologies needed to design and implement information system applications. Topic areas include the applications of information technology in manufacturing and business environments, including electronic commerce, supply chain and enterprise information systems, manufacturing information systems, and financial enterprises.

ISE Curriculum

The ISE curriculum is designed to provide graduates with the skills and knowledge that employers expect of young industrial and systems engineers beginning their professional careers, and to instill the ability for lifetime learning. It includes the basic mathematical, physical, and social sciences, together with the principles and methods of engineering analysis and design that are specific to industrial and systems engineering. These principles and methods include probability and statistics, engineering economy, cost accounting, operations research,
in computer simulation, work methods and measurement, manufacturing processes, production and inventory control, and information technology.

In the junior year, an ISE student may elect to specialize more in production systems by choosing a course in modern manufacturing methods. Alternatively, a student may elect to specialize more in information systems by choosing a course in computer algorithm design. An ISE student must choose at least one of these courses, but may elect to choose both for a broader preparation for a career.

Specialized ISE electives in the senior year include: advanced optimization models, stochastic models, operations research, operations management, organization planning and control, statistical quality control, database design, web technologies, and data communications technologies. Electives related to manufacturing systems engineering include: industrial robotics, facilities planning and material handling, logistics and supply chain, and production engineering.

Program Educational Objectives

The set of key, over-arching objectives of the Industrial and Systems Engineering program are to prepare our students, within the first several years of the beginning of their careers, to
1. meet the expectations of employers of industrial and systems engineers,
2. pursue advanced study, if desired,
3. be active leaders in their profession and/or community.

Specifically, these general objectives can be met by graduates that
1. recognize and analyze problems, design innovative solutions, and lead their implementation
2. excel as industrial and systems engineering professionals who are able to operate effectively in a global, culturally diverse society,
3. communicate effectively using written, oral, and electronic media,
4. pursue life-long learning and professional growth as ethical and responsible members of society,
5. form, lead, and participate on multi-disciplinary teams that solve problems in engineering and business.

In each course in the Industrial & Systems Engineering program, a subset of the student outcomes, listed below, are pursued to prepare students to achieve the Industrial and Systems Engineering program's stated objectives. This list of student outcomes articulated by the Engineering Accreditation Commission of ABET, http://www.abet.org, have been adopted by the program and are as follows:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

ISE Major Requirements

The ISE degree requires a minimum of 130 credit hours.

See freshman year requirements on the First Year Courses for Engineering Degrees under the heading of the P.C. Rossin College of Engineering and Applied Science (p. 357). An HSS course is assumed to be taken in the freshman year in the following semester course plans.

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The following special opportunities are available to majors in industrial and systems engineering:

**Nontechnical Minor.** Students may choose to pursue a nontechnical minor in an area of the humanities, social sciences, business, or entrepreneurship. Students in the business minor can satisfy the ACCT 108 requirement by completing BUS 127.

**Technical Minor.** Technical minors such as engineering leadership, materials science, environmental engineering, and computer science are available through departments in the P. C. Rossin College of Engineering and Applied Science. Consult the specific department for more details.

**Graduate Courses.** Seniors in industrial and systems engineering can petition to take up to two graduate ISE courses (400-level) to satisfy two of their four 300-level elective ISE course requirements. The petitioning senior must have a good scholastic record (generally above a 3.0 GPA).

**Senior Thesis Option.** Students interested in continuing on to graduate school or performing research are encouraged to take the senior thesis option. In this option a student takes ISE 255 as a free elective to develop the thesis proposal. ISE 255 serves as a prerequisite to ISE 256 in which the thesis is written. ISE 256 may be used as an ISE technical elective.

**Technical Minor in Engineering Leadership**
The minor in engineering leadership provides students with the background and practice to become more effective leaders. The minor consists of 5 courses that explore different aspects of leadership. Additional details can be found on the Engineering Leadership Minor website (http://lehigh.edu/~inleader/).

**Technical Minor in Manufacturing Systems Engineering**
The minor in manufacturing systems engineering provides a concentration of courses in the manufacturing and production areas. This minor is not available to students majoring in industrial and systems engineering. It requires 16 credits.

**Graduate Programs**
Several programs leading to master's and doctoral degrees are offered by the Department of Industrial and Systems Engineering. Each program has core requirements. Core requirements can be satisfied by previous coursework upon petition of the ISE curriculum committee. All core course prerequisites must also be satisfied. Prerequisites may be satisfied by (1) previous course work, (2) completing the prerequisite course without graduate credit, or (3) passing the final examination of the prerequisite course with a grade of B or better.

A Ph.D. student is required to complete core requirements with grades of B or better before being formally admitted to Ph.D. candidacy.

Further information about graduate programs is contained in an ISE graduate brochure available from the department. In addition, documents are available from the department that describe the requirements of each graduate program, both at the ISE departmental office and on its web page.

**M.S. in Industrial and Systems Engineering**
The minimum program for the master of science degree in Industrial and Systems Engineering consists of 24 credit hours of approved coursework and completion of a satisfactory thesis. Courses in other departments for which the student has the prerequisites may be integrated into this program. Subject to advisor approval, up to nine credit hours of 300 and 400-level courses from other departments may be included in the Industrial and Systems Engineering masters program. The other department courses usually include other engineering disciplines, mathematics, computer science, and business and economics.

**M.Eng. in Industrial and Systems Engineering**
This program of study is for those students whose interests are toward engineering design rather than research. The program provides opportunity to gain greater breadth of field through 30 credit hours of coursework (which can include a 3-credit-hour project).

**M.S. in Management Science and Engineering**
See separate catalog listing under Management Science and Engineering (p. 417).

**M.Eng. in Management Science and Engineering**
See separate catalog listing under Management Science and Engineering (p. 417).

**M.Eng. in Healthcare Systems Engineering**
This concentrated degree program is designed to prepare graduate students for engineering and management careers in firms engaged in delivering healthcare and health related products and services. See separate catalog listing under Healthcare Systems Engineering (p. 409).

**M.S. in Analytical Finance**
The Masters in Analytical Finance program combines key concepts in financial theory, mathematical finance and engineering decision making to produce professionals instrumental in creating innovative solutions to real financial issues. See separate catalog listing under Interdisciplinary Graduate Study and Research (p. 450).

**Ph.D. in Industrial and Systems Engineering**
The graduate program leading to the doctor of philosophy (Ph.D.) degree is organized to meet the individual goals and interests of graduate students whose professional plans include teaching, consulting, or research in an educational, governmental, or industrial environment. Each doctoral candidate is required to demonstrate: (1) a high level of proficiency in one or more fields of industrial and systems engineering, and (2) a capacity for independent research through the preparation of a dissertation related to his/her field of specialization.

This is to be facilitated as follows. During the first year of study, all Ph.D. students must complete the following core courses (or a substitute approved by the Ph.D. program coordinator): ISE 401, ISE 402, ISE 406, ISE 429, ISE 417, and ISE 418. During the second year all PhD students must pass ISE 407. At the end of the first year, each student must declare one of the following three methodological fields of study:

- Optimization, or
- Applied Probability and Statistics
- Applied Operations Research

In addition to the core courses, two courses in each of the three fields of study are required. Following the first year, an initial review, consisting of faculty evaluation, classroom performance, and a qualifier exam, must be passed. A review by the student's dissertation committee must be passed in each subsequent year, along with the required dissertation proposal and general exam.

**Courses**

**ISE 100 Industrial Employment 0 Credits**
Usually following the junior year, students in the industrial engineering curriculum are required to do a minimum of eight weeks of practical work, preferably in the field they plan to follow after graduation. A report is required. Must have sophomore standing.

**ISE 111 Engineering Probability 3 Credits**

**Prerequisites:** MATH 022 or MATH 096 or MATH 032 or MATH 052

**ISE 112 Computer Graphics 1 Credit**
Introduction to interactive graphics and construction of multiview representations in two and three dimensional space. Applications in industrial engineering. Must have sophomore standing in industrial engineering.

**ISE 121 Applied Engineering Statistics 3 Credits**
The application of statistical techniques to solve industrial problems. Regression and correlation, analysis of variance, quality control, and reliability.

**Prerequisites:** ISE 111 or MATH 231 or IE 111
ISE 131 Work Systems and Operations Management 3 Credits
Worker-machine systems, work flow, assembly lines, logistics and service operations, and project management. Operations analysis, methods engineering, work measurement, lean production, and six sigma. Workplace ergonomics, plant layout design, and work management.
Prerequisites: ISE 111 or MATH 231 or IE 111
Can be taken Concurrently: ISE 111, MATH 231, IE 111

ISE 132 Work Systems Laboratory 1 Credit
Laboratory exercises, case studies, and projects in operations analysis, methods engineering, work measurement, and plant layout design.
Prerequisites: ISE 131 or IE 131
Can be taken Concurrently: ISE 131, IE 131

ISE 168 (EMC 168) Production Analysis 3 Credits
A course for students not majoring in industrial engineering. Engineering economy; application of quantitative methods to facilities analysis and planning, operations planning and control, work measurement, and scheduling.
Prerequisites: MATH 021 or MATH 031 or MATH 051 or MATH 075 or MATH 076

ISE 172 Algorithms in Systems Engineering 4 Credits
Use of computers to solve problems arising in systems engineering. Design and implementation of algorithms for systems modeling, systems design, systems analysis, and systems optimization. Computer systems, basic data structures, the design and implementation of efficient algorithms, and application of algorithms to the design and optimization of complex systems such as those arising in transportation, telecommunications, and manufacturing. Weekly laboratory with exercises and projects.
Prerequisites: CSE 017 or CSE 018

ISE 215 Fundamentals of Modern Manufacturing 3 Credits
Manufacturing processes and systems. Metal machining and forming, polymer shape processes, powder metallurgy, assembly and electronics manufacturing. Introduction to automation, numerical control, and industrial robots.
Prerequisites: MAT 033

ISE 216 Manufacturing Laboratory 1 Credit
Laboratory exercises and experiments in manufacturing processes and systems.
Prerequisites: ISE 215 or IE 215
Can be taken Concurrently: ISE 215, IE 215

ISE 224 Information Systems Analysis and Design 3 Credits
An introduction to the technological as well as methodological aspects of computer information systems. Content of the course stresses basic knowledge in database systems. Database design and evaluation, query languages and software implementation. Students that take CSE 241 cannot receive credit for this course.

ISE 226 Engineering Economy and Decision Analysis 3 Credits
Economic analysis of engineering projects; interest rate factors, methods of evaluation, depreciation, replacement, break-even analysis, aftertax analysis, decision-making under certainty and risk.
Prerequisites: ISE 111 or MATH 231 or IE 111
Can be taken Concurrently: ISE 111, MATH 231, IE 111

ISE 230 Introduction to Stochastic Models in Operations Research 3 Credits
Formulating, analyzing, and solving mathematical models of real-world problems in systems exhibiting stochastic (random) behavior. Discrete and continuous Markov chains, queuing theory, inventory control, Markov decision process. Applications typically include traffic flow, call centers, communication networks, service systems, and supply chains.
Prerequisites: ISE 111 or IE 111 or MATH 231

ISE 240 Introduction to Deterministic Optimization Models in Operations Research 3 Credits
Formulating, analyzing, and solving mathematical models of real-world problems in systems design and operations. A focus on deterministic optimization models having parameters that are known and fixed. Algorithmic approaches for linear, integer, and nonlinear problems. Solving optimization problems utilizing specialized software.
Prerequisites: MATH 205

ISE 251 Production and Inventory Control 3 Credits
Techniques used in the planning and control of production and inventory systems. Forecasting, inventory models, operations planning, and scheduling.
Prerequisites: ISE 121 and ISE 230 and ISE 240
Can be taken Concurrently: ISE 230, ISE 240

ISE 254 Senior Project 3 Credits
The use of industrial and systems engineering techniques to solve a major problem in either a manufacturing or service environment. Problems are sufficiently broad to require the design of a system. Human factors are considered in system design. Laboratory.

ISE 255 Senior Thesis I 3 Credits
In-depth study of a research topic in industrial and systems engineering supervised by an Industrial and Systems Engineering department faculty member. Requires completion of a formal research proposal and a public presentation of the proposal at the end of the semester.

ISE 256 Senior Thesis II 3 Credits
Continued in-depth study of a research topic in industrial and systems engineering supervised by an Industrial and Systems Engineering department faculty member. Requires a formal thesis and public presentation of the results.
Prerequisites: ISE 255

ISE 275 Fundamentals of Web Applications 3 Credits
Introduction to web technologies required to support the development of client side and server side components of Internet based applications. Students will be exposed to the problems of design, implementation, and management by way of assigned readings, class discussion, and project implementation. Term project.
Prerequisites: ISE 224 or IE 224 or CSE 241
Can be taken Concurrently: ISE 224, IE 224, CSE 241

ISE 281 Leadership Project 1-3 Credits
Application of leadership principles through team projects with industry. Written report required.
Repeat Status: Course may be repeated.
Prerequisites: ISE 382 or IE 382

ISE 300 Apprentice Teaching 1-4 Credits

ISE 305 Simulation 3 Credits
Applications of discrete and continuous simulation techniques in modeling industrial systems. Simulation using a high level simulation language. Design of simulation experiments.
Prerequisites: ISE 121 or IE 121

ISE 316 Optimization Models and Applications 3 Credits
Modeling and analysis of operations research problems using techniques from mathematical programming Linear programming, integer programming, multicriteria optimization, stochastic programming, and nonlinear programming using an algebraic modeling language.
Prerequisites: ISE 220 or IE 220 or ISE 240 or IE 240 or ISE 221 or IE 221 or ISE 222 or IE 222

ISE 319 Facilities Planning and Material Handling 3 Credits
Facilities planning including plant layout design and facility location. Material handling analysis including transport systems, storage systems, and automatic identification and data capture.
Prerequisites: ISE 131 or IE 131

ISE 320 Service Systems Engineering 3 Credits
Models and algorithms for reducing costs and improving customer service in service industries such as transportation, health care, retail, hospitality, education, and emergency services. Topics include facility location, resource allocation, inventory management, workforce planning, queuing analysis, call center management, and vehicle routing, with an emphasis on their applications in service industries. This course is an undergraduate version of ISE 420. Credit will not be given for both ISE 320 and ISE 420.
Prerequisites: ISE 230 and ISE 240
Can be taken Concurrently: ISE 230
ISE 321 Independent Study in Industrial & Systems Engineering 3 Credits
Experimental projects in selected fields of industrial engineering, approved by the instructor. A written report is required. Department permission required.
Repeat Status: Course may be repeated.

ISE 324 Industrial Automation and Robotics 3 Credits
Introduction to robotics technology and applications. Robot anatomy, controls, sensors, programming, work cell design, part handling, welding, and assembly. Laboratory exercises.
Prerequisites: (MECH 003 or MECH 002) and MATH 205

ISE 328 Engineering Statistics 3 Credits
Random variables, probability functions, expected values, statistical inference, hypothesis testing, regression and correlation, analysis of variance, introduction to design of experiments, and fundamentals of quality control. This course cannot be taken by IE undergraduates.
Prerequisites: MATH 023 or MATH 096

ISE 332 Product Quality 3 Credits
Introduction to engineering methods for monitoring, control, and improvement of quality. Statistical models of quality measurements, statistical process control, acceptance sampling, and quality management principles. Some laboratory exercises.
Prerequisites: ISE 121 or IE 121

ISE 334 Organizational Planning and Control 3 Credits
Design of organization and procedures for managing functions of industrial engineering. Analysis and design of resources planning and control, including introduction of change in manmachine systems; manpower management and wage administration. Must have junior standing.

ISE 339 Stochastic Models and Applications 3 Credits
Introduction to stochastic process modeling and analysis techniques and applications. Generalizations of the Poisson process; renewal theory and applications to inventory theory, queuing, and reliability; Brownian motion and stationary processes.
Prerequisites: ISE 220 or IE 220 or ISE 230 or IE 220

ISE 340 Production Engineering 3 Credits
Prerequisites: ISE 215 or IE 215

ISE 341 Data Communication Systems Analysis and Design 3 Credits
An introduction to the hardware as well as performance evaluation of data communication networks. Emphasis on data transmission, encoding, data link control, communication networking techniques, and queuing/simulation analysis of network performance.
Prerequisites: (ISE 230 or IE 230) and (ISE 240 or IE 240)

ISE 347 Financial Optimization 3 Credits
Making optimal financial decisions under uncertainty. Financial topics include asset/liability management, option pricing and hedging, risk management and portfolio optimization. Optimization techniques covered include linear and nonlinear optimization, discrete optimization, dynamic programming and stochastic optimization. Emphasis on use of modeling languages and solvers in financial applications. Requires basic knowledge of linear optimization and probability. Credit will not be given for both ISE 347 and ISE 447.
Prerequisites: ISE 316

ISE 355 Optimization Algorithms and Software 3 Credits
Basic concepts of large families of optimization algorithms for both continuous and discrete optimization problems. Pros and cons of the various algorithms when applied to specific types of problems; information needed; whether local or global optimality can be expected. Participants practice with corresponding software tools to gain hands-on experience. Credit will not be given for both ISE 355 and IE 455.
Prerequisites: ISE 220 or IE 220 or ISE 240 or IE 240

ISE 356 Introduction to Systems Engineering and Decision Analysis 3 Credits
Systems Engineering modeling techniques. Architectures for large scale systems design. Includes physical, functional, and operational architectures. Requirements engineering, interface and integration issues, graphical modeling techniques. Additional topics may include: decision analysis techniques for systems, uncertainty analysis, utility functions, multiattribute utility functions and analysis, influence diagrams, risk preference, Analytical Hierarchy and Node Processes in decision making.
Prerequisites: (ISE 220 or IE 220) or ((ISE 230 or IE 230) and ISE 240 or IE 240),

ISE 357 Introduction to Industrial Engineering Mathematics 3 Credits
A review of linear algebra and an introduction to quantitative analysis, manipulation of matrices, core concepts associated with systems oaf linear equations and linear optimization, algebraic and geometric models. The credits for this course cannot be applied to any undergraduate degree offered by the Industrial & Systems Engineering Department. Consent of department required.

ISE 358 Game Theory 3 Credits
A mathematical analysis of how people interact in strategic situations. Applications include strategic pricing, negotiations, voting, contracts and economic incentives, and environmental issues.
Prerequisites: MATH 021 or MATH 031 or MATH 051 or MATH 076

ISE 362 (MSE 362) Logistics and Supply Chain Management 3 Credits
Modeling and analysis of supply chain design, operations, and management. Analytical framework for logistics and supply chains, demand and supply planning, inventory control and warehouse management, transportation, logistics network design, supply chain coordination, and financial factors. Students complete case studies and a comprehensive final project.
Prerequisites: ((ISE 220 or IE 220) and (ISE 251 or IE 251)), or ((ISE 230 or IE 230) and (ISE 240 or IE 240)),

ISE 364 Introduction to Machine Learning 3 Credits
Prerequisites: CSE 002

ISE 365 Applied Data Mining 3 Credits
Introduction to the data mining process including business problem understanding, data understanding and preparation, modeling and evaluation, and model deployment. Emphasis on hands-on data preparation and modeling using techniques from statistics, artificial intelligence, such as regression, decision trees, neural networks, and clustering. A number of application areas are explored. This course is an undergraduate version of IE 465. Credit will not be given for both ISE 365 and IE 465.
Prerequisites: ISE 121 or IE 121 or ISE 328 or IE 328

ISE 367 Mining of Large Datasets 3 Credits
Explores how large datasets are extracted and analyzed. Discusses suitable algorithms for high dimensional data, graphs, and machine learning. Introduces the use of modern distributed programming models for large-scale data processing. An undergraduate version of ISE 467, with assignments better geared towards undergraduate students. Credit will not be given for both ISE 367 and ISE 467.
Prerequisites: ISE 111 and CSE 002

ISE 372 Systems Engineering Design 3 Credits
Analysis, design, and implementation of solutions to problems in manufacturing and service sectors using information technology. Emphasis on problem identification and the evaluation of proposed solutions and implementations. Term Project.
Prerequisites: ((ISE 220 or IE 220) or ((ISE 230 or IE 230) and ISE 240 or IE 240)), and (ISE 275 or IE 275)
ISE 382 Leadership Development 3 Credits
Explanation and critical analysis of theories, principles, and processes of effective leadership. Managing diverse teams, communication, and ethics associated with leadership. Application of knowledge to personal and professional life through projects and team assignments.

ISE 401 Convex Analysis 3 Credits
Theory and applications of convex analysis, particularly as it relates to convex optimization and duality theory. Content of the course emphasizes rigorous mathematical analysis as well as geometric and visually intuitive viewpoints of convex objects and optimization problems.

ISE 402 Applied Models in Operations Research 3 Credits
Applied models in operations research, including applications in supply chain, energy, health care, and other fields. Seminal models, theorems, algorithms, and experience in translating practical problems into mathematical ones.
Prerequisites: ISE 406 and ISE 429
Can be taken Concurrently: ISE 429

ISE 404 Simulation 3 Credits
Applications of discrete and continuous simulation techniques in modeling industrial systems. Simulation using a high-level simulation language. Design of simulation experiments. This course is a version of IE 305 for graduate students, with research projects and advanced assignments.
Prerequisites: ISE 121 or IE 121 or ISE 328 or IE 121

ISE 405 Special Topics in Industrial & Systems Engineering 3 Credits
An intensive study of some field of industrial & systems engineering.

ISE 406 Introduction to Mathematical Optimization 3 Credits
Algorithms and techniques for the solution and analysis of deterministic linear optimization models used in operations research. Linear and integer linear optimization problems. Modeling techniques and fundamental algorithms and their complexity properties. Available open source and commercial solvers discussed.

ISE 407 Computational Methods in Optimization 3 Credits
Introduction to a wide range of topics related to computational methods encountered in the implementation of optimization algorithms. Lectures focus primarily on theoretical aspects of computation, but with the goal of understanding computation in practice. Assigned exercises focus on employing computational methods in real-world applications. Topical coverage will include data structures, design and analysis of algorithms (sequential and parallel), programming paradigms and languages, development tools and environments, numerical analysis, and matrix computations.

ISE 409 Time Series Analysis 3 Credits
Theory and applications of an approach to process modeling, analysis, prediction, and control based on an ordered sequence of observed data. Single or multiple time series are used to obtain scalar or vector difference/differential equations describing a variety of physical and economic systems.

ISE 410 Design of Experiments 3 Credits
Experimental procedures for sorting out important causal variables, finding optimum conditions, continuously improving processes, and trouble shooting. Applications to laboratory, pilot plant and factory. Must have some statistical background and experimentation in prospect.
Prerequisites: ISE 121 or IE 121 or ISE 328 or IE 328

ISE 411 Networks and Graphs 3 Credits
This course examines the theory and applications of networks and graphs. Content of the courses stresses on the modeling, analysis and computational issues of network and graph algorithms. Complexity theory, trees and arborescences, path algorithms, network flows, matching and assignment, primaldual algorithms, Eulerian and Hamiltonian walks and various applications of network models.
Prerequisites: ISE 406 or IE 406

ISE 412 Quantitative Models of Supply Chain Management 3 Credits
Analytical models for logistics and supply chain coordination. Modeling, analysis, and computational issues of production, transportation, and other planning and decision models. Logistics network configuration, risk pooling, stochastic decision-making, information propagation, supply chain contracting, and electronic commerce implication.
Prerequisites: ISE 316 or ISE 426

ISE 413 Asset Valuation 3 Credits
Valuation of projects and companies by discounted cash flow models. Mechanics of present value calculations. Understanding financial statements. The determinants of equity risk, expected return, earnings, reinvestment needs and growth. Role of debt and taxation. Valuing start-up companies, distressed companies, cyclical companies, firms with exclusive rights.

ISE 416 Dynamic Programming 3 Credits
This course is concerned with the dynamic programming approach to sequential decision making under uncertainty, exact solution algorithms, and approximate methods adapted to large-scale problems. Value iteration, policy iteration and lambda-policy iteration are introduced and analyzed using fixed-point theory. The linear optimization approach to dynamic programming is introduced. Special policy structures are studied. Algorithms based on sampling and on the use of linear approximation architectures are covered.
Prerequisites: ISE 316 or IE 316

ISE 417 Nonlinear Optimization 3 Credits
Advanced topics in mathematical optimization with emphasis on modeling and analysis of nonlinear problems. Convex analysis, unconstrained and constrained optimization, duality theory. Lagrangian relaxation, and methods for solving nonlinear optimization problems, including descent methods. Newton methods, conjugate gradient methods, and penalty and barrier methods.
Prerequisites: ISE 406 or 406

ISE 418 Discrete Optimization 3 Credits
Advanced topics in mathematical optimization with emphasis on modeling and analysis of optimization problems with integer variables. Polyhedral theory, theory of valid inequalities, duality and relaxation, computational complexity, and methods for solving discrete optimization problems, such as branch and bound.

ISE 419 Planning and Scheduling in Manufacturing and Services 3 Credits
Models for the planning and scheduling of systems that produce goods or services. Resource allocation techniques utilizing static and dynamic scheduling methods and algorithms. Application areas include manufacturing and assembly systems, transportation system timetabling, project management, supply chains, and workforce scheduling.

ISE 420 Service Systems Engineering 3 Credits
Models and algorithms for reducing costs and improving customer service in service industries such as transportation, health care, retail, hospitality, education, and emergency services. Topics include facility location, resource allocation, inventory management, workforce planning, queuing analysis, call center management, and vehicle routing, with an emphasis on their applications in service industries. This course is a graduate version of ISE 320 featuring some advanced assignments. Credit will not be given for both ISE 320 and ISE 420.
Prerequisites: ISE 339 or ISE 429 or MATH 310 or STAT 410

ISE 424 Robotic Systems and Applications 3 Credits
Detailed analysis for robotic systems in manufacturing and service industries. Task planning and decomposition, motion trajectory analysis, conveyor tracking, error detection and recovery, end effector design, and systems integration.

ISE 425 Advanced Inventory Theory 3 Credits
Advanced analytical, algorithmic, and heuristic methods for optimizing and managing inventory systems. Economic order quantity model and extensions; power-of-two policies; base-stock and other policies for stochastic systems; the Clark-Scarf model; assembly and distribution systems; proofs of policy optimality.
<table>
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<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
<th>Description</th>
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<tbody>
<tr>
<td>ISE 426</td>
<td>Optimization Models and Applications</td>
<td>3</td>
<td>Modeling and analysis of operations research problems using techniques from mathematical programming. Linear programming, integer programming, multicriteria optimization, stochastic programming and nonlinear programming using an algebraic modeling language. This course is a version of IE 316 for graduate students, with research projects and advanced assignments. Closed to students who have taken IE 316. <strong>Prerequisites:</strong> ISE 240 or IE 240</td>
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<tr>
<td>ISE 429</td>
<td>Stochastic Models and Applications</td>
<td>3</td>
<td>Introduction to stochastic process modeling and analysis techniques and applications. Generalization of the Poisson process; renewal theory, queueing, and reliability; Brownian motion and stationary processes. This course is a version of IE 39 for graduate students, with research projects and advanced assignments. Closed to students who have taken IE 339. <strong>Prerequisites:</strong> ISE 220 or IE 220 or ISE 230 or IE 230</td>
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<tr>
<td>ISE 430</td>
<td>Management Science Project</td>
<td>3</td>
<td>Analysis of a management problem and design of its solution incorporating management science techniques. An individual written report is required. Recommended to be taken in the last semester of the program.</td>
</tr>
<tr>
<td>ISE 431</td>
<td>Operations Research Special Topics</td>
<td>3</td>
<td>Extensive study of selected topics in techniques and models of operations research.</td>
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<tr>
<td>ISE 433</td>
<td>Manufacturing Engineering Special Topics</td>
<td>3</td>
<td>Extensive study of selected topics in the research and development of manufacturing engineering techniques.</td>
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<tr>
<td>ISE 437</td>
<td>Advanced Database Analysis and Design</td>
<td>3</td>
<td>Intensive treatment of design and application of modern database technology, including information modeling and logical design of databases. Emphasis on applications to the manufacturing environment. <strong>Prerequisites:</strong> ISE 224 or IE 224</td>
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<tr>
<td>ISE 439</td>
<td>Queueing Systems</td>
<td>3</td>
<td>Queueing theory and analysis of manufacturing, distribution, telecommunications, and other systems subject to congestion. Design and analysis of queueing networks; approximation methods such as mean value analysis, uniformization, fluid and diffusion interpretations; numerical solution approaches.</td>
</tr>
<tr>
<td>ISE 441</td>
<td>Financial Engineering Projects</td>
<td>3</td>
<td>Analysis, design and implementation of solutions to problems in financial services using information technology, mathematical modeling, and other financial engineering techniques. Emphasis on realworld problem solving, problem definition, implementation and solution evaluation.</td>
</tr>
<tr>
<td>ISE 442</td>
<td>Manufacturing Management</td>
<td>3</td>
<td>Study of factors affecting the development of a manufacturing management philosophy; decision-making process in areas of organization, planning, and control of manufacturing. The principles and techniques of TQM, Deming and others; metrics, costs, benchmarking, quality circles, and continuous improvement. Influence of the social, technical, and economic environment upon manufacturing management decisions. Case studies.</td>
</tr>
<tr>
<td>ISE 443</td>
<td>Automation and Production Systems</td>
<td>3</td>
<td>Principles and analysis of manual and automated production systems for discrete parts and products. Cellular manufacturing, flexible manufacturing systems, transfer lines, manual and automated assembly systems, and quality control systems. <strong>Prerequisites:</strong> ISE 215 or IE 215</td>
</tr>
<tr>
<td>ISE 444</td>
<td>Optimization Methods in Machine Learning</td>
<td>3</td>
<td>Machine learning models and advanced optimization tools that are used to apply these models in practice. Machine learning paradigm, machine learning models, convex optimization models, basic and advanced methods for modern convex optimization. <strong>Prerequisites:</strong> ISE 406 or IE 406</td>
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<tr>
<td>ISE 447</td>
<td>Financial Optimization</td>
<td>3</td>
<td>Making optimal financial decisions under uncertainty. Financial topics include asset/liability management, option pricing and hedging, risk management, and portfolio optimization. Optimization techniques covered include linear and nonlinear programming, integer programming, dynamic programming, and stochastic programming. Emphasis on use of modeling languages and solvers in financial applications. Requires basic knowledge of linear programming and probability. This course is a version of IE 347 for graduate students and requires advanced assignments. Credit will not be given for both IE 347 and IE 447. <strong>Prerequisites:</strong> ISE 220 or IE 220 or ISE 230 or IE 230</td>
</tr>
<tr>
<td>ISE 448</td>
<td>Optimization Algorithms and Software</td>
<td>3</td>
<td>Basic concepts of large families of optimization algorithms for both continuous and discrete optimization problems. Pros and cons of the various algorithms when applied to specific types of problems; information needed; whether local or global optimality can be expected. Participants practice with corresponding software tools to gain hands-on experience. This course is a version of IE 355 for graduate students and requires advanced assignments. Credit will not be given for both IE 355 and IE 455. <strong>Prerequisites:</strong> ISE 220 or IE 220 or ISE 240 or IE 240</td>
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<tr>
<td>ISE 456</td>
<td>Conic Optimization</td>
<td>3</td>
<td>A Conic Optimization (CO) problem is an optimization problem where the objective and constraints are linear, and the decision variables are required to belong to a closed convex cone. CO has an elegant theory, and allows us to formulate a very rich class of optimization problems that arise both in theory and practice. The aim of this course is to discuss both theoretical aspects of CO, as well as key practical applications. <strong>Prerequisites:</strong> ISE 406 or ISE 426</td>
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<tr>
<td>ISE 458</td>
<td>Topics in Game Theory</td>
<td>3</td>
<td>A mathematical analysis of how people interact in strategic situations. Topics include normalform and extensivform representations of games, various types of equilibrium requirements, the existence and characterization of equilibria, and mechanism design. The analysis is applied to microeconomic problems including industrial organization, international trade, and finance. Must have two semesters of calculus. <strong>Prerequisites:</strong> ECO 412 and ECO 413</td>
</tr>
<tr>
<td>ISE 460</td>
<td>Engineering Project</td>
<td>1-3</td>
<td>Intensive study of an area of industrial engineering with emphasis upon design and application. A written report is required.</td>
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<tr>
<td>ISE 461</td>
<td>Readings</td>
<td>1-3</td>
<td>Intensive study of some area of industrial engineering that is not covered in general courses.</td>
</tr>
<tr>
<td>ISE 465</td>
<td>Applied Data Mining</td>
<td>3</td>
<td>Introduction to the data mining process including business problem understanding, data understanding and preparation, modeling and evaluation, and model deployment. Emphasis on hands-on data preparation and modeling using techniques from statistics, artificial intelligence, such as regression, decision trees, neural networks, and clustering. A number of application areas are explored. This course is a graduate version of IE 365 possessing some advanced assignments. Credit will not be given for both IE 365 and IE 465. <strong>Prerequisites:</strong> ISE 121 or IE 121 or ISE 328 or IE 328</td>
</tr>
</tbody>
</table>
ISE 467 Mining of Large Datasets 3 Credits
Explores how large datasets are extracted and analyzed. Discusses suitable algorithms for high dimensional data, graphs, and machine learning. Introduces the use of modern distributed programming models for large-scale data processing. A graduate version of ISE 367 that will require graduate students to do more rigorous assignments. Credit will not be given for both ISE 367 and ISE 467. Students are expected to have basic knowledge of programming and probability.

ISE 470 Introduction to Healthcare Systems 3 Credits

ISE 471 Quality and Process Improvement in Healthcare 3 Credits
The dimensions of Healthcare quality and their definitions, quality metrics, accreditation and other benchmarking and evaluation methods. Change management, project planning and team management. Continuous improvement tools including “lean”, “six-sigma”, and “TQM”.

ISE 472 Financial Management in Healthcare 3 Credits
Engineering economics in Healthcare; value metrics (net present value, return on investment, etc.), cost-benefit analysis, capital projects and improvements. Accounting methods in Healthcare systems. Reimbursement methods, organizations, and alternatives. Financial strategy, planning, pricing and capital formation in “for”, and “not for” profit settings.

ISE 473 Information Technology in Healthcare 3 Credits
Introduction to information systems in Healthcare. Components of the system; electronic medical records, patient monitoring and data collection (clinical information systems), ancillaries (lab, pharmacy, radiology), imaging and digital technology, financial, inventory and management information systems. Enterprise systems in Healthcare, IT driven cost, efficiency and treatment quality metrics. Data warehousing, sharing, mining, protection and privacy issues.

ISE 474 Healthcare Systems Engineering Capstone Project 3 Credits
A three credit hour “capstone” project to be completed in collaboration with industry partners and under the supervision of faculty. Students will work in small groups on projects in the Healthcare industry. The Professor of Practice is the general advisor for the capstone project course.

ISE 475 Healthcare Systems Project 1-3 Credits
Intensive study of an area of healthcare systems engineering with emphasis upon design and application. Written report is required.

ISE 482 Leadership Development 3 Credits
Exploration and critical analysis of theories, principles, and processes of effective leadership. Managing diverse teams, communication, and ethics associated with leadership. Application of knowledge to personal and professional life through projects and team assignments. Credit will not be given to a student for both ISE 382 and ISE 482.

ISE 490 Thesis 1-6 Credits
ISE 499 Dissertation 1-15 Credits

Management Science and Engineering
The Management Science and Engineering program is directed toward integrating scientific methods with the functional aspects of organizations by investigating the application of quantitative methodology and systems analysis in the context of decision making, risk analysis, economics and cost analysis, production management, and supply chain logistics. This integration provides the students with a broader perspective toward managerial decision-making in both private enterprise and public administration.

Midcareer professionals and recent graduates with a background in engineering, mathematics, and physical sciences who intend to seek managerial, consulting or systems analyst positions are appropriate candidates. In particular, those candidates who intend to seek positions demanding both technical and management skills find the management science background advantageous in dealing with the complex problems of industrial, commercial, and public service organizations.

The Industrial and Systems Engineering Department administers the Management Science and Engineering program. To be admitted to the program a candidate must demonstrate basic competence in calculus, statistics, linear algebra, introductory operations research, accounting, production and economics. A candidate lacking appropriate background may be required to take background courses. The minimum program consists of 30 credit hours of course work, of which at least 18 credit hours must be in the 400-level. The ISE graduate faculty coordinator must approve all course work. No more than 9 credit hours may be taken from the College of Business.

M.S. IN MANAGEMENT SCIENCE AND ENGINEERING
The minimum program for the master of science degree in Management Science & Engineering consists of 24 credit-hours of approved courses and completion of a satisfactory 6 credit thesis. A faculty member must supervise the thesis. Courses from outside the ISE department usually include other engineering disciplines, mathematics, computer science, and business and economics.

M.ENG. IN MANAGEMENT SCIENCE AND ENGINEERING
The minimum program for the master of engineering degree in Management Science & Engineering consists of 30 credit-hours of coursework which can include a 3 credit-hour project. This program of study is only for those students whose interests are geared toward engineering design rather than research. A faculty member must supervise the project.

MANAGEMENT SCIENCE AND ENGINEERING CORE COURSES
Details on course requirements for the Management Science and Engineering master's degree can be found at Master's Program web page (https://ise.lehigh.edu/content/masters-programs-courses/#Management) or at the Industrial and Systems Engineering office.

Materials Science and Engineering
As science and technology advance in the 21st century, progress in many fields will depend on the discovery and development of new materials, processed in more complex ways, and with new kinds of properties. It is widely recognized that the progress of history has been divided into periods characterized by the materials that mankind has used, e.g., the stone age, the bronze age, the iron age. Today, materials science and engineering is critical to all other fields of engineering, and advances in other fields are often limited by advances in materials.

Interest in new materials for solid-state devices, space technology, and superconductivity, as well as a better understanding of the behavior of materials in the design of structures, automobiles and aircraft, plant processing equipment, electronic devices, biomedical devices, etc., have increased the need for people trained in science and technology of materials.

Education for this field of engineering requires basic studies in mathematics, chemistry, physics and mechanics, plus a general background in engineering principles, followed by intensive training in the application of these principles to the development and use of materials in a technological society.

Professors. Helen M. Chan, PHD (Imperial College London); Manoj K. Chaudhury, PHD (State University of New York at Buffalo); Volkmar R. Dierolf, PHD (University of Utah); John N. DuPont, PHD (Lehigh University); Martin P. Harmer, DSC (University of Leeds); Himanshu Jain, ENGRSC (Columbia University); Christopher J. Kiely, PHD (University of Bristol); Wojciech Z. Misielew, DSC (AGH University Science & Technology); Raymond A. Pearson, PHD (University of Michigan); Jeffrey M. Rickman, PHD (Carnegie Mellon University)

Associate Professors. Xuanhong Cheng, PHD (University of Washington); Sabrina S. Gedlicka, PHD (Purdue University); Nicholas Strandwitz, PHD (University of California Santa Barbara); Masashi Watanabe, PHD (Kyushu University)

Assistant Professors. Joshua Carl Agar, PHD (University of Illinois at Urbana-Champaign); Lesley W. Chow, PHD (Northwestern University); Siddha Pimpulkar, PHD (University of California, Santa Barbara)

Professor Of Practice. Eric S. Daniels, PHD (Lehigh University)
Emeriti. Betzalel Avitzur, PhD (University of Michigan); G. Slade Cargill, III, PhD (Harvard University); Ye T. Chou, PhD (Carnegie Mellon University); John Alwyn Eades, PhD (University of Cambridge); Richard W. Hertzberg, PhD (Lehigh University); Charles E. Lyman, PhD (Massachusetts Institute of Technology); Arnold R. Marder, PhD (Lehigh University); Michael R Notis, PhD (Lehigh University); Alan W. Pense, PhD (Lehigh University); David A. Thomas, DSc (Massachusetts Institute of Technology); David B. Williams, PhD (University of Cambridge)

B.S. IN MATERIALS SCIENCE AND ENGINEERING

The undergraduate program is designed to prepare graduates for research, development, operations, management, and sales careers in industry or for graduate study in various specialties of the field, including the improvement of properties in metals, ceramics, polymers, composites, electronic materials, and biomaterials. While some graduates go directly into materials-producing companies, most serve as engineers in the transportation, electronics, chemical, communications, space, and other industries. A number of students pursue graduate study leading to careers in research and teaching, medicine, or the law.

Materials Science and Engineering majors have opportunities to gain valuable experience in related fields, including other areas of engineering or science, by choosing to concentrate elective courses in one of these areas. Requirements for the Minor include acquiring at least 15 course credits in that area, which may be taken as technical or free electives in the student's major. It is particularly straightforward for students to obtain a minor in Chemical and Biomolecular Engineering, in Mechanical Engineering, in Nanotechnology, or in Polymer Science and Engineering. There is also a path to a Business minor.

Materials Science and Engineering majors can also participate in undergraduate research at overseas universities during the summer between the Junior and Senior years. The Materials Science and Engineering Industrial Option program enables students to gain work experience during the Senior Year. The Materials Science and Engineering Research Option program provides senior undergraduates with research experience.

Five-Year programs are available to broaden the Materials Science and Engineering undergraduate experience. One such program is the Arts-Engineering Program, in which students can earn both the Bachelor of Science degree in Materials Science and Engineering and the Bachelor of Arts degree in some area within the College of Arts and Sciences, such as biology, physics, chemistry, or history. Another is the B.S./M.Ed. Program, which leads (in five years of study and internships) to the B.S. degree in Materials Science and Engineering and a masters degree (M.Ed.) in Education, with elementary or secondary teacher certification.

MINOR IN MATERIALS SCIENCE AND ENGINEERING

The Department of Materials Science and Engineering offers minors to students majoring in other subjects. The Department is enthusiastic in its support of students who wish to broaden their education by taking a minor. To obtain a minor in Materials Science and Engineering, a student must complete:

- MAT 033 Engineering Materials and Processes 3
- MAT 10 or MAT 028 may be used as an elective. The remaining courses may be chosen from a list of 200 and 300 level courses relevant to various engineering disciplines. List is maintained by the department. 12

MINOR IN NANOTECHNOLOGY

Materials for nanotechnology applications have new properties unavailable in bulk materials. The synthesis, processing, and characterization of these materials require facility with concepts beyond those needed for typical engineering materials. This minor requires:

- MAT 355 Materials for Nanotechnology 3
- One course on crystallography and band theory 3
- Additional electives 9

Additional requirement: Since the aim of this minor is to provide an interdisciplinary program in nanotechnology, students must take at least one course outside their home department. Courses of individual study (including laboratory projects) on relevant topics, in any appropriate department, will also be accepted as electives for the minor, with the approval of the advisor.

EDUCATIONAL MISSION

The Materials Science and Engineering undergraduate program's mission is to provide its students an excellent education in a scholarly environment.

PROGRAM EDUCATIONAL OBJECTIVES

- Graduates will have the knowledge and experience to pursue successful careers;
- Graduates will meet the expectations of employers;
- Qualified graduates will be admitted to highly ranked advanced degree programs; and
- Successful careers will be reflected in professional recognition, advancement in responsibility, and awards.

STUDENT OUTCOMES

The MS&E undergraduate Student Outcomes declare that graduates should have:

1. an ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics;
2. an ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desire needs;
3. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions;
4. an ability to communicate effectively with a range of audiences;
5. an ability to recognize responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts;
6. an ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately;
7. an ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.

MAJOR REQUIREMENTS

The recommended sequence of courses is shown below. A total of 132 credits or more is required to graduate.

First Year

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Credits</th>
<th>Second Semester</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ENGL 001</td>
<td>3</td>
<td>ENGL 002</td>
<td>3</td>
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<tr>
<td>MATH 021</td>
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<td>MATH 022</td>
<td>4</td>
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<tr>
<td>ENGR 005</td>
<td>2</td>
<td>PHY 011 (^1)</td>
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<tr>
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<td>PHY 012 (^1)</td>
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<tr>
<td>CHM 030 (^1)</td>
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<tr>
<td>ECO 001</td>
<td>4</td>
<td>Humanities or Social Sciences Elective</td>
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Second Year

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Credits</th>
<th>Second Semester</th>
<th>Credits</th>
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<tr>
<td>MAT 033 (^2)</td>
<td>3</td>
<td>MAT 203</td>
<td>4</td>
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<tr>
<td>MAT 010</td>
<td>2</td>
<td>MAT 205</td>
<td>3</td>
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<tr>
<td>MATH 023</td>
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<td>MAT 218</td>
<td>3</td>
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<tr>
<td>PHY 021</td>
<td>4</td>
<td>MAT 204</td>
<td>3</td>
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<tr>
<td>PHY 022</td>
<td>1</td>
<td>Humanities or Social Sciences Elective</td>
<td>3</td>
</tr>
<tr>
<td>ECO 001</td>
<td>4</td>
<td>Select one of the following:</td>
<td>4</td>
</tr>
</tbody>
</table>

Additional electives: Since the aim of this minor is to provide an interdisciplinary program in nanotechnology, students must take at least one course outside their home department. Courses of individual study (including laboratory projects) on relevant topics, in any appropriate department, will also be accepted as electives for the minor, with the approval of the advisor.
Humanities or Social Sciences Elective 4

18 16

### Third Year

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Second Semester</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MAT 020</td>
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<td>MAT 206</td>
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<tr>
<td>MAT 216</td>
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<td>MAT 214</td>
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<tr>
<td>MAT 101</td>
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<td>MAT 201</td>
<td>3</td>
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<tr>
<td>MATH 205</td>
<td>3</td>
<td>Engineering Science Elective</td>
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<tr>
<td>MECH 003</td>
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<td>TE 211</td>
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<tr>
<td>Free Elective</td>
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### Fourth Year

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<td>MAT 252</td>
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<td>MAT 268</td>
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<tr>
<td>Engineering Science Elective</td>
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<td>CHE 280</td>
<td>3</td>
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<td>TE 212</td>
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<td>ECE 083</td>
<td>3</td>
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<tr>
<td>Approved Elective</td>
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<td>ECE 162</td>
<td>1</td>
</tr>
<tr>
<td>Humanities or Social Science Elective</td>
<td>4</td>
<td>Free Elective</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits: 132

1 Required natural science courses, one taken fall semester and the other taken in spring
2 MAT 033 is taught in both the fall and spring semesters

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### PROGRAM REQUIREMENTS

Students must achieve a grade of C- or better in all required courses, in addition to a major GPA of 2.0.

### ELECTIVES

Electives for the sophomore, junior, and senior years must be distributed as follows:

- Humanities and Social Sciences: 13-15 credit hours.
- Free Electives: 9 credit hours in any department.

Approved Elective (3 credit hours) and Engineering Science Electives (6 credit hours) must be selected from a specific list supplied by the Materials Science and Engineering Department. The list includes the Industrial Option and the Research Option.

### PROGRAM OPTIONS

Recognizing that the field of materials science and engineering may be pursued in either an industrial setting or a research setting, the department offers three elective options to prepare students for these careers: The Co-Op Program, the Industrial Option, and the Research Option.

### Co-Op Program

The department's optional Co-Op program, operated within the College of Engineering and Applied Science, provides opportunities for integration of academic studies with significant periods of engineering practice. The program provides eight months of paid, full-time work at selected companies, while still allowing the student to graduate in four years. To be considered for this program, the student should discuss application requirements with his or her advisor.

### Industrial Option

The Industrial Option introduces students to the work of materials engineers in industry. The emphasis is a team approach to the solution of actual plant problems. The courses are conducted in cooperation with local industries. 20 hours per week are spent at the plant of the cooperating industry on investigations of selected problems. The option is limited to a small group of seniors, selected by the Department from those who apply. Summer employment is provided when possible for those who elect to initiate the program during the summer preceding the senior year.

### Research Option

The Research Option is offered for students interested in research and development. Financial support may be available for students who elect to initiate a research program during the summer preceding the senior year. The option is limited to a small group of students, selected by the Department from those who apply.

### FOR GRADUATE STUDENTS

The department offers graduate degrees in Materials Science and Engineering at both masters (M.S. and M.Eng.) and doctoral levels (Ph.D.). Specialized masters degree programs are also available in Photonics, in Polymers, and in Business Administration and Engineering (MBA&E). The M.S. Degree in Photonics is an interdisciplinary degree for broad training in such topics as fiber optics, light-wave communications, and optical materials, to prepare students for work in industry or for further graduate research at the Ph.D. level. The program requires a total of 30 credits of graduate work, including a 15-credit core of courses in materials, electrical engineering, and physics. The Polymer Science and Engineering Program offers interdisciplinary M.S. and Ph.D. degrees through several departments, including Materials Science and Engineering. The program includes courses in materials, chemical engineering, chemistry, physics, and mechanical engineering. The MBA&E is an interdisciplinary degree program in business and engineering designed primarily for students with an undergraduate degree in engineering and two years or more of relevant work experience. The curriculum consists of an MBA core and electives (23 credits) and an engineering core and electives (18 credits), plus other electives and a project which integrates business and engineering (4 credits). Students wishing to have the engineering core in Materials Science and Engineering may enter this program through the Materials Science and Engineering Department.

### SPECIAL PROGRAMS AND OPPORTUNITIES

The department has established specific recommended programs for the M.S., the M.Eng., and the Ph.D., emphasizing the following areas: metals processing and performance, ceramics and glass processing and properties, electronic and photonic materials, polymer modification, processing and characterization, biomaterials, electron microscopy and microstructural characterization.

These programs are flexible and often interdisciplinary.

### Major Requirements

A candidate for the M.S. completes a thesis, unless fully funded by industry, in which case a thesis is not required. M.S. thesis research normally represents six of the 30 semester hours required for this degree. Candidates for the M.Eng. complete a three-credit engineering project.

A candidate for the Ph.D. prepares a preliminary program of courses and research, providing for specialization in some field (largely through research) in consultation with the adviser. Prior to formal establishment of the doctoral program by the special committee and its approval by the college, the student passes a qualifying examination that must be taken in the first or second year of doctoral work. The department does not require a foreign language. It does require preparation and defense of a research proposal as a portion of the general examination.

Of the courses listed only those in the 300 series are available for graduate credit. There are many additional offerings in materials under the listings of other departments.
Most graduate students receive some form of financial aid. Several kinds of fellowships and assistantships are available. This type of aid generally provides for tuition, and a stipend. For details of graduate scholarships, fellowships, and assistantships, please refer to the Financial Aid (p. 39) section.

Research Activities
Graduate students conduct their research in facilities located in the Department or other centers and institutes. The following list describes current Materials Science and Engineering research activities:

**Metals Processing and Performance**
Joining of metals and alloys, additive manufacturing, solidification modeling, deformation processing, grain boundary cohesion, high entropy materials.

**Ceramics and Glass Processing and Properties**
Fundamental studies of sintering and grain growth, novel reaction-based processing for bulk and thin film ceramics, microstructure and properties of oxides for environmental coatings, growth of single crystal piezoelectric ceramics, creep and grain boundary chemistry of alumina, dielectric and electrical properties of glasses, corrosion of glass.

**Electronic and Photonic Materials**
Thin films synthesis and characterization, novel wide-bandgap semiconductors, degradation processes in light-emitting semiconductors, bulk single crystal growth, reliability of MEMS materials, polymer packaging materials, glass nanostructure and chemistry, glasses for nonlinear optical applications, transparent glass ceramics, photo-induced phenomena, and photovoltaics.

**Polymer Modification, Processng and Characterization**
Polymer conjugation and chemical modification, cure kinetics, melt compounding and extrusion, surface characterization, adhesion, additive manufacturing, degradation behavior, mechanical properties, and thermal analysis.

**Biomaterials**
Synthesis of biomaterials, biophysics, biomimicry, fabrication, chemical functionalization, characterization methods, biological materials, and application-driven design.

**Electron Microscopy and Microstructural Characterization**
Transmission electron microscopy, scanning electron microscopy, nanoscale compositional mapping, cathodoluminescence microscopy and spectroscopy, x-ray diffraction and fluorescence, x-ray microanalysis, electron-loss spectrometry, extended x-ray absorption and electron energy loss fine structure.

Courses
**MAT 010 Materials Laboratory 2 Credits**
Introduction to experimental methods used to fabricate and measure the structure and properties of materials. Thermal and mechanical processing and properties are emphasized. Specimen preparation and examination by light optical microscopy.
**Prerequisites:** MAT 033
**Can be taken Concurrently:** MAT 033

**MAT 020 Computational Methods in Materials Science 3 Credits**
The use of computers and computational methods to solve problems in materials science and engineering. Students will employ both commercial packages and their own code in order to complete assignments. Students will utilize word processing and display packages to present results of projects.
**Prerequisites:** ENGR 010

**MAT 028 Silicon, Steel, or Styrofoam? Designing with Materials 3 Credits**
A systematic methodology for selecting materials and fabrication processes in engineering design; case studies in which this methodology is used; overview of engineering materials and their properties; development of material performance indices; materials for environmentally conscious and sustainable design; industrial design considerations; design-directed development of new materials. No previous engineering experience required.
**Prerequisites:** PHY 009 and PHY 010 or PHY 011
**Can be taken Concurrently:** PHY 009, PHY 010, PHY 011

**MAT 033 Engineering Materials and Processes 3 Credits**
Application of physical and chemical principles to understanding, selection, and fabrication of engineering materials. Materials considered include metals, polymers, ceramics, composites, and electronic materials. Case studies of materials used range from transportation systems to microelectronic devices.

**MAT 101 Professional Development 2 Credits**
The role and purpose of engineering in society; the meaning of being a professional; engineering ethics; environmental issues; safety issues; communications and decision-making in the engineering process; expectations and problems of young engineers; personal goals; choosing a career. Required reading. Written reports based on library research.

**MAT 107 Special Topics in Materials 1-3 Credits**
A study of selected topics in materials science and engineering not covered in other formal courses. Consent of instructor required.

**MAT 201 Physical Properties of Materials 3 Credits**
Basic concepts of modern physics and quantum mechanics needed for an understanding of electrons in solids. The experimental development leading to wave mechanics is emphasized. Uses of the Schrodinger equation as the basis for the free electron theory of metals and band theory. Optical properties are developed leading to a discussion of lasers.
**Prerequisites:** PHY 021 and MAT 033 and MATH 205

**MAT 203 Materials Structure at the Nanoscale 4 Credits**
The structure of metals, ceramics, semiconductors, and polymers at the atomic scale. Crystalline, semicrystalline, liquid crystalline and amorphous (glassy) states. Fundamental aspects of formal crystallography and crystal structures. Point, line, and planar crystal defects. Materials characterization by x-ray diffraction, light microscopy, electron microscopy, and other techniques.
**Prerequisites:** CHM 030 and MAT 033 and MAT 010

**MAT 204 Processing and Properties of Polymeric Materials 3 Credits**
The structure-property relationships in polymers will be developed, emphasizing the glass transition, rubber elasticity, crystallinity, and mechanical behavior. Elements of polymer processing. Extrusion of plastics and films, and fiber spinning operations.
**Prerequisites:** MAT 033

**MAT 205 Thermodynamics of Macro/Nanoscale Materials 3 Credits**
The three laws of thermodynamics. Gibbs free energy and conditions of equilibrium. Effects of scale on material behavior. Binary and ternary equilibrium phase diagrams. Application of thermodynamics to materials problems, with examples from nanotechnology, biotechnology, and structural materials.
**Prerequisites:** MATH 023 and MAT 033
**Can be taken Concurrently:** MATH 023, MAT 033

**MAT 206 Processing and Properties of Metals 3 Credits**
The production and purification of metals, their fabrication, and control of their properties. Includes topics such as precipitation hardening, hot and cold working, and casting.
**Prerequisites:** MAT 218 and MAT 216

**MAT 214 Processing and Properties of Ceramic Materials 3 Credits**
**Prerequisites:** MAT 033

**MAT 216 Diffusion and Phase Transformations 3 Credits**
Fundamental diffusion equations; liquid-solid transformations; solid-solid transformations; transformation kinetics; metastable transformations; diffusionless transformations; examples of various transformations in different materials and their effect on properties.
**Prerequisites:** MAT 203 and MAT 205
MAT 218 Mechanical Behavior of Macro/Nanoscale Materials 3 Credits
Elasticity, plasticity, and fracture of metals, ceramics, polymers, and composites. The roles of defects and size scale on mechanical response. Strengthening and toughening mechanisms in solids. Statics and time-dependent failures from microstructural and fracture mechanics viewpoints. Lectures and laboratories.
Prerequisites: MAT 033 and MAT 010

MAT 252 Electronic Properties of Materials 3 Credits
Electronic structure of materials, i.e., band and zone theory, is presented from a physical point of view. Electrical conductivity in metals, semiconductors, insulators and superconductors discussed. Simple semiconductor devices reviewed. Magnetic properties examined in the context of domain theory and applications. Optical and dielectric properties of semiconductors and ferroelectrics are considered.
Prerequisites: MAT 201 and MAT 203

MAT 268 Failure Analysis Reports 3 Credits
Application of chemical and mechanical failure concepts, microstructural analysis, and fracture surface characterization to the analysis and prevention of engineering component failures. Materials selection from databases of AISI standard alloys. Laboratory investigations on component failures using ASTM standard testing methods. Written and oral presentations of the results. Must have senior standing.
Prerequisites: MAT 204 and MAT 206 and MAT 214

MAT 300 Apprentice Teaching 3 Credits

MAT 309 (ME 309) Composite Materials 3 Credits
Principles and technology of composite materials. Processing, properties, and structural applications of composites, with emphasis on fiber-reinforced polymers.
Prerequisites: MAT 033 or MECH 003

MAT 310 Independent Study in Materials 1-3 Credits
Provides an opportunity for advanced, independent study of selected topics in materials science and engineering not covered in other formal courses.
Repeat Status: Course may be repeated.

MAT 314 (ME 314) Metal Forming Processes 3 Credits
Prerequisites: MAT 206

MAT 315 Physical Properties of Structural and Electronic Ceramics 3 Credits
Structure-property relationships in ceramics. Mechanical behavior including plasticity, hardness, elasticity, strength and toughening mechanisms. Thermal behavior including specific heat, thermal expansion, thermal conduction and thermal shock. Electrical behavior including application of tensors and crystal physics to electroceramics.
Prerequisites: MAT 214

MAT 316 Optical Properties of Materials 3 Credits
Interaction of electromagnetic waves with solid, liquid, and gaseous matter: reflection, refraction, polarization, diffraction, scattering, absorption, and luminescence. Factors determining the perceived color of metals, ceramics, polymers, and various nanostructured materials. Overview of the technological applications of optical materials in coatings, lighting, display technologies, lasers, solar cells, and optical communications. Credit will not be given for both MAT 316 and MAT 416.
Prerequisites: MAT 033

MAT 317 Imperfections in Crystals 3 Credits
The major types of crystal defects and their role in controlling the properties of materials. Point, line and planar defects, their atomic configurations and experimental techniques to study their characteristics. Emphasis on the role of dislocations and grain boundaries in the control of mechanical properties.
Prerequisites: MAT 203

MAT 319 Current Topics in Materials Science 3 Credits
Selected topics of current interest in the field of materials engineering but not covered in the regular courses. Consent of department required.
Repeat Status: Course may be repeated.

MAT 320 Analytical Methods in Materials Science 3 Credits
Selected topics in modern analysis and their application to materials problems in such areas as thermodynamics, crystallography, deformation and fracture, diffusion.
Prerequisites: MATH 231 or MATH 205

MAT 324 (BIOE 324) Introduction to Organic Biomaterials 3 Credits
Property, characterization, fabrication and modification of organic materials for biomedical and biological applications; host responses to biomaterials on the molecular, cellular and system level; general introduction to biosensors, drug delivery devices and tissue engineering. Consent of instructor required.
Prerequisites: BIOE 110 or MAT 204

MAT 325 (BIOE 325) Inorganic Biomaterials 3 Credits
Fabrication methods for biomedical implant and devices. Selection of metals and ceramics with specific bulk and surface physical as well as chemical properties. The role of materials chemistry and microstructure. Biocompatibility. Case studies (dental and orthopedic implants, stents, nonporous ceramic filters for kidney dialysis).
Prerequisites: MAT 033

MAT 326 (BIOE 326) Biomimetic and Bio-enabled Materials 3 Credits

MAT 327 Industrial Project 4 Credits
Restricted to a small group of seniors and graduate students selected by the department from those who apply. Two full days per week are spent on development projects at the plant of an area industry, under the direction of a plant engineer and with faculty supervision.

MAT 329 Industrial Project 4 Credits
To be taken concurrently with MAT 327. Material is the same as MAT 327.

MAT 332 Basics of Materials Science and Engineering 3 Credits
Physical and chemical principles applied to understanding the structure, properties, selection, fabrication, and use of engineering materials: metals, polymers, ceramics, composites and electronic materials. Case studies of materials used ranged from transportation systems to microelectronic devices. Lectures and individual study assigned by graduate advisor. Must have graduate student status. Consent of department required. Not available to students who have taken MAT 033 or equivalent.

MAT 333 Crystallography and Diffraction 3 Credits
Introduction to crystal symmetry, point groups, and space groups. Emphasis on materials characterization by x-ray diffraction and electron diffraction. Specific topics include crystallographic notation, stereographic projections, orientation of single crystal, textures, phase identification, quantitative analysis, stress measurement, electron diffraction, ring and spot patterns, convergent beam electron diffraction (CBED), and space group determination. Applications in mineralogy, metallurgy, ceramics, microelectronics, polymers, and catalysts. Lectures and laboratory work. Senior standing in chemistry.
Prerequisites: MAT 203 or EES 133

Lehigh University 2019-2020 421
MAT 334 (CHE 334) Electron Microscopy and Microanalysis 4 Credits
Fundamentals and experimental methods in electron optical techniques including scanning electron microscopy (SEM), conventional transmission (TEM) and scanning transmission (STEM) electron microscopy. Specific topics covered will include electron optics, electron beam interactions with solids, electron diffraction and chemical microanalysis. Applications to the study of the structure of materials are given. Consent of department required.

MAT 340 Research Techniques 3 Credits
Study and application of research techniques in materials science and engineering. Research opportunities, design of experimental programs, analysis of data, presentation of results. Selection of research topic and preparation and defense of research proposal. Restricted to a small number of students selected by the department from those who apply.

MAT 341 Undergraduate Research 3 Credits
Application of research techniques to a team-based project in materials science and engineering selected in consultation with the faculty and advised by at least one faculty member in Materials Science and Engineering. Thesis writing in consultation with faculty advisor and mentors. Preceded by MAT 340. Department permission required.

MAT 342 Inorganic Glasses 3 Credits
Definition, formation and structure of glass; common glass systems; manufacturing processes; optical, mechanical, electrical and dielectric properties; chemical durability; glass fibers and glass ceramics. Lectures and laboratories.

Prerequisites: MAT 033

MAT 345 Additive Manufacturing and Powder Metallurgy 3 Credits
Application of powder metallurgy in emerging technologies in the field of Additive Manufacturing (aka 3-D Printing). Metal powder fabrication and characterization methods. Powder processing including powder compaction, theory of compaction, press and die design, sintering, hot consolidation and additive manufacturing. Microstructure and properties of sintered materials and their relationship to processing conditions. Industrial applications. Emerging powder metallurgy technologies. Credit will not be given for both MAT 345 and MAT 445.

Prerequisites: MAT 206 or ISE 215 or ME 240

MAT 346 Physical Metallurgy of Welding 3 Credits

Prerequisites: MAT 216

MAT 355 Materials for Nanotechnology 3 Credits
An introduction to the nanoworld and how we observe the nanoworld through transmission electron microscopy. Other topics include: probing nanosurfaces, carbon as a nanomaterial, fullerences, carbon nanotubes, metal clusters, metal nanoparticle preparation, and directed self-assembly of nanoparticles. Also discussed are the thermal, chemical, electronic, optical, and magnetic properties of metal nanoparticles, nanowires, semiconductor nanoparticles, and inorganic nanoparticles.

Prerequisites: MAT 216

MAT 356 Strategies for Nanocharacterization 3 Credits
Lectures describe various nanocharacterization techniques in terms of which technique is best for specific measurements on nanostructures less than 100 nm in extent. Special attention is paid to spatial resolution and detection limits for SEM, TEM, X-ray analysis, diffraction analysis, ion beam techniques, surface techniques, AFM and other SPMs, and light microscopies and spectroscopies.

MAT 359 Thin Film Deposition, Processing, and Characterization 3 Credits
Thin films are at the heart of electronics, optics, medicine, and nanotechnology. Fundamental and applied aspects of thin film deposition, processing, and characterization. Growth methods including physical and chemical deposition techniques. Equipment and hardware for deposition and analysis. Structural, mechanical, electronic, and chemical properties of films. Processing methods and their relationship to specific applications. Must have Junior or Senior level standing.

MAT 363 Computational Methods in Science and Engineering 3 Credits
Computer simulation of systems at various length and time scales. Atomistic simulation (molecular dynamics and Monte Carlo) methods are presented and applied to models described by simple interatomic potentials. Mesoscale simulation is described in the context of domain growth and, at the continuum scale, finite-difference and finite-element methods are employed to model heat conduction and mass diffusion. Lecture and computer laboratory sessions. Credit will not be given for both MAT363 and MAT463.

MAT 386 Polymer Nanocomposites 3 Credits
Synthesis, morphology and properties of polymer nanocomposites. Comparisons with traditional particulate composites will be made and models predicting properties will be emphasized. Melt viscosity, mechanical properties, barrier properties and flame retardancy will be discussed. Credit is not given for both MAT 386 and MAT 486.

Prerequisites: MAT 204 or MAT 393

MAT 388 (CHE 388, CHM 388) Polymer Synthesis and Characterization Laboratory 3 Credits
Techniques include: free radical and condensation polymerization; molecular weight distribution by gel chromatography; crystallinity and order by differential scanning calorimetry; pyrolysis and gas chromatography; dynamic mechanical and dielectric behavior; morphology and microscopy; surface properties. Must have senior level standing in chemical engineering, chemistry, or materials science and engineering.

Prerequisites: CHM 341 and CHM 110

MAT 392 (CHE 392) Introduction to Polymer Science 3 Credits
Introduction to concepts of polymer science. Kinetics and mechanism of polymerization, synthesis and processing of polymers, characterization. Relationship of molecular conformation, structure and morphology to physical and mechanical properties.

MAT 393 (CHE 393, CHM 393) Physical Polymer Science 3 Credits
Structural and physical aspects of polymers (organic, inorganic, natural). Molecular and atomic basis for polymer properties and behavior. Characteristics of glassy, crystalline, and paracrystaline states (including viscoelastic and relaxation behavior) for single-and multi-component systems. Thermodynamics and kinetics of transition phenomena. Structure, morphology, and behavior. Available to graduate and undergraduate students (with senior level standing) in CHE, CHEM or MAT.

MAT 401 Thermodynamics and Kinetics 4 Credits
Integrated treatment of the fundamentals of thermodynamics, diffusion and kinetics, as related to materials processes including both hard and soft materials. Laws of thermodynamics, conditions of equilibrium, free energies, statistical thermodynamics, thermodynamics of surfaces, bulk and grain-boundary diffusion, nucleation, spinodal decomposition, and reaction kinetics.

MAT 402 (ME 402) Advanced Manufacturing Science 3 Credits
The course focuses on the fundamental science-base underlying manufacturing processes, and applying that science base to develop knowledge and tools suitable for industrial utilization. Selected manufacturing processes representing the general classes of material removal, material deformation, material phase change, material flow, and material joining are addressed. Students create computer-based process simulation tools independently as well as utilize leading commercial process simulation packages. Laboratory experiences are included throughout the course.

MAT 403 Structure/Property Relations 4 Credits
Structure of materials and relationship to properties. Crystal structures and crystalline defects, structure in biological systems, amorphous materials, microstructure, and relationships to mechanical and other properties.

MAT 406 Solidification 3 Credits
Structure, theory and properties of liquids. Homogeneous and heterogeneous nucleation theory and experimental results. Solidification phenomena in pure, single and multiphase materials including the nature of the freezing interface, segregation, constitutional supercooling, dendritic growth, crystallographic effects, the origin of defects, crystal growing, zone processes. Consent of department chair required.
MAT 409 Current Topics in Materials 3 Credits
Recent practical and theoretical developments in materials. This course may be repeated for credit if new material is covered. Consent of department required.
Repeat Status: Course may be repeated.

MAT 414 Metal Forming Processes 3 Credits
Prerequisites: MAT 206

MAT 415 Mechanical Behavior of Ceramic Solids 3 Credits
Strength, elasticity, creep, thermal stress fracture, hardness, abrasion and high-temperature deformation characteristics of single- and multicomponent brittle ceramic solids. Statistical theories of strength, static and cyclic fatigue, crack propagation, fracture toughness. Correlation of mechanical behavior, microstructure, and processing parameters.

MAT 416 Optical Properties of Materials 3 Credits
Interaction of electromagnetic waves with solid, liquid, and gaseous matter: reflection, refraction, polarization, diffraction, scattering, absorption, and luminescence. Factors determining the perceived color of metals, ceramics, polymers, semiconductors, biomaterials, and various nanostructured materials. Overview of the technological applications of optical materials in coatings, lighting, display technologies, lasers, solar cells, and optical communications. Additional coursework work will be required of students seeking the graduate level qualification. Credit will not be given for both MAT 316 and MAT 416.
Prerequisites: MAT 033

MAT 423 Advanced Transmission Electron Microscopy 4 Credits
The theory and practice of operation of the transmission and scanning transmission electron microscope. Techniques covered include bright field, high resolution and weak-beam dark field, lattice imaging, diffraction pattern indexing and Kikuchi line analysis. The theory of diffraction contrast is applied to the interpretation of electron micrographs. Specimen preparation techniques.
Prerequisites: MAT 334

MAT 424 (BIOE 424) Introduction to Organic Biomaterials 3 Credits
Property, characterization, fabrication, and modification of organic materials for biomedical and biological applications; host responses to biomaterials on the molecular, cellular, and system level; general introduction to biosensors, drug delivery, and tissue engineering. Graduate version of MAT 324 requiring additional assignments. Credit is not given for both MAT 324 (BioE 324) and MAT 424 (BioE 424).
Prerequisites: MAT 033

MAT 425 (BIOE 425) Inorganic Biomaterials 3 Credits
Fabrication methods for biomedical implant and devices. Selection of metals and ceramics with specific bulk and surface physical as well as chemical properties. The role of materials chemistry and microstructure. Biocompatibility. Case studies (dental and orthopedic implants, stents, nonporous ceramic filters for kidney dialysis). Graduate version of MAT 325; credit will not be given for both MAT 325 and MAT 425.
Prerequisites: MAT 033

MAT 426 (BIOE 426) Biomimetic and Bio-enabled Materials 3 Credits
This course is a graduate version of MAT 326 (BIOE 326). While the lecture content will be the same as the 300-level course, students enrolled in MAT 426 (BIOE 426) will have more advanced assignments. Closed to students who have taken MAT 326 (BIOE 326). Requirements: Graduate standing in Bioengineering or Materials Science and Engineering.

MAT 427 Advanced Scanning Electron Microscopy 4 Credits
The theory and practice of operation of the scanning electron microscope and electron microprobe. Techniques covered will include high-resolution scanning, quantitative electron probe microanalysis. Electron beam sample interactions, X-ray spectrometry, and electron optics will be discussed in detail.
Prerequisites: MAT 334

MAT 430 Glass Science 3 Credits
Definition and formation of glass. Structure of common inorganic (including metallic) and polymeric glass systems. Methods of glass making. Phase separation of devitrification. Physical properties including diffusion, electrical conductivity, chemical durability, and optical and mechanical properties. Special products including glass ceramics, optical fibers, photosensitive glasses, etc. Visit to a glass manufacturing plant may also be included.

MAT 431 Sintering Theory and Practice 3 Credits
Science and technology of the sintering of solid-state materials. Driving force and variables. Critical review of the sintering models. Coverage of single phase, multiphase and composite systems. Special sintering techniques such as fast firing, rate controlled sintering, hot pressing and transient second-phase sintering. Sintering of specific ceramic and metal systems.

MAT 442 Inorganic Glasses 3 Credits
Definition, formation and structure of glass; common glass systems; manufacturing processes; optical, mechanical, electrical and dielectric properties; chemical durability; glass fibers and glass ceramics. Lectures and laboratories. Credit is not given for both MAT 342 and MAT 442.

MAT 443 (CHM 443) Solid-State Chemistry 3 Credits
This solid state chemistry course will introduce students into symmetry of extended solids, X-ray crystallography of solids, crystal structures, band theory, electronic and ionic conductivity in solids, defects in solids, silicate chemistry and nonporous solids.

MAT 445 Additive Manufacturing and Powder Metallurgy 3 Credits
Application of powder metallurgy in emerging technologies in the field of Additive Manufacturing (aka 3-D Printing). Metal powder fabrication and characterization methods. Powder processing including powder compaction, theory of compacting, press and die design, sintering, hot consolidation and additive manufacturing. Microstructure and properties of sintered materials and their relationship to processing conditions. Industrial applications. Emerging powder metallurgy technologies. Graduate version of MAT 345 requiring additional assignments. Credit is not given for both MAT 345 and MAT 445.

MAT 445 Materials for Nanotechnology 3 Credits
An introduction to the nanoworld and how we observe the nanoworld through transmission electron microscopy. Other topics include: probing nanosurfaces, carbon as a nanomaterial, fullerences, carbon nanotubes, metal clusters, metal nanoparticle preparation, and directed self-assembly of nanoparticles. Also discussed are the thermal, chemical, electronic, optical, and magnetic properties of metal nanoparticles, nanowires, semiconductor nanoparticles, and inorganic nanoparticles.

MAT 456 Strategies for Nanocharacterization 3 Credits
Lectures describe various nanocharacterization techniques in terms of which technique is best for specific measurements on nanostructures less than 100 nm in extent. Special attention is paid to spatial resolution and detection limits for SEM, TEM, X-ray analysis, diffraction analysis, ion beam techniques, surface techniques, AFM and other SPMs, and light microscopies and spectroscopies.

MAT 459 Thin Film Deposition, Processing, and Characterization 3 Credits
Thin films are at the heart of electronics, optics, medicine, and nanotechnology. Fundamental and applied aspects of thin film deposition, processing, and characterization. Growth methods including physical and chemical deposition techniques. Equipment and hardware for deposition and analysis. Structural, mechanical, electronic, and chemical properties of films. Processing methods and their relationship to specific applications. Graduate version of MAT 359 with extra assignments for graduate students. Credit will not be given for both MAT 359 and MAT 459.
MAT 460 Engineering Project 1-6 Credits
In-depth study of a problem in the area of materials engineering or design. The study is to lead to specific conclusions and be embodied in a written report. Intended for candidates for the M.Eng.
Repeat Status: Course may be repeated.

MAT 462 Independent Study 1-4 Credits
An intensive study, with report, of a topic in materials science and engineering which is not treated in other courses. Consent of instructor required.
Repeat Status: Course may be repeated.

MAT 463 Computational Methods in Science and Engineering 3 Credits
Computer simulation of systems at various length and time scales. Atomistic simulation (molecular dynamics and Monte Carlo) methods are presented and applied to models described by simple interatomic potentials. Mesoscale simulation is described in the context of domain growth and, at the continuum scale, finite-difference and finite-element methods are employed to model heat conduction and mass diffusion. Lecture and computer laboratory sessions. Extra assignments provided to graduate students. Credit will not be given for both MAT363 and MAT463.

MAT 482 (CHE 482, CHM 482) Mechanical Behaviors of Polymers 3 Credits
A treatment of the mechanical behavior of polymers. Characterization of experimentally observed viscoelastic response of polymeric solids with the aid of mechanical model analogs. Topics include time-temperature superposition, experimental characterization of large deformation and fracture processes, polymer adhesion, and the effects of fillers, plasticizers, moisture and aging on mechanical behavior.

MAT 483 (CHE 483, CHM 483) Emulsion Polymers 3 Credits
Examination of fundamental concepts important in the manufacture, characterization, and application of polymer latexes. Topics to be covered will include colloid stability, polymerization mechanisms and kinetics, reactor design, characterization of particle surfaces, latex rheology, morphology considerations, polymerization with functional group copolymerization, film formation and various application problems.

MAT 485 (CHE 485, CHM 485) Polymer Blends and Composites 3 Credits
Synthesis, morphology, and mechanical behavior of polymer blends and composites. Mechanical blends, block and graft copolymers, interpenetrating polymer networks, polymer impregnated concrete, and fiber and particulate reinforced polymers are emphasized. Must have completed any introductory polymer course or equivalent.

MAT 486 Polymer Nanocomposites 3 Credits
Synthesis, morphology and properties of polymer nanocomposites. Comparisons with traditional particulate composites will be made and models predicting properties will be emphasized. Melt viscosity, mechanical properties, barrier properties and flame retardancy will be discussed. This course is a version of MAT 386 for graduate students, with additional research projects and advanced assignments. Closed to students who have taken MAT 386. Credit is not given for both MAT 386 and MAT 486.

Prerequisites: MAT 204 or MAT 393

MAT 487 Adhesion and Adhesives Technology 3 Credits
Basics of intermolecular forces, surface science, and mechanics of materials and how these relate to adhesion. Processing and design of adhesive joints. Formulation and behavior of pressure sensitive and structural adhesives. Background in polymers is helpful.

MAT 490 Thesis 1-6 Credits
Repeat Status: Course may be repeated.

MAT 492 (CHE 492, CHM 492) Topics in Polymer Science 1-3 Credits
Intensive study of topics selected from areas of current research interest such as morphology and mechanical behavior, thermodynamics and kinetics of crystallization, new analytical techniques, molecular weight distribution, non-Newtonian flow behavior, second-order transition phenomena, novel polymer structures. Credit above three hours is granted only when different material is covered.

MAT 499 Dissertation 1-15 Credits
Repeat Status: Course may be repeated.

Mechanical Engineering and Mechanics

OUR MISSION
The mission of the Department of Mechanical Engineering and Mechanics is to provide quality education and training to undergraduate and graduate students, to develop new knowledge and engineering methodology through research, and to provide service to industry and society at large.

The undergraduate program provides students with the basic education they will need to function in an engineering environment, pursue graduate studies, continue their professional development, and establish an awareness of the culture and society in which we live. Because of technological innovations and the long term demands of global competition, the department seeks to prepare our students to adapt to the rapid advances and changes in technology, and to serve as agents and leaders in effecting these changes, while being cognizant of the needs and concerns of the society at large.

The graduate program bridges between the generalized undergraduate studies and the more focused research and remarkable accomplishments of our faculty. New graduate students participate in research by working closely with their faculty advisors; however, they are quickly encouraged to work and think independently, assuming greater responsibility for critical research functions. This learning process prepares the students for future research and development positions in industry or academia, where they can contribute toward the improvement and advancement of the community and society at large.

Professors. John P. Coulter, PHD (University of Delaware); John N. DuPont, PHD (Lehigh University); Patrick V. Farrell, PHD (University of Michigan); Joachim L. Grenestedt, DSC (Royal Institute of Technology); D. Gary Harlow, PHD (Cornell University); Jacob Y. Kazakia, PHD (Lehigh University); Yaling Liu, PHD (Northwestern University); Wojciech Z. Misiolek, DSC (AGH University Science & Technology); Herman F. Nied, PHD (Lehigh University); Alparslan Oztekin, PHD (University of Illinois at Urbana-Champaign); Donald O. Rockwell, Jr., PHD (Lehigh University); Eugenio Schuster, PHD (University of California, San Diego); Arkady Voloshin, PHD (Tel Aviv University)

Associate Professors. Arindam Banerjee, PHD (Texas A&M University); Meng-Sang Chew, PE (University of Virginia); Brandon A. Kric, PHD (University of Florida); Nader Motee, PHD (University of Pennsylvania); Noel Duke Pereira, PHD (University of California Los Angeles); Edmund B. Webb, III, PHD (Rutgers University); Xiaohui Zhang, PHD (University of Miam)

Assistant Professors. Ganesh Balasubramanian, PHD (Virginia Polytechnic Institute and State University); Subhrajit Bhattacharya, PHD (University of Pennsylvania); Hannah Lee Dailey, PHD (Lehigh University); Justin Jaworski, PHD (Duke University); Keith W. Moored, III, PHD (University of Virginia); Cristian Ioan Vasile, PHD (Boston University); Natasha Vermaak, PHD (University of California, Santa Barbara)

Professors Of Practice. David C. Angstadt, PHD (Lehigh University); William Andrew Best, MS (Virginia Polytechnic Institute and State University); Marc de Vinck, BFA (Parsons School of Design); Christina Vlau Haden, PHD (University of Virginia); Terry J. Hart, MS (Rutgers University); Michael Lehman, MD (Penn State College of Medicine); Murat Ozturk, PHD (Lehigh University); Marsha Wender Timmerman, MS (Rutgers University)
Program graduates are expected, three to five years from graduation, to:
1. Successfully practice mechanical engineering and/or pursue advanced education, possibly towards other professions such as law, medicine, business, etc.
2. Participate at varying degrees in research and development, and other creative efforts in science, engineering, technology and/or technological entrepreneurship.
3. Engage in activities that demonstrate a commitment to professionalism and personal development and demonstrate leadership qualities.

By "successfully practice mechanical engineering" we mean:
• Advancement in careers in Mechanical, other Engineering, or careers such as health care, consulting, entrepreneurship, finance, management etc. assuming the utilization of basic engineering and science/mathematics principles and/or methodology taught in an ME program.
• Assuming increased levels of responsibility is a clear indicator of success.
• Effective communication with peers and working/leading diverse multi-disciplinary teams.
• Recognizing the global, societal and ethical contexts of their work.

In order to achieve these objectives the ME program ensures that its graduates are capable of the Student Outcomes (1-7) proposed by the accreditation organization ABET and adopted verbatim by the Lehigh University ME program. These outcomes are:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Achievement of the aforementioned educational objectives is served first through a sound education in mathematics, physics, and engineering sciences; second, by exposure to the engineering process (creation, innovation, analysis, and judgment) through design courses, projects, laboratories, and a choice of technical electives that permits a degree of specialization; and third, by the development of cultural awareness through courses in humanities and social sciences. Students may also take elective courses that transcend traditional disciplinary lines, while still satisfying the requirements for mechanical engineering.

The curriculum leading toward the bachelor of science in mechanical engineering combines a broad base in mathematics, physics sciences, and the engineering sciences (mechanics of solids, materials, dynamics and fluid, thermal and electrical sciences), including laboratory. Special emphasis is placed on the practice of modern Integrated Product Development, combining state-of-the-art computer aided design and manufacturing methods in a business oriented framework. Several specific application fields are chosen toward the end of the program in the form of four or more courses elected from a wide variety of 300-level offerings. Courses in mechanical engineering and engineering mechanics are equally available.

The course requirements for a B.S. degree in mechanical engineering are listed below. In addition to required mathematics, physics, chemistry and basic engineering courses, the program includes a minimum of seven courses in humanities and social sciences (see humanities/social sciences), two free electives and five approved electives. The total graduation requirement is 129 credits.

**UNDERGRADUATE CURRICULUM IN MECHANICAL ENGINEERING**

### First Year

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Credits</th>
<th>Second Semester</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 001 (Composition &amp; Literature)</td>
<td>3</td>
<td>ENGL 002 (Composition &amp; Literature II)</td>
<td>3</td>
</tr>
<tr>
<td>MATH 021 (Calculus I)</td>
<td>4</td>
<td>MATH 022 (Calculus II)</td>
<td>4</td>
</tr>
<tr>
<td>ENGR 005 (Introduction to Engineering Practice)</td>
<td>2</td>
<td>ECO 1 or HSS elective</td>
<td>4</td>
</tr>
</tbody>
</table>

Select one of the following: 5-6  
Select one of the following: 5-6

| ENGR 010 & CHM 030 | 1 |
| PHY 011 & PHY 012 (Introductory Physics I and Lab) | 1 |

14-15  
16-17

### Second Year

<table>
<thead>
<tr>
<th>First Semester</th>
<th>Credits</th>
<th>Second Semester</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 010 (Graphics for Engineering Design)</td>
<td>3</td>
<td>ME 104 (Thermodynamics I)</td>
<td>3</td>
</tr>
<tr>
<td>MECH 003 (Fundamentals of Engineering Mechanics)</td>
<td>3</td>
<td>MECH 012 (Strength of Materials)</td>
<td>3</td>
</tr>
<tr>
<td>ME 017 (Numerical Methods in ME)</td>
<td>2</td>
<td>MATH 205 (Linear Methods)</td>
<td>3</td>
</tr>
</tbody>
</table>
ME 031 (Engineering Elective A: Select one of the following for 3 credits)

ME 207 (Fluid Mechanics) 3
ME 321 (Advanced Mechanics of Materials (Fall Semester)) 3
ME 343 (Control Systems (Fall Semester)) 4
ME 352 (Advanced Dynamics (Spring Semester)) 3
ME 380 (Advanced Mechanics of Materials (Fall Semester)) 3
ME 382 (Mechanical Engineering Laboratory III) 2
ME 385 (Advanced Mechanics of Materials (Fall Semester)) 3
ME 400 (Engineering Practice) 3
ME 407 (Mechanical Engineering Laboratory IV) 2
ME 410 (Advanced Dynamics (Spring Semester)) 3
ME 415 (Mechanical Engineering Laboratory IV) 2
ME 420 (Advanced Fluid Mechanics) 3
ME 425 (Engineering Practice) 3
ME 430 (Advanced Mechanics of Materials (Fall Semester)) 3
ME 435 (Mechanical Engineering Laboratory IV) 2
ME 440 (Advanced Dynamics (Spring Semester)) 3
ME 445 (Mechanical Engineering Laboratory IV) 2
ME 450 (Advanced Fluid Mechanics) 3
ME 455 (Mechanical Engineering Laboratory IV) 2
ME 460 (Advanced Mechanics of Materials (Fall Semester)) 3
ME 465 (Mechanical Engineering Laboratory IV) 2
ME 470 (Advanced Dynamics (Spring Semester)) 3
ME 475 (Mechanical Engineering Laboratory IV) 2
ME 480 (Advanced Fluid Mechanics) 3
ME 485 (Mechanical Engineering Laboratory IV) 2
ME 490 (Advanced Mechanics of Materials (Fall Semester)) 3
ME 495 (Mechanical Engineering Laboratory IV) 2
ME 500 (Advanced Dynamics (Spring Semester)) 3
ME 505 (Mechanical Engineering Laboratory IV) 2
ME 510 (Advanced Fluid Mechanics) 3
ME 515 (Mechanical Engineering Laboratory IV) 2
ME 520 (Advanced Mechanics of Materials (Fall Semester)) 3
ME 525 (Mechanical Engineering Laboratory IV) 2
ME 530 (Advanced Dynamics (Spring Semester)) 3
ME 535 (Mechanical Engineering Laboratory IV) 2
ME 540 (Advanced Fluid Mechanics) 3
ME 545 (Mechanical Engineering Laboratory IV) 2
ME 550 (Advanced Mechanics of Materials (Fall Semester)) 3
ME 555 (Mechanical Engineering Laboratory IV) 2
ME 560 (Advanced Dynamics (Spring Semester)) 3
ME 565 (Mechanical Engineering Laboratory IV) 2
ME 570 (Advanced Fluid Mechanics) 3
ME 575 (Mechanical Engineering Laboratory IV) 2
ME 580 (Advanced Mechanics of Materials (Fall Semester)) 3
ME 585 (Mechanical Engineering Laboratory IV) 2
ME 590 (Advanced Dynamics (Spring Semester)) 3
ME 595 (Mechanical Engineering Laboratory IV) 2
ME 600 (Advanced Fluid Mechanics) 3
ME 605 (Mechanical Engineering Laboratory IV) 2
ME 610 (Advanced Mechanics of Materials (Fall Semester)) 3
ME 615 (Mechanical Engineering Laboratory IV) 2
ME 620 (Advanced Dynamics (Spring Semester)) 3
ME 625 (Mechanical Engineering Laboratory IV) 2
ME 630 (Advanced Fluid Mechanics) 3
ME 635 (Mechanical Engineering Laboratory IV) 2
ME 640 (Advanced Mechanics of Materials (Fall Semester)) 3
ME 645 (Mechanical Engineering Laboratory IV) 2
ME 650 (Advanced Dynamics (Spring Semester)) 3
ME 655 (Mechanical Engineering Laboratory IV) 2
ME 660 (Advanced Fluid Mechanics) 3
ME 665 (Mechanical Engineering Laboratory IV) 2
ME 670 (Advanced Mechanics of Materials (Fall Semester)) 3
ME 675 (Mechanical Engineering Laboratory IV) 2
ME 680 (Advanced Dynamics (Spring Semester)) 3
ME 685 (Mechanical Engineering Laboratory IV) 2
ME 690 (Advanced Fluid Mechanics) 3
ME 695 (Mechanical Engineering Laboratory IV) 2
ME 700 (Advanced Mechanics of Materials (Fall Semester)) 3
ME 705 (Mechanical Engineering Laboratory IV) 2
ME 710 (Advanced Dynamics (Spring Semester)) 3
ME 715 (Mechanical Engineering Laboratory IV) 2
ME 720 (Advanced Fluid Mechanics) 3
ME 725 (Mechanical Engineering Laboratory IV) 2
ME 730 (Advanced Mechanics of Materials (Fall Semester)) 3
ME 735 (Mechanical Engineering Laboratory IV) 2
ME 740 (Advanced Dynamics (Spring Semester)) 3
ME 745 (Mechanical Engineering Laboratory IV) 2
ME 750 (Advanced Fluid Mechanics) 3
ME 755 (Mechanical Engineering Laboratory IV) 2
ME 760 (Advanced Mechanics of Materials (Fall Semester)) 3
ME 765 (Mechanical Engineering Laboratory IV) 2
ME 770 (Advanced Dynamics (Spring Semester)) 3
ME 775 (Mechanical Engineering Laboratory IV) 2
ME 780 (Advanced Fluid Mechanics) 3
ME 785 (Mechanical Engineering Laboratory IV) 2
ME 790 (Advanced Mechanics of Materials (Fall Semester)) 3
ME 795 (Mechanical Engineering Laboratory IV) 2
ME 800 (Advanced Dynamics (Spring Semester)) 3
ME 805 (Mechanical Engineering Laboratory IV) 2
ME 810 (Advanced Fluid Mechanics) 3
ME 815 (Mechanical Engineering Laboratory IV) 2
ME 820 (Advanced Mechanics of Materials (Fall Semester)) 3
ME 825 (Mechanical Engineering Laboratory IV) 2
ME 830 (Advanced Dynamics (Spring Semester)) 3
ME 835 (Mechanical Engineering Laboratory IV) 2
ME 840 (Advanced Fluid Mechanics) 3
ME 845 (Mechanical Engineering Laboratory IV) 2
ME 850 (Advanced Mechanics of Materials (Fall Semester)) 3
ME 855 (Mechanical Engineering Laboratory IV) 2
ME 860 (Advanced Dynamics (Spring Semester)) 3
ME 865 (Mechanical Engineering Laboratory IV) 2
ME 870 (Advanced Fluid Mechanics) 3
ME 875 (Mechanical Engineering Laboratory IV) 2
ME 880 (Advanced Mechanics of Materials (Fall Semester)) 3
ME 885 (Mechanical Engineering Laboratory IV) 2
ME 890 (Advanced Dynamics (Spring Semester)) 3
ME 895 (Mechanical Engineering Laboratory IV) 2
ME 900 (Advanced Fluid Mechanics) 3
ME 905 (Mechanical Engineering Laboratory IV) 2
ME 910 (Advanced Mechanics of Materials (Fall Semester)) 3
ME 915 (Mechanical Engineering Laboratory IV) 2
ME 920 (Advanced Dynamics (Spring Semester)) 3
ME 925 (Mechanical Engineering Laboratory IV) 2
ME 930 (Advanced Fluid Mechanics) 3
ME 935 (Mechanical Engineering Laboratory IV) 2
ME 940 (Advanced Mechanics of Materials (Fall Semester)) 3
ME 945 (Mechanical Engineering Laboratory IV) 2
ME 950 (Advanced Dynamics (Spring Semester)) 3
ME 955 (Mechanical Engineering Laboratory IV) 2
ME 960 (Advanced Fluid Mechanics) 3
ME 965 (Mechanical Engineering Laboratory IV) 2
ME 970 (Advanced Mechanics of Materials (Fall Semester)) 3
ME 975 (Mechanical Engineering Laboratory IV) 2
ME 980 (Advanced Dynamics (Spring Semester)) 3
ME 985 (Mechanical Engineering Laboratory IV) 2
ME 990 (Advanced Fluid Mechanics) 3
ME 995 (Mechanical Engineering Laboratory IV) 2

**Total Credits Required: 129**
Senior year Required/Technical-Elective courses total 23 credits according to the following schedule:

- ME 321 Introduction to Heat Transfer (For 3 credits; available Fall or Spring) 3
- ME 207 Mechanical Engineering Laboratory III (For 2 credits; available Fall or Spring) 2
- MECH 302 Advanced Dynamics (Spring Semester) 6
- MECH 305 Advanced Mechanics of Materials (Fall Semester) 2
- ME 304 Thermodynamics II (Fall Semester) 3
- ME 322 Gas Dynamics (Spring Semester) 3
- ME 331 Advanced Fluid Mechanics (Fall Semester) 3
- ME 343 Control Systems (Fall Semester) 3

Engineering Elective B: Select two of the following, for 6 credits:

- ME 300 Methods of Applied Analysis II 3
- ME 310 Nonlinear Systems 3

From any ME or MECH three-hundred-level course, excluding ME 300 and ME 310 12

Total Credits: 23

4 Total Credits Required: 127

*Co-op students must take ME 021 sophomore year, second semester (18-19 credit hours). Co-op students will take ME 231 (3), MECH 102 (3), and two HSS electives (6-8) during the summer. See Co-op program for details.

Typical recommended options:

**Applied Mathematics and Computational Mechanics**
- MECH 305 Advanced Mechanics of Materials 3
- MECH 312 Finite Element Analysis 3
- MATH 309 Theory of Probability 3
- MATH 322 Methods of Applied Analysis I 3
- MATH 323 Methods of Applied Analysis II 3

**Solid Mechanics**
- MECH 305 Advanced Mechanics of Materials 3
- MECH 307 Mechanics of Continua 3
- MECH 312 Finite Element Analysis 3
- MECH 313 Fracture Mechanics 3
- MATH 322 Methods of Applied Analysis I 3

**Engineering Materials**
- MECH 305 Advanced Mechanics of Materials 3
- MECH 313 Fracture Mechanics 3
- MAT 218 Mechanical Behavior of Macro/Micro Materials 3
- PHY 031 Introduction to Quantum Mechanics 3
- PHY 363 Physics of Solids 3

**Fluid Mechanics**
- MECH 331 Advanced Fluid Mechanics 3
- ME 322 Gas Dynamics 3
- MECH 326 Aerodynamics 3
- MATH 322 Methods of Applied Analysis I 3

**MINOR IN AEROSPACE ENGINEERING**

The minor in aerospace engineering provides a foundation for students who intend to pursue a career in the aerospace industry. This minor will also provide sufficient technical background in aerospace studies for undergraduates who plan to enter graduate programs in this field. The minor requires a minimum of 15 credits from the following course selection:

**Required Courses**
- ME 255 Introduction to Aerospace Engineering 3
- MECH 326 Aerodynamics 3
- MECH 328 Fundamentals of Aircraft Design 3

**Elective Courses**
MINOR IN ENERGY ENGINEERING

The minor in energy engineering touches upon the technologies associated with the transformation and use of energy in various forms. Since every sector of engineering and the economy require energies of one form or another, the courses included in this minor program will permit student exposure to fossil, nuclear and renewable energy technologies. The mechanical engineering curriculum provides the fundamental knowledge in thermodynamics, fluid mechanics and other related areas leading up to the courses for the energy engineering minor. The courses offer a wide variety of topics including fundamental, analytical and design aspects of energy conservation as well as various forms of energy used in power generation, transportation and industry.

The minor in energy engineering requires a minimum of 15 credits, which must be taken from MEM offerings. The minor in energy primarily intended for ME Majors but students with other majors, particularly Chemical engineering will be able to take some or all the related courses. Four courses are required with some degree of choice and an additional course must be selected from a broader set.

**Required course**

**ME 304** Thermodynamics II 3

**Elective Energy Courses**

Select at least three of the following:

**ME 360** Nuclear Reactor Engineering
**ME 362** Nuclear Fusion and Radiation Protection
**ME 364** Renewable Energy
**ME 366** Engineering Principles of Clean Coal Technology

**Additional Electives**

Select one of the following:

**CHE 373** Fundamentals of Air Pollution
**CHE/ME 376** Energy: Issues & Technology
**CHE 386** Process Control
**ME 322** Gas Dynamics
**ME 331** Advanced Fluid Mechanics
**ME 343** Control Systems

Other Energy related 300 level courses with the approval of the ME Dept. Chair.

Total Credits 15

GRADUATE PROGRAMS

The Department offers programs of study leading to the degrees of Master of Science and Doctor of Philosophy in Mechanical Engineering.

The mission of the Department of Mechanical Engineering and Mechanics is to provide quality education and training to undergraduate and graduate students, to develop new knowledge and engineering methodology through research, and to provide service to industry and society at large.

Consistent with the above mission statement, the education components of the graduate programs strive to:

- Educate graduate students to a level of Mechanical Engineering higher to that of the high quality undergraduate program. This level is mainly defined by the content and scope of the core courses offered.
- Enable students to engage in advanced study and research with scholars on a variety of topics relating to Mechanical Engineering.
- Familiarize students with issues relating to support, funding and presentation of research results and products.

In addition to the foregoing objectives, the presence of graduate programs and students has additional, beneficial effects on the goals of the Department and the University, such as:

- Interaction of undergraduate students with a diverse body of highly motivated learners.
- Increase in the efficiency of actual basic and applied research.
- Continuous incentive for improvement in the methods and material taught to graduate and undergraduate students.

Subject to approval, courses from other engineering curricula, such as electrical engineering, industrial engineering, materials science and engineering, chemical engineering, civil and environmental engineering, and computer science and engineering, together with courses in mathematics and engineering mathematics, may be included in the degree program.

MASTERS DEGREE PROGRAM

The Department of Mechanical Engineering and Mechanics offers a Master of Science degree which requires 30 credit hours of graduate work (audit courses may not be used towards the degree) and must satisfy the following University course distribution requirements, as outlined in the RCEAS Graduate Student Handbook. The minimum program for all Masters degrees includes:

- Not less than 24 credits of 300- and 400-level coursework of which at least 18 hours is at the 400-level. Thesis credits count as part of the 400-level requirement.
- Not less than 18 credit hours in Mechanical Engineering and Mechanics.
- Not less than 15 credit hours of 400-level coursework in Mechanical Engineering and Mechanics.
• No course below the 300-level in Mechanical Engineering and Mechanics can be used toward the degree; however, two courses (6 credits) outside of the department, but in the engineering field, at level 200 and above, may apply, with approval from a student's advisor and the Departmental Graduate Committee.

Master of Science in Mechanical Engineering

The Master of Science degree in Mechanical Engineering requires a total of 30 credits with a minimum of 18 credits in Mechanical Engineering and Mechanics. The courses taken for the MS degree must satisfy both the core course requirements and the University course distribution requirements. Three core courses must be taken, corresponding to a total of 9 credits. In addition, the student selects three other MEM courses (9 credits) at the 300 and 400 level. The remaining 12 credits are free electives approved by the Graduate Program Coordinator or the Student’s Advisor such that all courses for the MS degree satisfy the distribution requirements of the University Masters Level Degree. Under circumstances where the student arrives at Lehigh with an excellent academic record of graduate study at another (peer) institution, and subject to an approval process within the Department, alternative courses may be substituted for selected core courses.

Group I: Required Core Course in Engineering Mathematics: 3
ME 452 Mathematical Methods In Engineering I

Group II: Required Core Course in Mechanical Engineering (2 courses): 6
ME 413 Numerical Methods in Mechanical Engineering
ME 423 Heat and Mass Transfer
ME 430 Advanced Fluid Mechanics
ME 433 Linear Systems and Control
ME 453 Mathematical Methods in Engineering II
MECH 406 Fundamentals of Solid Mechanics
MECH 425 Analytical Methods in Dynamics and Vibrations
ME 401 or ME 402 Integrated Product Development or Advanced Manufacturing Science

Group III: Three other MEM courses at the 300 and 400 level. (Only one course may be at the 300 level). 9
Group IV: up to 4 free electives (12 credits) approved by the Graduate Program Coordinator or the Student's Advisor 12

Doctor of Philosophy in Mechanical Engineering

The Ph.D. program in Mechanical Engineering and Mechanics requires innovative research in collaboration with one or more faculty members, along with the completion of 72 credit hours beyond the bachelor’s degree (if graduate study is carried out entirely at Lehigh University), or 48 beyond the master’s degree (obtained at another university). The first stage of Ph.D. candidacy in Mechanical Engineering and Mechanics is attained by achieving a minimum GPA of 3.35 in five core courses (see core course requirements in the table below). Ph.D. students must also take ME 453, which can either be taken as part of the five core course requirement or taken as an additional course. Under circumstances where the student arrives at Lehigh with an excellent academic record of graduate study at another (peer) institution, and subject to an approval process within the Department, alternative courses may be substituted for selected core courses. The second stage of candidacy involves completion of a General Examination, which is based on an assessment of research topic, formulation of a research proposal, and completion of an associated oral examination. Formal University candidacy for the Ph.D. is granted upon submittal of a proposal for the dissertation research and recommendation of the doctoral committee followed by approval of the Rossin College of Engineering and Applied Science. Coursework for the Ph.D. is determined in consultation with the student's advisor and approved by the doctoral committee. To complete the Ph.D. degree, the student must present and defend a dissertation before the doctoral committee.

Group I: Required Core Courses in Engineering Mathematics (two courses):

| ME 452 | Mathematical Methods In Engineering I |
| ME 413 | Numerical Methods in Mechanical Engineering |
| ME 453 | Mathematical Methods in Engineering II |

Group II: Required Core Courses in Mechanical Engineering (minimum of 2 courses, up to 3 courses):

| ME 423 | Heat and Mass Transfer |
| ME 430 | Advanced Fluid Mechanics |
| ME 433 | Linear Systems and Control |
| MECH 406 | Fundamentals of Solid Mechanics |
| MECH 425 | Analytical Methods in Dynamics and Vibrations |

Group III: Optional Core Course (only one course):

| ME 402 or ME 402 | Advanced Manufacturing Science |

Course requirements for the PhD Degree

Students pursuing the PhD must complete a total of eight courses. Five of these courses are indicated in the aforementioned core courses for the PhD degree. These core courses are defined according to the following groups. Group I: two (2) core mathematics courses (ME 452 and either ME 413 or ME 453). Group II: at least two MEM core courses selected from MECH 406, ME 423, MECH 425, ME 430, ME 433 and any core courses that may be added in the future. Group III: One course may be selected from ME 401 or ME 402; if one of these courses is not chosen, then three core courses must be selected from Group II.

In addition to the required core courses, it is necessary to complete two (2) graduate courses in the student’s (MEM) emphasis area (depth requirement) and one (1) graduate course outside the (MEM) emphasis area but related to the student’s research (breadth requirement). A Group I math core course cannot be used to satisfy the breadth requirement. For students working in an interdisciplinary area, the advisor in coordination with the Ph.D. committee possesses the freedom to choose the most appropriate courses for the depth and breadth requirements. Ph.D. students must also take ME 453, which can either be taken as part of the five core course requirement or as an additional course.

A minimum GPA of 3.35/4.0 (based on the first five graduate core courses taken) must be attained. This minimum GPA requirement represents the first stage of candidacy for the PhD degree at the Department level. If the minimum requirement is not met, the student may petition to: (a) take one replacement course from the same Group I, II or III of core courses; or (b) take one replacement course in the form of a (non-core) advanced course, but only after the petition is approved and the course instructor is made aware of the student’s petition for grade replacement. All petitions require approval of the Ph.D. advisor, then approval of the Graduate Committee.

A student pursuing the Ph.D. after completion of an MS/MSc degree from another institution may petition to have two courses taken at that institution be approved as equivalent to MEM core courses, with no more than one course equivalent to a Lehigh Group I core course (math course) and one course equivalent to a Group II core course (course in a fundamental subject area). In addition, the student may petition to substitute courses taken elsewhere for the two (2) non-core advanced courses in their subject area (depth requirement) and the one (1) non-core course outside their emphasis area (breadth requirement). All of the foregoing replacement courses must be approved by the instructor of the corresponding Lehigh course. The student must submit a petition with the following: (a) a syllabus in English or a sufficiently detailed print-out of the course catalog from the MS institution; (b) a letter of support or a signed petition from the Ph.D. advisor; and (c) any additional documentation beyond the syllabus as requested by the instructor. If permission is granted for the foregoing replacement courses, three (3) core courses will remain for completion at Lehigh.

General Examination for the PhD Degree

The General Examination is completed during the fourth semester of graduate study when all required core courses have been taken and the minimum GPA of 3.35/4.0 has been attained. Immediately following successful completion of the core courses, the student forms
include mechanical, electro-dynamic and servocontrolled hydraulic laboratories for multidisciplinary studies of phenomena in the area of experimental facilities include 11 pulsed and continuous laser units for 50 computers that include high-end engineering workstations. The department's CAD Lab has over...RESEARCH FACILITIES. Proposal for the PhD Degree. In order to formally become a PhD candidate at the University level, the student must prepare a proposal for the dissertation research; this proposal includes a course plan for all courses to be taken during the PhD program. The proposal is presented to, and approved by, the Ph.D. committee and schedules the oral exam by the last day of class. The Committee decides on a grade to be assigned for completion of the three credit independent study course. The General Examination must be passed at least seven months before the degree is to be conferred.

Additional Requirements for the PhD Degree. Two or more manuscripts must be submitted for (peer-reviewed) journal publication prior to the dissertation defense. At least one of these manuscripts must have gone through a first (external) review process. A student may petition, with detailed justification, to account for unusual preparation efforts. For example: submission of a single manuscript to an extraordinarily competitive journal; an unusually long review time for a submitted manuscript; and alternate products consistent with the indicators of scholarship in the student's area of research.

The minimum number of department seminars must have been attended by the student during the course of the PhD program.

RESEARCH FACILITIES. The department has a wide range of computational, computer graphics and experimental systems. The department's CAD Lab has over 50 computers that include high-end engineering workstations. The university supports networks of hundreds of PCs as well as links to the Internet with thousands of online services.

Experimental facilities include 11 pulsed and continuous laser units for laser diagnostics in the areas of fluid and solid mechanics, four image processing systems, and a number of unique facilities for observing and controlling flow past surfaces and through machines, including two wind tunnels and three large-scale water channels. There are well-equipped laboratories for multidisciplinary studies of phenomena in the area of solid mechanics, including electron microscopy facilities. Other facilities include mechanical, electro-dynamic and servocontrolled hydraulic testing machines, photoelastic equipment, and Moire strain measuring instruments.

Extensively equipped, interdepartmental robotics, controls, and manufacturing laboratories are also available.

RECENT RESEARCH ACTIVITIES. Continuum and Solid Mechanics. Formulation of field equations and constitutive equations in nonlinear elasticity theories; mechanics of viscoelastic solids and fluids, plasticity theory; generalized continuum mechanics; thermo-mechanical and electromechanical interactions; analyses and modeling of manufacturing processes; free vibration and dynamic response of elastic shells, elastic-plastic deformation of shells upon cyclic thermal loading, and applications of shell analysis to nuclear power plant components; optical stress analysis; biomechanics of gait; wave propagation; finite amplitude wave propagation; composite materials and fabrication; tribology, surface friction and wear.

Fracture Mechanics. Stress analysis of materials containing defects, including viscoelastic, nonhomogeneous, and anisotropic materials; analytical and experimental studies and modeling of crack growth under static, periodic, and random loadings and environmental effects; optimizations of fracture control; crack propagation theories for nonlinear material; influence of cracks on the strength of structural members and of interfaces; hydraulic fracture; applications to reliability and durability of composites, structural and microelectronic components, and to processes for resource recovery.

Thermofluids. Structure of turbulent boundary layers, wakes and jets; vortex solid boundary interactions; boundary layers in compressible flow, including hypersonic regimes; vortex breakdown in internal machinery and in flow past wings; drag reduction in turbulent flows; flow induced noise and vibration; flutter of blades in axial-flow turbomachinery and of tails and fins on aircraft; aero- and hydroelastic phenomena and noise generation of fliers and swimmers in nature; flow-structure interactions in rotating and oscillating systems for power generation; unsteady aerodynamic flows past three dimensional wings and bodies; flow structure and heat transfer at end-wall junctions in rotating machinery and on surfaces of aircraft flows in micro-hydro- electromechanical and nano-scale systems; convective heat transfer in systems of electronic components; flows through complex components of power generation systems; transport of coal particles; flow and heat transfer in fluidized beds; cycle analysis applied to coal gasifiers; control optimization of heat pumps; laser-Doppler and particle image velocimetry; liquid crystal sensors for heat transfer; Raman spectral techniques applied to two-phase flow; laser diagnostics and image processing of complex flow and heat transfer systems.

Theoretical Fluid Mechanics. Vortex boundary layer interaction, modeling of turbulent boundary layers; geophysical flows such as frontal systems and mountain flows; statistical mechanics of plasmas, liquids and shock waves; finite amplitude waves in stratified gases and liquids; shock wave propagation; non-Newtonian flows in flexible tubes with application to hemorheology; magneto-fluid mechanics; wing theory; thermally driven flows; noise generation due to flow past trailing edges of fliers in nature.

Design. Geometric modeling; tolerance analysis and synthesis; assembly modeling; geometric dimensioning and tolerancing; 3D digitizing; data and information structures; design for manufacturing; design methodology, tools and practices; expert systems in design; industry projects with Integrated Product Development (IPD) focus.

Manufacturing. Free-form surface machining; coordinate measuring machine applications to geometric dimensions and tolerances; Taguchi's method; injection molding; sheet metal fabrication; FEA/FEM applications to plastic deformation of metals; rapid prototyping; intelligent manufacturing incorporating process modeling, sensor subsystems for in situ product quality monitoring, and knowledge-based control for real-time process adaptation; blow molding; composites processing; thermoforming; resin transfer molding; spin coating; electronic packaging.

Systems Dynamics and Controls. Modeling, simulation and control of dynamic systems including: control of unstable processes, programmed logic control experience, compensator design and construction, issues in digital implementation, state-of-the-industrial art experimental equipment, energy methods...
and bond graph modeling, methods of model identification from experimental data; application to various mechanisms, vehicles, chemical processes, aircraft systems, chemical processes, hydraulic systems, thermodynamic systems, microelectromechanical actuators; application to mechatronics for the integration of mechanical systems, computer control and programming for the design of smart consumer products and intelligent manufacturing machinery.

**Stochastic Processes**
Modeling of random behavior in mechanical systems; static and time-dependent stochastic fracture mechanics, with particular applications to assessments of reliability and service life prediction.

**Engineering Mathematics**

**Mechanical Engineering Courses**

**ME 010 Graphics for Engineering Design 3 Credits**
Graphical description of mechanical engineering design for visualization and communication by freehand sketching, production drawings, and 3D solid geometric representations. Introduction to creation, storage, and manipulation of such graphical descriptions through an integrated design project using state-of-the-art, commercially available computer-aided engineering software. Lectures and laboratory. (ES 1), (ED 2).

**Prerequisites:** ENGR 010

**ME 021 Mechanical Engineering Laboratory I 1 Credit**

**Prerequisites:** MECH 012

**Can be taken Concurrently:** MECH 012

**ME 050 Supplemental Topics in Mechanical Engineering 1-2 Credits**
Completion of material for Mechanical Engineering courses transferred from other institutions. Student will be scheduled for that part of Mechanical Engineering that is required for completion of missing material. Subject matter and credit hours to be determined by department chair for each student.

**ME 104 Thermodynamics I 3 Credits**
Basic concepts and principles of thermodynamics with emphasis on simple compressible substances. First and second law development, energy equations, reversibility, entropy and efficiency. Properties of pure substances and thermodynamic cycles.

**Prerequisites:** (MATH 033 or MATH 023) and (PHY 011)

**Can be taken Concurrently:** MATH 033, MATH 023, PHY 011

**ME 111 Professional Development 1 Credit**
Examination of ethical and professional choices facing mechanical engineers. Written and oral communications. Must have senior standing in Mechanical Engineering and Mechanics.

**ME 121 Mechanical Engineering Laboratory II 1 Credit**
A continuation of ME 21 including use of transducers, advanced instrumentation, and data acquisition. Emphasis on experimental exercises that illustrate, and/or introduce material from thermodynamics, and fluid mechanics. Includes proposal writing and interpretation of results.

**Prerequisites:** ME 021 and ME 104 and ME 231

**Can be taken Concurrently:** ME 231

**ME 141 General Aviation Technology and Operations 2 Credits**
A Federal Aviation Administration (FAA) certified course for students interested in understanding the engineering and operational aspects of the general aviation industry, including aerodynamics, aircraft systems and performance, weather, navigation, flight procedures, regulations, maneuvers, and the physiology of flight. Successful completion of the course will fulfill the FAA requirement for the ground school component of a private pilot certification.

**ME 142 Instrument Ground Training 2 Credits**
A Federal Aviation Administration (FAA) certified course for students interested in pursuing an instrument rating from the FAA. Successful completion of the course will fulfill the FAA requirement for the ground school component of an instrument rating.

**Prerequisites:** ME 141

**ME 207 Mechanical Engineering Laboratory III 2 Credits**
Formulation of laboratory experiments through open-ended planning, including decision criteria for laboratory techniques and approaches. Execution of experiments based on individual plans, followed by assessment of experimental results.

**Prerequisites:** ME 121

**ME 215 Engineering Reliability 3 Credits**
Applications of reliability methods to engineering problems. Modeling and analysis of engineered components and systems subjected to environmental and loading conditions. Modeling content encompasses mechanistically based probability and experimentally based statistical approaches. Concepts needed for design with uncertainty are developed. Principles are illustrated through case studies and projects. Engineering applications software will be extensively utilized for the projects.

**Prerequisites:** (MATH 023 or MATH 033) and MECH 012

**Can be taken Concurrently:** MECH 012

**ME 231 Fluid Mechanics 3 Credits**

**Prerequisites:** MATH 205

**ME 240 Manufacturing 3 Credits**

**Prerequisites:** ME 010 and MECH 012

**ME 242 Mechanical Engineering Systems 3 Credits**
The modeling and analysis of mechanical, fluid, electrical and hybrid systems, with emphasis on lumped models and dynamic behavior, including vibrations. Source-load synthesis. Analysis in temporal and frequency domains. Computer simulation of nonlinear models, and computer implementation of the superposition property of linear models.

**Prerequisites:** MECH 102 and MATH 205

**ME 245 Engineering Vibrations 3 Credits**

**Prerequisites:** MECH 102 and MATH 205 and ME 017

**ME 252 Mechanical Elements 3 Credits**
Methods for the analysis and design of machine elements such as springs, gears, clutches, brakes, and bearings. Motion analysis of cams and selected mechanisms. Projects requiring the design of simple mechanisms of mechanical sub-assemblies.

**Prerequisites:** MECH 012 and MECH 010 and MECH 102
ME 255 Introduction to Aerospace Engineering 3 Credits
An introductory course in the core engineering principles used in the aerospace industry: aerodynamics, controls, propulsion, and structures. The course is designed for any engineering student who may intend to work in the aerospace industry and develops a basic understanding of the technologies used in the design and operation of today’s aircraft, rockets, and spacecraft.
Prerequisites: ME 104

ME 299 Special Topics in Mechanical Engineering 1-4 Credits
Repeat Status: Course may be repeated.

ME 300 Apprentice Teaching 3 Credits

ME 304 Thermodynamics II 3 Credits
Prerequisites: ME 104

ME 309 (MAT 309) Composite Materials 3 Credits
Principles and technology of composite materials. Processing, properties, and structural applications of composites, with emphasis on fiber-reinforced polymers.
Prerequisites: MECH 003 and MAT 033

ME 310 (TE 310) Directed Study 1-3 Credits
Project work on any aspect of engineering, performed either individually or as a member of a team made up of students, possibly from other disciplines. Project progress is reported in the form of several planning and project reports. Direction of the projects may be provided by faculty from several departments and could include interaction with outside consultants and local communities and industries. Consent of department required.
Repeat Status: Course may be repeated.

ME 312 Analysis and Synthesis Of Mechanisms 3 Credits
Types of motion. Degrees of freedom of motion. Position, velocity and acceleration analysis of linkage mechanisms. Systematic approach to the design of linkage mechanisms. Motion generation, path synthesis and function synthesis. Structural synthesis of planar and spatial mechanisms. Static force analysis of mechanisms using virtual work.
Prerequisites: MATH 205 and MECH 102

ME 314 (MAT 314) Metal Forming Processes 3 Credits

ME 315 (BIOE 315) Bioengineering Statistics 3 Credits
Probability and statistics applied to bioengineering problems focusing on modeling and data analysis. Types of data, types of distributions, parametric and nonparametric analyses, goodness-of-fit, regression, power analysis, and multivariate analysis, life models, simulation, cluster analysis, and Bayesian statistics. Projects and case studies.
Prerequisites: MATH 231

ME 316 (BIOE 316) Introduction to Force Spectroscopy 3 Credits
Fundamentals of major force spectroscopy methods, including atomic force microscopy, optical tweezers, and magnetic tweezers. Principles of force measurement, force calibration, and signal and noise. Applications to the mechanical properties of biomaterials, such as polymer elasticity, protein folding, nanoinertion, and structural transitions in macromolecules. Closed to students who have taken BIOE 416.
Prerequisites: MECH 003

ME 321 Introduction to Heat Transfer 3 Credits
Analytical and numerical solutions to steady and transient one-and two-dimensional conduction problems. Forced and natural convection in internal and external flows. Thermal radiation. Thermal design of engineering processes and systems.
Prerequisites: ME 104 and ME 231

ME 322 Gas Dynamics 3 Credits
Prerequisites: ME 231 and ME 104

ME 323 Reciprocating and Centrifugal Engines 3 Credits
Thermal analysis and design of internal combustion engines (conventional and unconventional), gas turbine engines, air breathing jet engines, and rockets. Components such as jet nozzles, compressors, turbines, and combustion chambers are chosen to exemplify the theory and development of different types of components. Both ideal fluid and real fluid approaches are considered.
Prerequisites: ME 104

ME 331 Advanced Fluid Mechanics 3 Credits
Prerequisites: ME 231

ME 333 Propulsion Systems 3 Credits
Review of jet and rocket engine technologies. Jet and rocket engine thermodynamic and aerodynamic principles. Performance of turbojet, turbopan, and turboprop jet engines. Rocket engines include liquid, cryogenic, solid, and electric propulsion.
Prerequisites: ME 104 and MECH 326
Can be taken Concurrently: MECH 326

ME 340 Advanced Mechanical Design 3 Credits
Probabilistic design of mechanical components and systems. Reliability functions, hazard models and product life prediction. Theoretical stress-strength-time models. Static and dynamic reliability models. Optimum design of mechanical systems for reliability objectives or constraints.

ME 341 Mechanical Systems 3 Credits
Prerequisites: ME 252

ME 342 Dynamics of Engineering Systems 3 Credits
Dynamic analysis of mechanical, electromechanical, fluid and hybrid engineering systems with emphasis on the modeling process. lumped and distributed-parameter models. Use of computer tools for modeling, design and simulation. Design projects.
Prerequisites: ME 242

ME 343 Control Systems 3 Credits
A comprehensive course in classical and modern linear control systems. Includes root locus, frequency response, state space, and digital control techniques with extensive use of computational methods. A design project provides experience with practical design issues and tradeoffs.
Prerequisites: ME 242 or ECE 125 or ME 245

ME 348 Computer-Aided Design 3 Credits
Impact of computer-aided engineering tools on mechanical design and analysis. Part geometry modeling and assembly modeling using solid representations. Analysis for mass properties, interference, kinematics, displacements, stresses and system dynamics by using state-of-the-art commercially available computer-aided-engineering software. Integrated design projects.
Prerequisites: ME 010 and MECH 012 and MECH 102 and MATH 205

ME 350 Special Topics 1-5 Credits
A study of some field of mechanical engineering not covered elsewhere. Consent of department chair required.
Repeat Status: Course may be repeated.
ME 354 Automatic Control of Aerospace Vehicles 3 Credits
The forces and moments acting on rigid aircraft are developed from basic aerodynamics and used to determine the equations of motion and the resulting dynamic models. Analysis from these dynamic models supports the design of flight control, guidance, and autopilot systems. Modern control methods for missiles and spacecraft are also included. Undergraduate course assumes rigid aircraft structures, while the graduate course develops the effects of flexible structures.
Prerequisites: MECH 326 and ME 343

ME 355 Spacecraft Systems Engineering 3 Credits
Systems engineering approach to design, integration, testing, and operations of spacecraft for various missions. Technologies currently used in modern spacecraft bus and payload systems, astrodynamics, launch systems, life-cycle costs, and operational issues. Team works to design a spacecraft that meets a specific set of mission requirements.
Prerequisites: ME 255

ME 360 Nuclear Reactor Engineering 3 Credits
A consideration of the engineering problems related to nuclear reactor design and operation. Topics include fundamental properties of atomic and nuclear radiation, reactor fuels and materials, reactor design and operation, thermal aspects, safety and shielding, instrumentation and control. Course includes several design projects stressing the major topics in the course. Must have senior standing in engineering or physical science.

ME 362 Nuclear Fusion and Radiation Protection 3 Credits

ME 364 Renewable Energy 3 Credits
Fundamentals and design aspects of Renewable Energy (RE) technologies: biofuels, hydropower, solar photovoltaic, solar thermal, wind, geothermal energies. Details and difficulties in implementing RE. Senior standing in Engineering. Credit not given for both ME 364 and ME 464.
Prerequisites: ME 104 and ME 231

ME 366 Engineering Principles of Clean Coal Technology 3 Credits
Effect of coal properties on plant performance. Design and performance of coal-based electric power generation systems. Technologies to control emissions. Carbon capture and sequestration methods for coal-fired power plants and analysis of CCS options. Must have junior standing in engineering or physical science.

ME 368 Fundamentals of Energy Efficiency Practicum 3 Credits
Studies of the plant operation and energy usage. Students work with the Lehigh Industrial Assessment Center to do technical and economic feasibility studies of optimizing energy consumption. Industrial experience. Fundamentals of best practices to save energy, reduce waste, and increase productivity. Consent of instructor required.
Prerequisites: ME 104 and ME 231

ME 373 Mechatronics 3 Credits
Synergetic integration of mechanical engineering with electronics and intelligent computer control in designing and manufacturing machines, products and processes; semiconductor electronics, analog signal processing, with op amps, digital circuits, Boolean algebra, logic network designs, Karnaugh map, flip-flops and applications, data acquisition, A/D and D/A, interfacing to personal computers, sensors and actuators, microcontroller programming and interfacing.

ME 374 Mechatronics Laboratory 3 Credits
Experiments and applications utilizing combinations of mechanical, electrical, and microprocessor components. Theory and application of electronic and electromechanical equipment, operation and control of mechatronic systems. Projects integrating mechanical, electronic and microcontrollers.

ME 376 (CHE 376) Energy: Issues & Technology 3 Credits
Energy usage and supply, fossil fuel technologies, renewable energy alternatives and environmental impacts. The scope will be broad to give some perspective of the problems, but in-depth technical analysis of many aspects will also be developed.
Prerequisites: CHE 210 or ME 104 or CHM 342 or MAT 205

ME 385 Polymer Product Manufacturing 3 Credits
Polymer processes such as injection molding and extrusion, and the business of new product development. Topics include design methods, polymer chemistry and structure, molecular orientation development, process simulation software development, manufacturing defects, manufacturing window establishment, and manufacturing process optimization. Must have senior level standing in engineering or science. Credit not given for both ME 385 and ME 485.

ME 387 (CHE 387, ECE 387) Digital Control 3 Credits
Sampled-data systems; z-transforms; pulse transfer functions; stability in the z-plane; root locus and frequency response design methods; minimal prototype design; digital control hardware; discrete state variables; state transition matrix; Lyapunov stability state feedback control (two lectures and one laboratory per week).
Prerequisites: CHE 386 or ECE 212 or ME 343

ME 388 Honors Project for Eckardt Scholar 1-4 Credits
Opportunity for Eckardt Scholars to pursue an extended project for senior honors. Transcript will identify department in which project was completed.
Repeat Status: Course may be repeated.

ME 389 (CHE 389, ECE 389) Control Systems Laboratory 2 Credits
Experiments on a variety of mechanical, electrical and chemical dynamic control systems. Exposure to state-of-the-art control instrumentation: sensors, transmitters, control valves, analog and digital controllers. Emphasis on design of feedback controllers and comparison of theoretical computer simulation predictions with actual experimental data. Lab teams will be interdisciplinary.
Prerequisites: CHE 386 or ECE 212 or ME 343

ME 401 (MSE 401) Integrated Product Development 3 Credits
An integrated and interdisciplinary approach to engineering design, concurrent engineering, design for manufacturing, industrial design and the business of new product development. Topics include design methods, philosophy and practice, the role of modeling and simulation, decision making, risk, cost, material and manufacturing process selection, platform and modular design, mass customization, quality, planning and scheduling, business issues, teamwork, group dynamics, creativity and innovation. The course uses case studies and team projects. ME 402.

ME 402 (MAT 402) Advanced Manufacturing Science 3 Credits
The course focuses on the fundamental science-base underlying manufacturing processes, and applying that science base to develop knowledge and tools suitable for industrial utilization. Selected manufacturing processes representing the general classes of material removal, material deformation, material phase change, material flow, and material joining are addressed. Students create computer-based process simulation tools independently as well as utilize leading commercial process simulation packages. Laboratory experiences are included throughout the course.

ME 411 Boundary-Layer Theory 3 Credits
The course is intended as a first graduate course in viscous flow. An introduction to boundary-layer theory, thermodynamics and heat transfer at the undergraduate level are assumed to have been completed. Topics include the fundamental equation of continuum fluid mechanics, the concept of asymptotic methods and low and high Reynolds number flows, laminar boundary layers, generalized similarity methods, two- and three-dimensional flows, steady and unsteady flows and an introduction to hydrodynamic stability. The material is covered in the context of providing a logical basis as an introduction to a further course in turbulent flows.
ME 415 Flow-Induced Vibrations 3 Credits

ME 420 Advanced Thermodynamics 3 Credits

ME 421 Topics in Thermodynamics 3 Credits
Emphasis on theoretical and experimental treatment of combustion processes including dissociation, flame temperature calculations, diffusion flames, stability and propagation: related problems in compressible flow involving one-dimensional, oblique shock waves and detonation waves. Methods of measurement and instrumentation.

ME 423 Heat and Mass Transfer 3 Credits
This course is a first graduate course in the basic concepts of heat and mass transfer, providing a broad coverage of key areas in diffusion, conduction, convection, heat and mass transfer, and radiation. Topics covered include: the conservation equations, steady and transient diffusion and conduction, periodic diffusion, melting and solidification problems, numerical methods, turbulent convection, transpiration and film cooling, heat transfer with phase change, heat exchanges, radiation, mixed mode heat and mass transfer.

ME 424 Unsteady and Turbulent Flow 3 Credits
Stability of laminar flow; transition to turbulence. Navier-Stokes equations with turbulence. Bounded turbulent shear flows; free shear flows; statistical description of turbulence.

ME 426 Radiative and Conductive Heat Transfer 3 Credits
Principles of radiative transfer; thermal-radiative properties of diffuse and specular surfaces; radiative exchange between bodies; radiative transport through absorbing, emitting and scattering media. Advanced topics in steady-state and transient conduction; analytical and numerical solutions; problems of combined conductive and radiative heat transfer.

ME 428 Boundary Layers and Convective Heat Transfer 3 Credits
Navier-Stokes and energy equations, laminar boundary layer theory, analysis of friction drag, transfer and separation. Transition from laminar to turbulent flow. Turbulent boundary layer theory. Prandtl mixing length, turbulent friction drag, and heat transfer. Integral methods. Flow in ducts, wakes and jets. Natural convection heat transfer.

ME 430 Advanced Fluid Mechanics 3 Credits
This course is a first graduate course in incompressible fluid mechanics, providing a broad coverage of key areas of viscous and inviscid fluid mechanics. Topics covered include: Flow kinematics, differential equations of motion, viscous and inviscid solutions, vorticity dynamics and circulation, vorticity equation, circulation theorems, potential flow behavior, irrotational and rotational flows, simple boundary layer flows and solutions, and real fluid flows and consequences.

ME 431 Advanced Gas Dynamics 3 Credits

ME 433 (CHE 433, ECE 433) Linear Systems and Control 3 Credits
This course covers the following topics in linear systems and control theory: review of fundamental concepts in linear algebra, state-space representation of linear systems, linearization, time-variance and linearity properties of systems, impulse response, transfer functions and their state-space representations, solution to LTI and LTV state equations. Jordan form, Lyapunov stability, input-output stability, controllability, stabilizability, observability, detectability. Canonical forms, minimal realizations, introduction to optimal control theory. Linear Quadratic Regulator (LQR), Algebraic Riccati Equation (ARE), frequency domain properties of LQR controllers.

ME 434 (CHE 434, ECE 434) Multivariable Process Control 3 Credits
A state-of-the-art review of multivariable methods of interest to process control applications. Design techniques examined include loop interaction analysis, frequency domain methods (Inverse Nyquist Array, Characteristic Loci and Singular Value Decomposition) feed forward control, internal model control and dynamic matrix control. Special attention is placed on the interaction of process design and process control. Most of the above methods are used to compare the relative performance of intensive and extensive variable control structures.

Prerequisites: CHE 433 or ME 433 or ECE 433

ME 436 (CHE 436, ECE 436) Systems Identification 3 Credits
The determination of model parameters from time-history and frequency response data by graphical, deterministic and stochastic methods. Examples and exercises taken from process industries, communications and aerospace testing. Regression, quasilinearization and invariant-imbedding techniques for nonlinear system parameter identification included.

ME 437 (CHE 437, ECE 437) Stochastic Control 3 Credits

Prerequisites: CHE 433 or ME 433 or ECE 433

ME 444 Experimental Stress Analysis in Design 3 Credits
Fundamental concepts of strain measurements and application of strain gages and strain gage circuits. Two- and three-dimensional photoelasticity, stress separation techniques, birefringent coatings, moiré methods, caustics. Use of image analysis in data acquisition and interpretation. Selected laboratory experiments.

ME 446 Mechanical Reliability 3 Credits

ME 450 Special Topics 3 Credits
An intensive study of some field of mechanical engineering not covered in more general courses.

Repeat Status: Course may be repeated.

ME 452 (BIOE 452, CHE 452, ENGR 452) Mathematical Methods In Engineering I 3 Credits
Analytical techniques relevant to the engineering sciences are described. Vector spaces; eigenvalues; eigenvectors. Linear ordinary differential equations; diagonalizable and non-diagonalizable systems. Inhomogeneous linear systems; variation of parameters. Non-linear systems; stability; phase plane. Series solutions of linear ordinary differential equations; special functions. Laplace and Fourier transforms; application to partial differential equations and integral equations. Sturm-Liouville theory. Finite Fourier transforms; planar, cylindrical, and spherical geometries.

ME 453 Mathematical Methods in Engineering II 3 Credits
ME 454 Automatic Control of Aerospace Vehicles 3 Credits
The forces and moments acting on aircraft are developed from basic aerodynamics and used to determine the equations of motion and the resulting dynamic models. Analysis from these dynamic models supports the design of flight control, guidance, and autopilot systems. Modern control methods for missiles and spacecraft are also included. Effects of flexible structures are developed. Cannot receive credit if previously completed ME 354.
Prerequisites: MECH 326 and MECH 343

ME 458 Modeling of Dynamic Systems 3 Credits
Modeling of complex linear and nonlinear energetic dynamic engineering systems. Emphasis on subdivision into multiport elements and representation by the bondgraph language using direct, energetic, and experimental methods. Field lumping. Analytical and graphical reductions. Simulation and other numerical methods. Examples including mechanisms, electromechanical transducers, electric and fluid circuits, and thermal systems.

ME 460 Engineering Project 1-6 Credits
Project work on some aspect of mechanical engineering in an area of student and faculty interest. Selection and direction of the project could involve interaction with local communities or industries. Consent of department required.
Repeat Status: Course may be repeated.

ME 461 Integrated Product Development (IPD) Projects-1 2 Credits
Technical and economic feasibility study of new products. Selection and content of the project is determined by the faculty project advisor in consultation with the student, progress and final reports, oral and posters presentations. Consent of the program director and faculty project advisor required.
Prerequisites: TE 401 or ME 401

ME 462 IPD: Manufacturing 3 Credits
Industry sponsored Integrated Product Development Project (IPD) projects. The student works with an industry sponsor to create detailed design specifications, fabricate and test a prototype new product and plan for production. Selection and content of the project is determined by the faculty project advisor in consultation with the industry sponsor. Deliverables include progress and final reports, oral presentations, posters and a prototype. Consent of the department chair and faculty project advisor required.

ME 464 Renewable Energy 3 Credits
Fundamentals and design aspects of Renewable Energy (RE) technologies; bio-fuels, hydropower, solar photovoltaic, solar thermal, wind, geothermal energies. Details and difficulties in implementing RE. ME 464 is graduate level version of ME 364 and will require additional assignments and/or projects appropriate for graduate level study. Closed to students who have taken ME 364.

ME 466 Fundamentals of Acoustics 3 Credits

ME 468 Advanced Energy Efficiency Practicum 3 Credits
Critical assessments of energy management systems. Establishment of framework for industrial facilities to manage energy systems. Fundamentals of best practices for energy efficiencies associated with industrial energy savings. Progress and final reports required. Engineering graduate students only. Consent of instructor required.

ME 485 Polymer Product Manufacturing 3 Credits
An exploration of the science underlying polymer processes such as injection molding through a combination of theory development, practical analysis, and utilization of commercial software. Polymer chemistry and structure, material rheological behavior, processing kinetics, molecular orientation development, process simulation software development, manufacturing defects, manufacturing window establishment, manufacturing process design, manufacturing process optimization. This course is a version of ME 385 for graduate students, with research projects and advanced assignments. Closed to students who have taken ME 385. Must have graduate level standing in engineering or science.

ME 490 Thesis 1-6 Credits
Repeat Status: Course may be repeated.

ME 499 Dissertation 1-15 Credits
Repeat Status: Course may be repeated.

Mechanics Courses
MECH 002 Elementary Engineering Mechanics 3 Credits
Static equilibrium of particles and rigid bodies. Elementary analysis of simple trusses and frame structures, internal forces, stress, and strain. Credit will not be given for both MECH 002 and MECH 003.
Prerequisites: (MATH 022 or MATH 052 or MATH 032) and (PHY 010 or PHY 011)
Can be taken Concurrently: MATH 022, MATH 052, MATH 032

MECH 003 Fundamentals of Engineering Mechanics 3 Credits
Static equilibrium of particles and rigid bodies. Analysis of simple trusses and frame structures, internal forces, stress, strain, and Hooke’s Law, torsion of circular shafts; pure bending of beams. Is intended as a prerequisite for MECH 012. Credit not given for both MECH 002 and MECH 003.
Prerequisites: (MATH 022 or MATH 032) and PHY 011
Can be taken Concurrently: MATH 022, MATH 032

MECH 012 Strength of Materials 3 Credits
Prerequisites: MECH 003 and (MATH 023 or MATH 033)
Can be taken Concurrently: MATH 023, MATH 033

MECH 050 Supplemental Topics in Mechanics 1-2 Credits
Completion of material for MECH courses transferred from other institutions. Student will be scheduled for that part of MECH course that is required for completion of missing material. Subject matter and credit hours to be determined by department chair for each student.

MECH 102 Dynamics 3 Credits
Particle dynamics, work-energy, impulse-momentum, impact, systems of particles; kinematics of rigid bodies, kinetics of rigid bodies in plane motion, energy, momentum, eccentric impact.
Prerequisites: (MECH 002 or MECH 003) and (MATH 023 or MATH 033)
Can be taken Concurrently: MATH 023, MATH 033

MECH 103 Principles of Mechanics 4 Credits
Composition and resolution of forces; equivalent force systems; equilibrium of particles and rigid bodies; friction. Kinematics and kinetics of particles and rigid bodies; relative motion; work and energy; impulse and momentum.
Prerequisites: (MATH 023 or MATH 033) and (PHY 010 or PHY 011)

MECH 300 Apprentice Teaching 3 Credits

MECH 302 Advanced Dynamics 3 Credits
Fundamental dynamic theorems and their application to the study of the motion of particles and rigid bodies, with particular emphasis on three-dimensional motion. Use of generalized coordinates; Lagrange’s equations and their applications.
Prerequisites: MATH 205 and (MECH 102 or MECH 103)

MECH 305 Advanced Mechanics of Materials 3 Credits
Strength, stiffness, and stability of mechanical components and structures. Fundamental principles of stress analysis: three-dimensional stress and strain transformations, two-dimensional elasticity, contact stresses, stress concentrations, energy and variational methods. Stresses and deformations for rotating shafts, thermal stresses in thick-walled cylinders, curved beams, torsion of prismatic bars, and bending of plates. Projects relate analysis to engineering design.
Prerequisites: MECH 012 and MATH 205

MECH 307 Mechanics of Continua 3 Credits
Fundamental principles of the mechanics of deformable bodies. Study of stress, velocity and acceleration fields. Compatibility equations, conservation laws. Applications to two-dimensional problems in finite elasticity, plasticity, and viscous flows.
Prerequisites: MECH 305
MECH 312 Finite Element Analysis 3 Credits
Basic concepts of analyzing general media (solids, fluids, heat transfer, etc.) with complicated boundaries. Emphasis on mechanical elements and structures. Element stiffness matrices by minimum potential energy. Isoparametric elements. Commercial software packages (ABAQUS, NISA) are used. In addition, students develop and use their own finite element codes. Applications to design.
Prerequisites: MECH 012

MECH 313 Fracture Mechanics 3 Credits
Fracture mechanics as a foundation for design against or facilitation of fracture. Fracture behavior of solids; fracture criteria; stress analysis of cracks; subcritical crack growth, including chemical and thermal effects; fracture design and control, and life prediction methodologies.
Prerequisites: MECH 012 and MATH 205

MECH 326 Aerodynamics 3 Credits
Prerequisites: ME 231

MECH 328 Fundamentals of Aircraft Design 3 Credits
Prerequisites: MECH 012

MECH 350 Special Topics 3 Credits
A study of some field of engineering mechanics not covered elsewhere. Consent of department required.

MECH 404 Mechanics & Behavior of Structural Members 3 Credits

MECH 406 Fundamentals of Solid Mechanics 3 Credits
An introductory graduate course in the mechanics of solids. Topics to be addressed include: curvilinear tensor analysis, analysis of strain and nonlinear kinematics, stress, work conjugate stress-strain measures, conservation laws and energy theorems, variational calculus, isotropic and anisotropic linear elasticity, boundary value problems, beam and plate theories.

MECH 408 Introduction To Elasticity 3 Credits
This course is a first graduate course in solid mechanics. It addresses: kinematics and statics of deformable elastic solids; compatibility, equilibrium and constitutive equations; problems in plane elasticity and torsion; energy principles, approximate methods and applications.

MECH 410 Theory of Elasticity II 3 Credits
Advanced topics in the theory of elasticity. The subject matter may vary from year to year and may include, theory of potential functions, linear thermoelasticity, dynamics of deformable media, integral transforms and complex-variable methods in classical elasticity. Problems of boundary layer type in elasticity; current developments on the microstructure theory of elasticity.

MECH 411 Continuum Mechanics 3 Credits
An introduction to the continuum theories of the mechanics of solids and fluids. This includes a discussion of the mechanical and thermodynamical bases of the subject, as well as the use of invariance principles in formulating constitutive equations. Applications of the theories to specific problems are given.

MECH 413 Fracture Mechanics 3 Credits
Elementary and advanced fracture mechanics concepts; analytical modeling; fracture toughness concept; fracture toughness testing; calculation of stress intensity factors; elastic-plastic analysis; prediction of crack trajectory; fatigue crack growth and environmental effects; computational methods in fracture mechanics; nonlinear fracture mechanics; fracture of composite structures; application of fracture mechanics to design.

MECH 415 Stability of Elastic Structures 3 Credits
Basic concepts of instability of a structure; bifurcation; energy increment, snap-through, dynamic instability. Analytical and numerical methods of finding buckling loads of columns. Postbuckling deformations of cantilever columns. Dynamic buckling with nonconservative forces. Effects of initial imperfections. Inelastic buckling. Instability problems of thin plates and shells.

MECH 418 Finite Element Methods 3 Credits
Finite element approximations to the solution of differential equations of engineering interest. Linear and nonlinear examples from heat transfer, solid mechanics, and fluid mechanics are used to illustrate applications of the method. The course emphasizes the development of computer programs to carry out the required calculations. Must have knowledge of a high-level programming language.

MECH 419 (CHE 419) Asymptotic Methods in the Engineering Sciences 3 Credits

MECH 424 Unsteady Fluid Flows 3 Credits
Gas dynamics, finite amplitude disturbances in perfect and real gases; channel flows; three-dimensional acoustics; theories of the sonic boom. Motions in fluids with a free surface; basic hydrodynamics, small amplitude waves on deep water; ship waves; dispersive waves; shallow water gravity waves and atmospheric waves. Hemodynamics; pulsatile blood flow at high and low Reynolds number. Models of the interaction of flow with artery walls.

MECH 425 Analytical Methods in Dynamics and Vibrations 3 Credits
This course will mainly cover the following topics: coordinate systems, conservation laws, inertial frames, systems of particles, DAE sets, variable-mass systems, transport equation, review of some of the basic concepts from variational calculus, D’Alembert’s principle, Hamilton’s principle, Lagrange multipliers, generalized momenta, 3D rigid-body motion, Inertia matrices, Euler angles, inertial and elastic coupling, discrete eigenvalue problem, linearization of nonlinear systems, chaotic systems, Hamilton’s principle for continuous systems, Torsion, Sturm-Liouville equations, Rayleigh’s quotient, finite-element eigen-problems, interpolating functions, combined-effect vibrations, and some other related topics.

MECH 432 Inelastic Behavior Of Materials 3 Credits

MECH 445 Nondeterministic Models in Engineering 3 Credits
Application of probability and stochastic processes to engineering problems for a variety of applications. Modeling and analysis of common nondeterministic processes. Topics are selected from the following: linear and nonlinear models for random systems; random functions; simulation; random loads and vibrations; Kalman filtering, identification, estimation, and prediction; stochastic fracture and fatigue; probabilistic design of engineering systems; and spatial point processes. Must have advanced calculus and some exposure to probability and statistics.
**MECH 450 Special Problems 3 Credits**
An intensive study of some field of applied mechanics not covered in more general courses.
**Repeat Status:** Course may be repeated.

**MECH 454 Mechanics and Design of Composites 3 Credits**

**Interdisciplinary and Inter-College Undergraduate Study**
The university's interdisciplinary programs are designed to cross the boundaries between colleges to accommodate new and developing fields as well as the interests of students. Some of Lehigh's interdisciplinary programs draw on disciplines within a single college; these are housed within that college. Other interdisciplinary programs draw on faculty and curricula in two or more colleges; these are considered inter-college (IC) programs, and these programs are not housed within a specific college. Prospective undergraduate students interested in these programs apply not to one of Lehigh's colleges but instead apply to the IC program.

**Computer Science and Business Program**
The College of Business and the Computer Science and Engineering department in the P.C. Rossin College of Engineering and Applied Science jointly offer the Computer Science and Business (CSB) program. The mission of the program is to provide rigorous computer science education integrated with in-depth business training that prepares high quality undergraduate students with diverse backgrounds for lifelong learning and to assume positions of leadership in the business community. This carefully crafted 136 credit hour degree integrates technology skills in software development with a solid background in business and economics. Deep immersion in both of these areas distinguishes CSB from programs offered by other universities. At the same time it is well balanced with approximately one third of the courses in liberal arts, one-third in computer science, and one-third in business.

After four years the program leads to a degree in Computer Science and in Business, which is jointly awarded by the College of Business and the P.C. Rossin College of Engineering and Applied Science. Graduates of the program will be ideal candidates for placement within public and private companies._none of the program requirements for the CSB major may be taken pass/fail._

The mission of the program is to provide rigorous computer science education integrated with in-depth business training that prepares high quality undergraduate students with diverse backgrounds for lifelong learning and to assume positions of leadership in the business community. This carefully crafted 136 credit hour degree integrates technology skills in software development with a solid background in business and economics. Deep immersion in both of these areas distinguishes CSB from programs offered by other universities. At the same time it is well balanced with approximately one third of the courses in liberal arts, one-third in computer science, and one-third in business.

While honors-like in quality and rigor, the CSB program is open to any student wishing to accept the challenges it offers. Students may matriculate at Lehigh specifically into CSB or enter the program at a later point. Transferring into CSB after freshman year, however, may require students to take additional credits to graduate. The CSB program is accredited in Business (AACSB International) and is accredited by the Computing Accreditation Commission of ABET, http://www.abet.org.

The co-directors of the CSB program are James A. Hall, Peter E. Bennett Chair in Business and Economics (jah0@lehigh.edu) and Henry Korth, Professor of Computer Science and Engineering (htk2@lehigh.edu).

For additional information visit the CSB web site (https://cbeundergrad.lehigh.edu/curriculum).

**MISSION FOR PROGRAM**
The Computer Science and Business program's mission is to provide its students with a strong education in mathematics, science, business, and computer science fundamentals and to prepare them to be able to adapt to future changes in the practice of Computer Science.

**PROGRAM EDUCATIONAL OBJECTIVES**
Graduates of the Bachelor of Science in Computer Science and Business Program will:

- Account for ethical and social issues when solving business and industrial problems.
- Function effectively in a collaborative team and effectively communicate with members of the team.
- Engage in continued education in their field of expertise.
- Attain positions of expertise in their chosen field.
- Apply their training to problems where information technologies and business processes converge.

**DEGREE REQUIREMENTS**
The required courses for the CSB degree constitute the fundamentals of structured programming, discrete mathematics, algorithms, computer architecture, and computer and information systems, programming languages, software engineering, accounting, finance, marketing, management, and economics. None of the program requirements for the CSB major may be taken pass/fail.

The requirements are stated below. To view a number of suggested sequences of courses for satisfying these requirements see Suggested Sequences of Courses (p. 438).

**Required Computer Science courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CSE 001</td>
<td>Breadth of Computing</td>
<td>2-3</td>
</tr>
<tr>
<td>or CSE 012</td>
<td>Survey of Computer Science</td>
<td></td>
</tr>
<tr>
<td>CSE 002</td>
<td>Fundamentals of Programming</td>
<td>2</td>
</tr>
<tr>
<td>CSE 017</td>
<td>Programming and Data Structures</td>
<td>3</td>
</tr>
<tr>
<td>CSE 109</td>
<td>Systems Software</td>
<td>4</td>
</tr>
<tr>
<td>CSE 140</td>
<td>Foundations of Discrete Structures and Algorithms</td>
<td>3</td>
</tr>
<tr>
<td>CSE 202</td>
<td>Computer Organization and Architecture</td>
<td>3</td>
</tr>
<tr>
<td>CSE 216</td>
<td>Software Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CSE 241</td>
<td>Database Systems and Applications</td>
<td>3</td>
</tr>
<tr>
<td>or CSE 341</td>
<td>Database Systems, Algorithms, and Applications</td>
<td>3</td>
</tr>
<tr>
<td>CSE 262</td>
<td>Programming Languages</td>
<td>3</td>
</tr>
<tr>
<td>CSE 303</td>
<td>Operating System Design</td>
<td>3</td>
</tr>
<tr>
<td>CSE 340</td>
<td>Design and Analysis of Algorithms</td>
<td>3</td>
</tr>
<tr>
<td>CSE Elective from approved list 2</td>
<td>3</td>
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</table>

**Required Business courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUS 001</td>
<td>Foundations of Business</td>
<td>1</td>
</tr>
<tr>
<td>ACCT 151</td>
<td>Introduction to Financial Accounting</td>
<td>3</td>
</tr>
<tr>
<td>ACCT 152</td>
<td>Introduction to Managerial Accounting</td>
<td>3</td>
</tr>
<tr>
<td>ECO 001</td>
<td>Principles of Economics</td>
<td>4</td>
</tr>
<tr>
<td>ECO 146</td>
<td>Intermediate Microeconomic Analysis</td>
<td>3</td>
</tr>
<tr>
<td>or ECO 119</td>
<td>Intermediate Macroeconomic Analysis</td>
<td></td>
</tr>
<tr>
<td>FIN 125</td>
<td>Introduction to Finance</td>
<td>3</td>
</tr>
<tr>
<td>LAW 201</td>
<td>Legal Environment of Business</td>
<td>3</td>
</tr>
<tr>
<td>SCM 186</td>
<td>Supply Chain Operations Management</td>
<td>3</td>
</tr>
<tr>
<td>MGT 043</td>
<td>Organizational Behavior</td>
<td>3</td>
</tr>
<tr>
<td>MKT 111</td>
<td>Principles of Marketing</td>
<td>3</td>
</tr>
<tr>
<td>MGT 301</td>
<td>Strategic Management in a Global Environment</td>
<td>3</td>
</tr>
</tbody>
</table>

**Required Math and Science courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 021</td>
<td>Calculus I (or MATH 075 followed by MATH 076)</td>
<td>4</td>
</tr>
<tr>
<td>MATH 022</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 205</td>
<td>Linear Methods</td>
<td>3</td>
</tr>
<tr>
<td>MATH 231</td>
<td>Probability and Statistics</td>
<td>3</td>
</tr>
<tr>
<td>or ECO 045</td>
<td>Statistical Methods</td>
<td></td>
</tr>
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</table>

**Natural science courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CSB 311</td>
<td>Computer Applications in Business</td>
<td>3</td>
</tr>
<tr>
<td>CSB 312</td>
<td>Design of Integrated Business Applications I</td>
<td>3</td>
</tr>
</tbody>
</table>

Lehigh University 2019-2020
CSB 313  Design of Integrated Business Applications II  3

**Required CSB electives**

Courses approved by program co-directors  9

**Humanities and Social Science requirements**

ENGL 001  Critical Reading and Composition  3
BUS 003  Business Communication I  1.5
BUS 203  Business Communication II  1.5
CSE 252  Computers, the Internet, and Society  3

Humanities (HU) electives  6
Social Sciences (SS) electives  3
Free electives  7
Total Credits  136-137

1. Such that one course has an attached laboratory and such that two courses are in a laboratory science with the first course a prerequisite to the second course. Note that there are some NS courses that, though in a laboratory science, do not include a laboratory; instead the "attached lab" has a separate course number. See Suggested Sequences of Natural Science Courses (http://www.cse.lehigh.edu/academics/undergraduate-computer-science/ba-in-computer-science-and-business-2-uncategorised/174-natural-science-course-sequence).


**CSB TRACKS**

Students may choose to use their CSB professional electives to develop areas of concentrations or tracks from courses offered within the CSE department or CBE. In certain cases, the program co-directors may also approve courses from other departments. See some examples of CSB tracks (https://engineering.lehigh.edu/cse/undergraduate-studies/computer-science-business-bs/csb-tracks). Note: that it is not required that a student complete a track, just that students fulfill the 9-credit professional elective requirement.

**SAMPLE SEQUENCES OF COURSES**

Below are several sample course sequences that fulfill the CSB degree requirements. These are only examples and nothing here is intended to suggest implicit requirements. It should be clear in particular that electives can easily be rearranged. All sample sequences assume a non-Physics science sequence; the first Physics course in the Physics sequence is 5 credits (4-credit course plus 1-credit lab).

None of these samples assume AP credit. Generally, students with AP move courses in the sequence earlier to leave room for more electives in the junior and/or senior years.

Samples A and B are shown in two versions: Samples A1 and B1 assume MATH 021 in the fall of first year. Samples A2 and B2 assume that MATH 021 is replaced by the sequence of MATH 075 in the fall and MATH 076 in the spring with MATH 022 deferred until sophomore year.

Students contemplating the Lehigh in Prague Program during the summer following their sophomore year should complete ACCT 151 and ACCT 152, CSE 311, and CSE 241 (or CSE 341) by the end of sophomore year. (See Samples B1 and B2). It is necessary to request an override to be allowed to take ACCT 152 concurrent with CSE 311.

Students not planning to go to Prague, or who plan to go in the summer following their junior year should take CSE 311 in the spring of junior year.

Students contemplating graduate study in computer science or employment at major computing software firms (e.g. Microsoft, Google, Oracle, IBM) should choose MATH 231 instead of ECO 045 and CSE 341 instead of CSE 241 if possible. These student must take CSE 340 prior to senior year. CSE 326 is strongly recommended as an elective choice for these students.

Students seeking to transfer into CSB from Engineering, Business or Arts and Sciences, should consult as soon as possible with the program co-directors. Note that to graduate in the normal 4 years it is necessary for CSB students to:

- Complete CSE 002 by spring of first year
- Complete CSE 017 by fall of second year
- Complete CSE 241 by spring of second year

CSE 002 and CSE 017 are offered fall and spring. CSE 241 is guaranteed only for spring semester.

### Computer Science and Business - SAMPLE A1 (MATH 021)

This is compatible with participating in the Lehigh in Prague Program during the summer after sophomore year, though it is not compatible with participation during the summer after junior year.

<table>
<thead>
<tr>
<th>First Year</th>
<th>CR</th>
<th>Second Semester</th>
<th>CR</th>
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<tbody>
<tr>
<td>BUS 001</td>
<td>1</td>
<td>CSE 017</td>
<td>3</td>
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<tr>
<td>BUS 003</td>
<td>1.5</td>
<td>MATH 022</td>
<td>4</td>
</tr>
<tr>
<td>CSE 001</td>
<td>2</td>
<td>MATH 231 or ECO 045</td>
<td>3</td>
</tr>
<tr>
<td>CSE 002</td>
<td>2</td>
<td>MGT 043</td>
<td>3</td>
</tr>
<tr>
<td>ECO 001</td>
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<td>Science elective-first course in two-course sequence</td>
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</tr>
<tr>
<td>ENGL 001</td>
<td>3</td>
<td>MATH 021</td>
<td>4</td>
</tr>
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</table>

**Total Credits:** 136

### Computer Science and Business - SAMPLE A2 (MATH 075/076)

This is not compatible with participating in the Lehigh in Prague Program during the summer after sophomore year, though it is compatible with participation during the summer after junior year.

<table>
<thead>
<tr>
<th>First Year</th>
<th>CR</th>
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<tbody>
<tr>
<td>BUS 003</td>
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<td>CSE 311</td>
<td>3</td>
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<tr>
<td>CSE 304</td>
<td>3</td>
<td>CSE 312</td>
<td>3</td>
</tr>
<tr>
<td>CSE 216</td>
<td>3</td>
<td>CSE 252</td>
<td>3</td>
</tr>
<tr>
<td>FIN 225</td>
<td>3</td>
<td>ECO 146 or 119</td>
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<tr>
<td>SCM 186</td>
<td>3</td>
<td>LAW 201</td>
<td>3</td>
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<tr>
<td>SS elective</td>
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<td>CSB professional elective</td>
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**Total Credits:** 136
<table>
<thead>
<tr>
<th>First Year</th>
<th>CR</th>
<th>Second Semester</th>
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<tbody>
<tr>
<td>BUS 001</td>
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<td>CSE 017</td>
<td>3</td>
</tr>
<tr>
<td>BUS 003</td>
<td>1.5</td>
<td>MATH 076</td>
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<td>CSE 002</td>
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<td>MGT 043</td>
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<td>4</td>
<td>MKT 111</td>
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<td>MATH 075</td>
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15.5

Second Year
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<tbody>
<tr>
<td>ACCT 151</td>
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<td>ACCT 152</td>
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<tr>
<td>CSE 109</td>
<td>4</td>
<td>CSE 202</td>
<td>3</td>
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<tr>
<td>MATH 022</td>
<td>4</td>
<td>CSE 241 or 341</td>
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<td>SCM 186</td>
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<td>CSE 140</td>
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<td>Science elective or second course in science sequence</td>
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18

Third Year
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<tr>
<td>BUS 203</td>
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<td>CSE 311</td>
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<tr>
<td>CSE 340</td>
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<td>CSE 216</td>
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<td>CSE 252</td>
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<td>FIN 125</td>
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<td>ECO 146 or 119</td>
<td>3</td>
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<tr>
<td>MATH 205</td>
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<td>LAW 201</td>
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<td>SS elective¹</td>
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17.5

Fourth Year
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<tbody>
<tr>
<td>CSB 313</td>
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<td>MGT 301</td>
<td>3</td>
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<tr>
<td>CSE 303</td>
<td>3</td>
<td>CSE elective (See Computer Science &amp; Business electives)</td>
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<td>CSE 262</td>
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<tr>
<td>HU Elective</td>
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<td>Free elective</td>
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</table>

16

Total Credits: 136

Computer Science and Business - SAMPLE B1 (Math 021)
Targeted towards students thinking about spending the summer after sophomore year in the Lehigh in Prague Program. Students not going to Prague need to fit CSE 252 and 3 professional elective credits into the regular semesters.

<table>
<thead>
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<th>CR</th>
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<tbody>
<tr>
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<td>CSE 017</td>
<td>3</td>
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<tr>
<td>BUS 003</td>
<td>1.5</td>
<td>MATH 076</td>
<td>2</td>
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<tr>
<td>CSE 001</td>
<td>2</td>
<td>ECO 045</td>
<td>3</td>
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<tr>
<td>CSE 002</td>
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<td>MGT 043</td>
<td>3</td>
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<tr>
<td>ENGL 001</td>
<td>3</td>
<td>Science elective - first course in two-course sequence</td>
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17.5

Second Year
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<th>Second Semester</th>
<th>CR</th>
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<tbody>
<tr>
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<td>MATH 205</td>
<td>3</td>
<td>CSE 241 or 341</td>
<td>3</td>
</tr>
<tr>
<td>MKT 111</td>
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18

Third Year
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<td>CSE 216</td>
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<td>ECO 146 or 119</td>
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</tr>
<tr>
<td>FIN 125</td>
<td>3</td>
<td>LAW 201</td>
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<tr>
<td>SCM 186</td>
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<td>SS elective¹</td>
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17.5

Fourth Year
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</table>

16

Total Credits: 136

Computer Science and Business - SAMPLE B2 (MATH 075/076)
Targeted towards students thinking about spending the summer after sophomore year in the Lehigh in Prague Program. Students not going to Prague need to fit CSE 252 and 3 professional elective credits into the regular semesters.

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<tr>
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<td>BUS 003</td>
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<td>CSE 001</td>
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<td>ECO 045</td>
<td>3</td>
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<td>CSE 002</td>
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<td>ECO 001</td>
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17.5

Second Year
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<td>CSE 109</td>
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<td>MATH 205</td>
<td>3</td>
<td>CSE 241 or 341</td>
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<td>MKT 111</td>
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18

Third Year
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<td>CSE 216</td>
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<td>ECO 146 or 119</td>
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<tr>
<td>FIN 125</td>
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<td>LAW 201</td>
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17.5

Fourth Year
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16

Total Credits: 136
### Second Year

<table>
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| Subject          | CR |                |                | 18  |

#### Summer

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#### Third Year

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#### Fourth Year

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<td>CSE 303</td>
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<td>CSE 262</td>
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<td>HU elective&lt;sup&gt;2&lt;/sup&gt;</td>
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<td>Free elective</td>
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<tr>
<td></td>
<td></td>
<td>HU elective</td>
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<td></td>
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<td>14</td>
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</tbody>
</table>

Total Credits: 136

<sup>1</sup> One credit counts as free elective  
<sup>2</sup> Two credits count as free elective. Note that most HU and SS courses are 4 credits and the credits beyond the total required by CSB contribute towards satisfying the free elective requirement.

### COMPUTER SCIENCE & BUSINESS ELECTIVES

In addition to the CSB electives, students are required to take one Computer Science course from the following

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CSE 264</td>
<td>Web Systems Programming</td>
<td>3</td>
</tr>
<tr>
<td>CSE 265</td>
<td>System and Network Administration</td>
<td>3</td>
</tr>
<tr>
<td>CSE 271</td>
<td>Programming in C and the Unix Environment</td>
<td>3</td>
</tr>
<tr>
<td>CSE 302</td>
<td>Compiler Design</td>
<td>3</td>
</tr>
<tr>
<td>CSE 313</td>
<td>Computer Graphics</td>
<td>3</td>
</tr>
<tr>
<td>CSE 318</td>
<td>Introduction to the Theory of Computation</td>
<td>3</td>
</tr>
<tr>
<td>CSE 319</td>
<td>Image Analysis and Graphics</td>
<td>3</td>
</tr>
<tr>
<td>CSE 326</td>
<td>Fundamentals of Machine Learning</td>
<td>3</td>
</tr>
<tr>
<td>CSE 327</td>
<td>Artificial Intelligence Theory and Practice</td>
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</tr>
<tr>
<td>CSE 331</td>
<td>User Interface Systems and Techniques</td>
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<td>CSE 334</td>
<td>Software System Security</td>
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### SUGGESTED SEQUENCES OF NATURAL SCIENCE COURSES

The following is an incomplete list of course sequences that satisfy the requirement: "two courses are in a laboratory science with the first course prerequisite to the second course." The exact set of courses depends on what each science department offers each semester.

Any course used for the science requirement must have an "NS" designation in the catalog (and there are some CHM, BIOS, and EES courses that are not "NS" but rather "ND", meaning "not designated"). The sum of all the NS-designated science credits must be at least 12.

We list here only courses that contribute to a prerequisite sequence. These sequences add up to between 7 and 9 credits. The remaining credits to reach a total of 12 may consist of any NS-designated courses.

#### Astronomy Sequence

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>PHY 005</td>
<td>Concepts In Physics and Introduction to Planetary Astronomy</td>
<td>7</td>
</tr>
<tr>
<td>PHY 010</td>
<td>General Physics I and Introduction to Planetary Astronomy&lt;sup&gt;2&lt;/sup&gt;</td>
<td>7</td>
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<tr>
<td>PHY 011</td>
<td>Introductory Physics I and Introduction to Planetary Astronomy&lt;sup&gt;2&lt;/sup&gt;</td>
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#### Biology Sequence

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<tbody>
<tr>
<td>CHM 030</td>
<td>Introduction to Chemical Principles and Biology Core I: Cellular and Molecular</td>
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<tr>
<td>BIO 041</td>
<td>Introduction to Chemical Principles and Biology Core I: Cellular and Molecular</td>
<td>7</td>
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#### Chemistry Sequences

<table>
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<th>Course Title</th>
<th>Credits</th>
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<tr>
<td>CHM 030</td>
<td>Introduction to Chemical Principles and Chemical Equilibria in Aqueous Systems</td>
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<tr>
<td>CHM 030</td>
<td>Introduction to Chemical Principles and Organic Chemistry I</td>
<td>7</td>
</tr>
<tr>
<td>CHM 030</td>
<td>Introduction to Chemical Principles and Biology Core I: Cellular and Molecular</td>
<td>7</td>
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<tr>
<td>CHM 040</td>
<td>Honors General Chemistry I and Honors General Chemistry II</td>
<td>8</td>
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<td>CHM 040</td>
<td>Honors General Chemistry I and Organic Chemistry I&lt;sup&gt;1&lt;/sup&gt;</td>
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<tr>
<td>CHM 040</td>
<td>Honors General Chemistry I and Biology Core I: Cellular and Molecular</td>
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<tr>
<td>BIO 041</td>
<td>Introduction to Chemical Principles and Biology Core I: Cellular and Molecular</td>
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#### Physics Sequences

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<td>PHY 010</td>
<td>General Physics I and General Physics II&lt;sup&gt;2&lt;/sup&gt;</td>
<td>7</td>
</tr>
<tr>
<td>PHY 010</td>
<td>Introductory Physics I and General Physics II&lt;sup&gt;2&lt;/sup&gt;</td>
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#### Earth and Environmental Science Sequence

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
</table>
Introduction to Planet Earth and Exploring Earth

The Environment and Living Systems and Exploring Earth

Conservation and Biodiversity and Exploring Earth

Design of Integrated Business Applications I and III Credits
Integrated Product Development (IPD) Capstone I. Industry-based business information systems design project. Information systems design methodology, user needs analysis, project feasibility analysis of design alternatives, and integrated product development methodology. Formal oral and written presentations to clients.

Optional 1-credit lab: CHM 111

Can be taken Concurrently: ACCT 152 or ACCT 108 and (CSE 241 or CSE 341)

CSB 312 Design of Integrated Business Applications II 3 Credits
Integrated Product Development (IPD) Capstone Course II. This course extends the industry-based project initiated in CSB 312 into its implementation phase. Detailed design, in-house system construction and delivery, commercial software options, and systems maintenance and support. The practical component of the course is supplemented by several classroom-based modules dealing with topics that lie at the boundary of computer science and business. Formal, oral, and written presentations to clients.

Optional 1-credit lab: PHY 012

Can be taken Concurrently: CSB 311

CSB 313 Design of Integrated Business Applications III 3 Credits
Integrated Product Development (IPD) Capstone Course III. This course extends the industry-based project initiated in CSB 312 into its implementation phase. Detailed design, in-house system construction and delivery, commercial software options, and systems maintenance and support. The practical component of the course is supplemented by several classroom-based modules dealing with topics that lie at the boundary of computer science and business. Formal, oral, and written presentations to clients.

Global Citizenship

GLOBAL CITIZENSHIP PROGRAM

Website: http://globalcitizenship.cas2.lehigh.edu

Supported by the Office of International Affairs (https://global.lehigh.edu) 610-758-2981; invpia@lehigh.edu
Coxe Hall, 32 Sayre Drive, Bethlehem, PA 18015-3123

As the world becomes increasingly interdependent in commerce, technology, and popular culture, people of different cultures must reconcile diametrically opposed views of fairness, equity, and conduct. Religious extremism, trade policies, human rights abuses, and gender inequality are but a few examples of controversies born out of belief systems colliding on the global stage. How will individuals from different national, religious, and cultural traditions understand their personal responsibilities in a world increasingly strained by resurging nationalism and the pressures of globalization?

The Global Citizenship Program prepares students for engaged living in a culturally diverse and rapidly changing world. Emphasizing critical analysis and value reflection, the program structures educational experiences through which students learn to negotiate international boundaries and develop their own sense of personal, social, and corporate responsibility to the global community. The program is designed to be flexible so that undergraduate students in any college may participate. Students bring perspectives of their own disciplines to the fore as the group explores questions of what it means to be a global citizen as an engineer, or a businessperson, or an artist or a social or natural scientist. To participate, interested students should enroll in GCP 010 - which is a pre-requisite for application to the program.

Certificate in Global Citizenship

Core Courses

GCP 010 Introduction to Global Citizenship 3
GCP 185 Cosmopolitanism and Culture I 1 2
GCP 186 Cosmopolitanism and Culture II 2
GCP 285 The Citizen and the City 2
GCP 385 Global Citizenship Capstone Course 3 4

Electives

Two electives approved by the program director/adviser and each at a minimum of 3 credits.

International Experience

12-14 day faculty-led intersession trip abroad 4

Additional international experience at least 4 weeks in length and approved by the program director/adviser

Total Credits 19

1 Fall Semester
2 Spring Semester
3 Students may register for 2 to 4 credits of GCP 385 Capstone Course per semester for a maximum of 2 semesters and a total maximum of 4 credits.
4 Most intersession trips will occur during winter term. Occasionally, the trip may be scheduled for spring or summer.
Courses
GCP 010 Introduction to Global Citizenship 3 Credits
An interdisciplinary approach introduces the contested notion of global citizenship. Readings explore the meaning of citizenship in the global era; the viability of nationalism and cosmopolitanism; the efficacy of social change initiatives in transnational context; the impact of economic globalization on vulnerable populations; the role of the United Nations; the discourse of human rights; and the relation between global and local justice. Addressing topics of urgent concern, students’ assignments consider global citizenship practice in relation to their area of study.
Prerequisites: GCP 010
Attribute/Distribution: HU, SS

GCP 185 Cosmopolitanism and Culture I 2 Credits
This multidisciplinary practicum approaches the themes and questions of global citizenship through the lens of a particular region. Participants explore that area’s geography, history, politics, economy, and culture in anticipation of travel. Special attention is given to cultural expectations and relevant social issues, especially in light of their global consequence. Classroom discussion and assignments prompt students to reflect on the ethical issues surrounding travel, service, and study abroad.
Prerequisites: GCP 010 and GCP 185
Attribute/Distribution: HU, SS

GCP 186 Cosmopolitanism and Culture II 2 Credits
This post-trip seminar analyzes the cohort’s experiences abroad and articulates their implication for global citizenship practice. While examining philosophical, religious, and artistic traditions associated with the intersession trip destination, students revisit their travel, think critically about their personal interaction with foreign places and people, and make informed decisions regarding their future practice as citizens. Classroom discussion emphasizes responsible cross-cultural engagement and critical reflection, with attention paid to the traditions of cosmopolitan thinking and action native to the region of travel.
Prerequisites: GCP 010 and GCP 185
Attribute/Distribution: HU, SS

GCP 285 The Citizen and the City 2 Credits
With a focus on Bethlehem’s South Side, this community-engaged practicum provides participants with a theoretical framework and practical skills for efficacious civic action. Course readings address local citizenship, urbanization, the built environment, diversity, and inclusion; assignments ask students to make connections, in theory and practice, to Bethlehem’s history and people. In cooperation with the Center for Community Engagement, all participants will complete 10-15 hours of engaged learning in the Lehigh Valley.
Prerequisites: GCP 010 and GCP 185 and GCP 186

GCP 385 Global Citizenship Capstone Course 2-4 Credits
This year-long, project-based seminar assesses globalization and social change through the lens of cosmopolitanism. Readings examine issues of power, privilege, and aid, especially as they affect the local community. Special attention is paid to the difference between sympathetic feeling and political action. Assignments encourage critical reflection on the Global Citizenship Program and ask students to articulate a personal definition of global citizenship. In teams, students propose and execute a capstone project that puts their understanding of global citizenship into practice.
Repeat Status: Course may be repeated.
Prerequisites: GCP 010 or GCP 185 or GCP 186 or GCP 285
Can be taken Concurrently: GCP 285

IDEAS: Integrated Degree in Engineering, Arts and Sciences

IDEAS: INTEGRATED DEGREE IN ENGINEERING, ARTS AND SCIENCES

Co-Directors: Nikolai Nikolov, Associate Professor, College of Arts and Sciences; William Best, Professor of Practice, P.C. Rossin College of Engineering and Applied Science

IDEAS is a four-year honors program resulting in an integrated Bachelor of Science (BS) Degree—jointly administered by the College of Arts and Sciences and the P.C. Rossin College of Engineering and Applied Science.

Interdisciplinary education in the arts and sciences and engineering is of significant value to students who will pursue a wide variety of careers. The complex challenges and problems confronting us in the 21st century dramatically underscore the importance of liberally educated and technologically sophisticated individuals whose habits of thought are thoroughly and comfortably interdisciplinary. Moreover, Lehigh is one of a small number of universities with the resources necessary to provide such an education. The students in this program will benefit from the integrated strategic leveraging of strengths across college boundaries.

This program cultivates a new breed of cross-disciplinary innovators. It provides an education that produces students well versed in dual focus areas, one in engineering and one in the arts, humanities, social sciences, mathematics or natural sciences. This educational environment also cultivates a multitude of thinking styles. It is renaissance thinking for the technological era.

Entry Requirements
1. Admitted students who have expressed an interest when applying will be considered for the IDEAS program. Only a limited number of students will be accepted. Students are invited to join this honors program by invitation.
2. To remain in the IDEAS program students must maintain a 3.25 GPA. At the end of the first year, a student with a GPA below 3.25 is given two semesters to achieve a GPA of 3.25; otherwise the student will be asked to transfer to a regular degree program.
3. Students may transfer into the IDEAS program at the end of their first semester or year if space becomes available. A formal application to the program must be filed and approval from the co-directors must be obtained.
4. Students who are interested in the IDEAS program should indicate that interest when applying.

The IDEAS program is designed so that students who transfer out of the program at the completion of the first year will still be able to complete an arts and sciences or engineering degree in four years. The four-year IDEAS program does not lead to an ABET accredited engineering degree. It is possible for students to complete a BS degree in IDEAS and an ABET accredited BS engineering degree (dual degrees) in one or two additional semesters.

PROGRAM COMPONENTS

The IDEAS degree requires a minimum of 136 credits in the program components shown below:

<table>
<thead>
<tr>
<th>IDEAS core</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>IDEA 011</td>
<td>IDEAS Seminar I</td>
</tr>
<tr>
<td>IDEA 012</td>
<td>IDEAS Seminar II</td>
</tr>
<tr>
<td>IDEA 111</td>
<td>IDEAS Seminar III</td>
</tr>
<tr>
<td>IDEA 112</td>
<td>IDEAS Seminar IV</td>
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<tr>
<td>IDEA 150</td>
<td>IDEAS Seminar V</td>
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<tr>
<td>IDEA 151</td>
<td>IDEAS Seminar VI</td>
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<tr>
<td>IDEA 250</td>
<td>IDEAS Seminar VII</td>
</tr>
<tr>
<td>IDEA 251</td>
<td>IDEAS Seminar VIII</td>
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</table>

<table>
<thead>
<tr>
<th>Math/Science core</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 021</td>
<td>Calculus I</td>
</tr>
<tr>
<td>MATH 022</td>
<td>Calculus II</td>
</tr>
<tr>
<td>MATH 023</td>
<td>Calculus III</td>
</tr>
<tr>
<td>MATH 205</td>
<td>Linear Methods</td>
</tr>
<tr>
<td>CHM 030</td>
<td>Introduction to Chemical Principles</td>
</tr>
<tr>
<td>PHY 011</td>
<td>Introductory Physics I</td>
</tr>
<tr>
<td>&amp; PHY 012 &amp; Introductory Physics Laboratory I</td>
<td></td>
</tr>
</tbody>
</table>

Select three of the following:

<table>
<thead>
<tr>
<th>Select three of the following:</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOS 041</td>
<td>Biology Core I: Cellular and Molecular Biology and Biochemistry</td>
</tr>
<tr>
<td>&amp; BIOS 042</td>
<td>Cellular and Molecular Lab</td>
</tr>
<tr>
<td>CHM 110</td>
<td>Organic Chemistry I</td>
</tr>
<tr>
<td>&amp; CHM 111 &amp; Organic Chemistry Laboratory I</td>
<td></td>
</tr>
<tr>
<td>EES gateway courses</td>
<td></td>
</tr>
<tr>
<td>PHY 021</td>
<td>Introductory Physics II</td>
</tr>
<tr>
<td>&amp; PHY 022 &amp; Introductory Physics Laboratory II</td>
<td></td>
</tr>
</tbody>
</table>
Additional details on the main curricular components of the program include:

1. **IDEAS Core Courses:** One each semester.
   a. These courses replace ENGR 005, ENGL 001 & ENGL 002, the CAS college seminar, and the CAS junior year writing intensive requirement. All IDEAS core courses are writing intensive.
   b. IDEA 011 and IDEA 012: the first year IDEAS core courses will emphasize intensive faculty mentoring within a small seminar environment where students develop, write, and present their individual interest areas and select their concentrations.
   c. IDEA 111 and IDEA 112: a continuation of IDEA 011 & IDEA 112 where interest areas are integrated into themes as individual concentrations are pursued.
   d. IDEA 150 and IDEA 151: the junior year includes working on team-based projects and preparing for the senior year thesis work.
   e. IDEA 250 and IDEA 251: the senior year honors thesis courses.
2. **Math/Science Core:** All students are required to fulfill the 36 credit math/science requirement, regardless of their choice of concentrations.
3. **Engineering Majors:** Engineering majors are divided into two different categories:
   a. Interdisciplinary Theme: an approved interdisciplinary theme in engineering that can be coordinated with a liberal arts concentration.
   b. Engineering Discipline: a defined engineering discipline, e.g., mechanical engineering. Students will follow a concentration in the curriculum defined by the chosen area.
4. **Arts and Sciences Majors:** A&S majors are divided into two different categories:
   a. Interdisciplinary Theme: an approved interdisciplinary theme (e.g., STS) in arts and sciences that can be coordinated with an engineering concentration.
   b. Liberal Arts Discipline: a defined liberal arts discipline, e.g., English. Students will follow the curriculum defined by the chosen concentration.
   A minimum of 36 credits is required in the liberal arts concentration. If students choose a concentration that requires fewer than 36 credits, in addition to those taken as part of the math/science core, the additional credits must be selected in the CAS.
   Students may select mathematics or science as the liberal arts discipline. However, the humanities and social science distribution requirement (8 credits of humanities and 8 credits of social science) must be satisfied using the 16 credit elective core which is also be accepted for distribution in the RCEAS.
5. **Interdisciplinary Theme:** An approved interdisciplinary theme (e.g., STS) in arts and sciences that can be coordinated with an engineering concentration.
6. **Liberal Arts Discipline:** A defined liberal arts discipline, e.g., English. Students will follow the curriculum defined by the chosen concentration.
   a. A minimum of 36 credits is required in the liberal arts concentration. If students choose a concentration that requires fewer than 36 credits, in addition to those taken as part of the math/science core, the additional credits must be selected in the CAS.
   b. Students may select mathematics or science as the liberal arts discipline. However, the humanities and social science distribution requirement (8 credits of humanities and 8 credits of social science) must be satisfied using the 16 credit elective core which is also be accepted for distribution in the RCEAS.
7. **Combining the Engineering and Liberal Arts Concentrations:** You may combine your particular interests in engineering and in arts and sciences and customize your academic experience at Lehigh in one of the following ways:
   a. by combining an Engineering Discipline with an Arts and Sciences Discipline (e.g., Electrical Engineering and International Relations)
   b. by combining an Engineering Discipline with an Arts and Sciences Theme (e.g., Chemical Engineering and STS)
   c. by combining an Engineering Theme with an Arts and Sciences Discipline (e.g., Product Liability and Chemistry)
   d. or custom design your own combination between Engineering and Arts and Sciences with your advisors

### Academic Advising
1. The program is jointly administered by co-directors from the College of Arts and Sciences and the P.C. Rossin College of Engineering and Applied Science. They, after the first year, become the secondary academic advisors for all IDEAS students.
2. Primary faculty advisors from appropriate disciplines provide quality curriculum advising in each of the student’s chosen concentrations. Careful advising is required because of the greater flexibility of IDEAS.
3. Students who wish to earn an accredited engineering degree in one additional year should inform their advisors.

For general information visit the IDEAS web site at: www.lehigh.edu/IDEAS

### Courses
**IDEA 011 IDEAS Seminar I 2 Credits**
The first year IDEAS core courses will emphasize intensive faculty mentoring within a small seminar environment where students develop, write, and present their individual interest areas and select their concentrations.

**IDEA 012 IDEAS Seminar II 2 Credits**
The first year IDEAS core courses will emphasize intensive faculty mentoring within a small seminar environment where students develop, write, and present their individual interest areas and select their concentrations.

**IDEA 111 IDEAS Seminar III 2 Credits**
A continuation of IDEAS 011 & IDEA 012 where interest areas are integrated into themes as individual concentrations are pursued.

**IDEA 112 IDEAS Seminar IV 2 Credits**
A continuation of IDEAS 011 & IDEA 012 where interest areas are integrated into themes as individual concentrations are pursued.

**IDEA 150 IDEAS Seminar V 1 Credit**
The junior year courses have students working on team-based projects and preparing for the senior year thesis work.

**IDEA 151 IDEAS Seminar VI 1 Credit**
The junior year courses have students working on team-based projects and preparing for the senior year thesis work.
IDEA 250 IDEAS Seminar VII 1 Credit
The senior year honors thesis course.

IDEA 251 IDEAS Seminar VIII 1 Credit
The senior year honors thesis course.

IDEA 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

Integrated Business and Engineering Honors Program

INTEGRATED BUSINESS AND ENGINEERING HONORS PROGRAM
After four years and a minimum of 137 credits, students will receive a single Bachelor of Science Degree in Business and Engineering. The program meets the accreditation standards of AACSB International. Students are required to maintain a minimum GPA of 3.25 in order to remain in the program.

Students in the IBE Honors Program can major in any area of business or engineering that Lehigh offers. After freshman year, each student will elect a major in either the College of Business and Economics or the P. C. Rossin College of Engineering and Applied Science. Students wanting to major in an area of business can select from: accounting, business information systems, economics, finance, marketing, management or supply chain management.

DEGREE REQUIREMENTS
Engl 001 (3)
Humanities and Social Science (10)
Must include BUS 003 and BUS 203, Plus 7 HSS elective credits
Math and Science Core (31)
Engr 010 or CSE 011
Math 021, 022, and 023
Math 231 or (ISE 111 and ISE 121)
Physics 011, 012, 021 and 022
Chem 030
Engineering Core (20)
Courses depend on major
Business and Economics Core (34)
MGT 043
ACCT 151
ACCT 152
BIS 044
BIS 111 or ISE 224 or CSE 242
BIS 244
ECO 001
ECO 146 or ECO 119
Fin 125
Law 201
Mgt 243
Mkt 111
Major (18)
Specific courses in business or engineering that depend on the major selected
Integrated Courses in IBE (12)
IBE 010
IBE 050
IBE 150
IBE 250
IBE 380
IBE 385
Free Electives (9)
May be taken from any department in the University
Summer Internships (0)
At least one professional internship is required
Other internships, including an international internship, are strongly encouraged

TOTAL (137)
This is a minimum number of credits
The actual number of credits taken would depend upon advanced placement credits

It should be noted that the IBE Honors Program has a language requirement. Students must achieve proficiency at the sophomore level in the language of their choice. Students with no previous experience in a second language may need to take 16 foreign language credits (4 courses, each at 4 credits). Students may devote six credits of humanities and social science electives, and 6 credits of free electives to language courses. Thus students with absolutely no foreign language background may need an additional four credits above the 137 required for graduation.

DETAILED CURRICULUM INFORMATION BY MAJOR
For detailed information regarding major requirements, see the IBE website at URL: ibe.lehigh.edu.

Admission to the Integrated Business and Engineering Honors Program is highly selective, with annual admission limited to approximately 50 students. The University’s Office of Admissions (610-758-3100) can explain the procedure for applying to the program.

It is possible that a small number of exceptional students may be admitted to the program following the completion of their freshman year. Admission at this point would be highly competitive and based upon freshman year GPA, faculty recommendations, and space availability.

The co-directors of the IBE Honors Program are Richard J. Kish, Professor of Finance (rijk7@lehigh.edu) and Robert H. Storer, Professor of Industrial and Manufacturing Systems Engineering (rhs2@lehigh.edu). For additional information, visit the IBE web site at www.lehigh.edu/ibe.

Courses
IBE 010 Integrated Business and Engineering Seminar 1 Credit
Introduction to the various business and engineering professions through a series of presentations and demonstrations. Emphasis is on the diversity of business and engineering career opportunities and the associated curricular choices. Students also create their web page with four-year curriculum plan and an updated resume, learn Cad-Cam and presentation software, and explore career opportunities. Open only to first-year students in the Integrated Business and Engineering Honors Program.

IBE 050 Integrated Business and Engineering Workshop 3 Credits
The course introduces students to the interaction and interdependence of business planning and engineering design in the context of entrepreneurial new product development. Students develop skills in communication, teamwork and critical thinking while working in such areas as competitive strategy, financial modeling, marketing mix, prototyping, product testing, and the development of technical specifications. Open only to students in the Integrated Business & Engineering Honors Program.

IBE 150 Integrated Business and Engineering Sophomore Laboratory 1 Credit
A series of cases that integrate elements of business and engineering. Example topics include, but are not limited to, introduction to cost benefit analysis, introduction to modeling and optimization, team dynamics, and international negotiation and joint ventures. Oral presentations and written reports. Open only to students in the Integrated Business and Engineering Honors Program.

IBE 171 Integrated Business and Engineering Independent Study 1 Credit
Students address a technical issue in a business context from an entrepreneurial focus. Students pursue their own business start-up idea, either a product or a service, and develop a business plan that includes prototypes and testing (engineering) as well as a marketing plan and a base case financial model (business). The goal of the course is for students to enter a business plan or entrepreneurial competition in a local, regional or national level. Open only to students in the Integrated Business and Engineering Honors Program.

Prerequisites: IBE 050
IBE 250 Integrated Business and Engineering Junior Laboratory 1 Credit
A semester-long simulation game in which interdisciplinary teams of IBE students compete against each other. Topics include market analysis, working capital management, capital budgeting, raising long-term capital, plant location, and inventory control. Oral presentations and written reports. Open only to students in the Integrated Business and Engineering Honors Program.

IBE 271 Independent Study 1 Credit
IBE 380 Integrated Business and Engineering Capstone Project I 3 Credits
IBE students work in cross-disciplinary teams of 5 to 6 business and engineering majors with a faculty mentor on the marketing, financial and economic planning, and technical and economic feasibility of actual new product concepts initiated by the course’s corporate sponsors. These sponsors are incubator start-up firms to ensure that the projects have both business and engineering elements. Written reports and oral presentations to sponsors and invited venture capitalists are required. Open only to students in the Integrated Business and Engineering Honors Program.

IBE 385 Integrated Business and Engineering Capstone Project II 3 Credits
IBE students continue to work with the detailed design including the fabrication and testing of working prototypes of their new products designed in IBE Capstone Project I course. In addition to the technical design of the products, detailed financial and marketing plans are required. Written reports and oral presentations to sponsors and invited venture capitalists are required. Open only to students in the Integrated Business and Engineering Honors Program.

Military Science
The Department of Military Science, established in 1919, conducts the Army Reserve Officers Training Corps (ROTC) program at Lehigh University. This is one of the oldest ROTC programs in the nation. The Army ROTC program provides a means for students to qualify for a commission as an officer in the Active Army, Army Reserve, or Army National Guard.

OVERVIEW
The objectives of the military science program are to develop leadership and management ability in each student; to provide a basic understanding of the Army’s history, philosophy, organization, responsibilities, and role in American society; and to develop fundamental professional knowledge and skills associated with officership. These objectives are achieved through classroom instruction, leadership laboratories, realistic training scenarios, exposure to Army doctrine, professional development, leadership simulations, and individual assessment and counseling. Army ROTC offers a four-year program and a two-year program. The four-year program consists of a two-year basic course and a two-year advanced course. The two-year program consists of the two-year advanced course offered to students with previous military experience, and those who have successfully completed the four-week ROTC Cadet Initial Entry Training. Basic course students incur no obligation for service in the Army as a result of taking these courses.

Basic Course
The basic course, normally taken in the freshman and sophomore years, provides training and instruction in leadership, public speaking, and basic military subjects, such as the Army’s role and organizational structure, history and philosophy of the Army, basic tactics, land navigation, first aid, group dynamics, and leadership traits and characteristics. Basic course students incur no military obligation and is only available to freshman and sophomore students.

Advanced Course
The advanced course is normally taken in the junior and senior years. The instruction includes management, military skills, advanced leadership and tactics, logistics, administration, military law, ethics, and professionalism, and includes attendance at the ROTC Cadet Leadership Course (CLC). Students receive subsistence pay during their junior and senior years.

To enroll in the advanced course, an applicant must complete either the basic course or the four-week Cadet Initial Entry Training (CIET); or have received basic course credit for previous military experience. Note: The Advanced course (300 and 400 level) is a requirement for Scholarship and contracted cadets only and is not offered to participating students.

Uniforms and Equipment
Uniforms are provided to contracted and scholarship cadets only. In the event of lost equipment or uniforms, students will be charged for those items not returned upon leaving the program.

Transfers
Qualified students transferring from another institution may enter the ROTC program at the appropriate level and year, provided they have received the necessary credits, the recommendation of their former professor of military science (if applicable), and the approval of Cadet Command and the university. Please contact the ROTC office for details.

Obligation after Graduation
Upon graduation, a student will receive a commission as a Second Lieutenant in either the Active Army, Army Reserve, or National Guard. If offered active duty, scholarship students serve at least four years of active duty and four years of inactive ready reserve. If offered reserve duty, students normally serve eight years in a Reserve or National Guard unit.

Graduate Studies
ROTC graduates may request to delay their active service to pursue a full-time course of instruction leading to an advanced degree. The only four major areas of concentration are medical school, law school, veterinary school and seminary. Delay does not lengthen the active service obligation unless the degree is obtained at government expense.

Course Credit
Students in the College of Arts and Sciences and the College of Business may substitute military science advanced credits for six hours of electives. In the College of Engineering and Applied Science, six credits of advanced ROTC work are permissible within the normal program of each student, irrespective of curriculum. For curricula that include more than six hours of personal electives in the junior and senior years, inclusion of the more than six hours of ROTC credit with normal programs can be effected only with the approval of academic advisers. All military science credits, including those in the basic course, apply toward the student’s overall cumulative grade point average.

CAREER OPPORTUNITIES
Individuals are commissioned as officers in the United States Army after completion of the ROTC program including the Cadet Leadership Course (CLC), and the completion of their bachelor’s degree requirements. They then qualify in one of seventeen branches (specialties) such as the Corps of Engineers, Infantry, Armor, Aviation, Field Artillery, Air Defense Artillery, Signal Corps, Cyber Corps, Military Intelligence, Chemical Corps, Ordnance Corps, Finance, Transportation, Military Police, Adjutant General, Quartermaster, Medical Service Corps, or Nursing. Officers work as leaders/managers, specialists, or combinations of the two depending on the assignment.

PROGRAMS AND OPPORTUNITIES
ROTC Scholarship Program
This program is designed to offer financial assistance to outstanding young men and women entering the ROTC program who are interested in an Army career. Scholarships provide full annual tuition, a textbook allowance, and common fees; in addition students receive subsistence pay for the period the scholarship is in effect. Three-year and two-year scholarships may be available to outstanding cadets who are currently enrolled in the ROTC program and are completing their freshman or sophomore year of college. This program is also open to all qualified students who are not currently enrolled in Army ROTC.

Four-year scholarships are open to all students entering ROTC as freshmen. Applications for scholarship must be made to Headquarters, U.S. Army Cadet Command, Fort Knox, KY by July 15th prior to the high school senior year for early selection, but no later than November 15th for normal application. You may apply on line at www.goarmy.com (http://www.goarmy.com) and follow the appropriate links. Application
booklets are also available from most high school guidance offices, or may be obtained from the military science department.

Two-Year Program
Students who want to enroll in ROTC after their sophomore year may apply. Applicants must successfully complete a four-week Cadet Initial Entry Training (CIET) and have two years of undergraduate or graduate studies remaining. The student is paid for the four-week encampment and receives transportation costs to and from the camp. Additional scholarships may be available upon completion of basic camp (CIET).

Physical Facilities
Army ROTC uses areas on and adjacent to the university campus to conduct field training. These locations are excellent for most outdoor activities such as orienteering, patrolling, and survival training. Fort Indiantown Gap Military Reservation, located east of Harrisburg, Pa., and Fort Dix, N.J., located east of Philadelphia, Pa., are used for various weekend field exercises which allow cadets to apply the classroom leadership and Army doctrine in a training environment.

Off-campus U.S. Army Training Schools
Cadets may be selected to attend the following U.S. Army Schools: Airborne School (Fort Benning, Georgia), Air Assault School (Fort Campbell, Kentucky), Mountain Warfare School (Ethan Allen Training Center, Vermont), and Northern Warfare School (Fort Greely, Alaska). Combat Diver Qualification Course (Key West, Florida), Sapper Leader Course (Fort Leonardwood, MO). This off-campus program is fully funded by the U.S. Army. Many other installations throughout the world may be visited through the Cadet Troop Leader Training program. Nursing students may choose to attend the Nurse Summer Training Program at Army hospitals located throughout the United States.

A minor in military science is available in the College of Arts and Sciences. A minor in military science consists of a minimum of 28 credit hours beyond the basic Military Science course and is designed to provide the student with an academic foundation necessary to support continued intellectual growth and stimulate future inquiry in the realm of civil military affairs and military science. Credit hours required are distributed as follows:

<table>
<thead>
<tr>
<th>Military Science</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIL 101 Adaptive Team Leadership I</td>
<td>3</td>
</tr>
<tr>
<td>MIL 102 Adaptive Team Leadership II</td>
<td>3</td>
</tr>
<tr>
<td>MIL 113 Developing Adaptive Leaders</td>
<td>3</td>
</tr>
<tr>
<td>MIL 114 Leadership in a Complex World</td>
<td>3</td>
</tr>
<tr>
<td>HIST 110 American Military History</td>
<td>4</td>
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</table>

<table>
<thead>
<tr>
<th>International Relations</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select one course</td>
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<table>
<thead>
<tr>
<th>Written Communications</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Select one course from one of the following categories:</td>
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<tr>
<td>Creative Writing</td>
<td></td>
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<tr>
<td>Scientific Writing</td>
<td></td>
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<tr>
<td>Writing for Mass Communications</td>
<td></td>
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<tr>
<td>English Composition</td>
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<tr>
<th>Human Behavior</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Select one course from one of the following categories:</td>
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</tr>
<tr>
<td>General Psychology</td>
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<tr>
<td>Sociology</td>
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<tr>
<td>Anthropology</td>
<td></td>
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<tr>
<td>Ethics</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Computer Literacy</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select one course</td>
<td>3</td>
</tr>
</tbody>
</table>

| Total Credits                      | 28-29   |

COMMISSIONING REQUIREMENTS
Individuals must complete either the two- or four-year programs, attend CLC, receive a college degree, have a cumulative GPA of 2.0, and complete all professional military education requirements to become commissioned officers in the United States Army.

COURSE DESCRIPTIONS
Leadership Laboratory is conducted for all students once a week for 60 to 90 minutes. The Leadership Laboratory provides a forum for cadets to exercise their leadership skills amongst their peers.

Instruction at several levels on a variety of subjects with military application provides the context within which students are furnished opportunities to both teach and lead in a group setting. Responsibility is expanded as the student progresses through the program. In the senior year, the students assume the responsibility for the planning, preparation and conduct of the laboratory. Leadership Laboratory is mandatory for all students enrolled in military science courses.

CADET LEADERSHIP COURSE
This is a four-week training program normally conducted at Fort Knox, KY. Prerequisites are:

1. The completion of the basic 100 and 200 level military science courses or the equivalent which is the completion of the Cadet Initial Entry Training (CIET).
2. Scholarship/contracted cadets must have completed all level courses up to and including the 300 level military science courses.

Courses

<table>
<thead>
<tr>
<th>MIL 010 Introduction to the Army 1 Credit</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>The overall focus is on developing basic knowledge and comprehension of the Army Leadership Requirements Model while gaining a complete understanding of the Reserve Officers’ Training Corps (ROTC) program, its purpose in the Army, and its advantages for the student.</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>MIL 011 Foundations of Agile and Adaptive Leadership 1 Credit</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cadets learn how the personal development of life skills such as critical thinking, time management, goal setting, and communication. Cadets learn the basics of the communications process and the importance for leaders to develop the essential skills to effectively communicate in the Army.</td>
<td></td>
</tr>
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<table>
<thead>
<tr>
<th>MIL 015 Foundations Of Officership 0,1 Credits</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>The American Army as an institution, its roots, history, customs and traditions and philosophy of leadership. Emphasis on development and role of a professional officer corps. Includes leadership laboratory.</td>
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<table>
<thead>
<tr>
<th>MIL 016 Basic Leadership 1 Credit</th>
<th>Credit</th>
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<tbody>
<tr>
<td>Role of individual and leader within the group, leadership skills and characteristics. Emphasis on problem solving and application. Includes laboratory and FTX.</td>
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<thead>
<tr>
<th>MIL 020 Leadership and Decision Making 2 Credits</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>The course adds depth to the Cadets’ understanding of the Adaptability Army Learning Area. The outcomes are demonstrated through Critical and Creative Thinking and the ability to apply Troop Leading Procedures (TLP) to apply Innovative Solutions to Problems.</td>
<td></td>
</tr>
</tbody>
</table>

| Prerequisites: MIL 010 and MIL 011 |

<table>
<thead>
<tr>
<th>MIL 021 Army Doctrine and Team Development 2 Credits</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>The course begins the journey to understand and demonstrate competencies as they relate to Army doctrine. Army Values, Teamwork, and Warrior Ethos and their relationship to the Law of Land Warfare and philosophy of military service are also stressed.</td>
<td></td>
</tr>
</tbody>
</table>

| Prerequisites: MIL 010 and MIL 011 and MIL 020 |

<table>
<thead>
<tr>
<th>MIL 023 Individual Leadership Studies 0-2 Credits</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maps as tools in basic terrain analysis and as navigational aids and introduction to small unit tactics. Emphasis on application and field exercises at individual and small group levels. Includes leadership laboratory and FTX.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MIL 024 Leadership and Teamwork 2 Credits</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contemporary theories, traits and principles and small unit tactics development. Leadership philosophies, communications, leader-follower relationships, and leadership problem-solving. Leadership simulations. Includes leadership laboratory and FTX.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MIL 101 Adaptive Team Leadership 10,3 Credits</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essential junior officer skills: advanced land navigation, principles of war, small unit tactical planning, tactics and techniques of the soldier, team leading techniques, oral communications and trainer skills. Emphasizes application and field experience. Includes leadership laboratory and FTX. Consent of department chair required.</td>
<td></td>
</tr>
</tbody>
</table>
MIL 102 Adaptive Team Leadership II 3 Credits
Critical examination of leadership qualities, traits and principles with emphasis on military environment. Self, peer, and instructor leadership evaluation. Advanced military skills reinforced. Includes leadership laboratory and FTX. Consent of department chair required.

MIL 113 Developing Adaptive Leaders 0.3 Credits
Role, authority and responsibility of military commanders and staff in personnel, logistics and training management. Staff procedures, problem solving, training methods and oral and written communications skills used in military organizations. Includes leadership laboratory and FTX. Consent of department chair required.

MIL 114 Leadership in a Complex World 3 Credits
Development of the Profession of Arms, its fundamental values and institutions. Ethical responsibilities of military professionals in contemporary American society. Just war theory, international law of war, and American military law. Also covered are current topics to assist cadets in making the transition to the officer corps and service on active duty or in the reserve forces. Includes leadership laboratory and FTX. Consent of department chair required.

MIL 118 Special Topics for Army Officer 1 Credit

MIL 201 Training Management and the Warfighting Functions 3 Credits
It is an academically challenging course where you will study, practice, and apply the fundamentals of Training Management and how the Army operates through the Warfighting functions.
Prerequisites: MIL 100 and MIL 011 and MIL 020 and MIL 021

MIL 202 Applied Leadership in Small Unit Operations 3 Credits
It is an academically challenging course where you will study, practice, and apply the fundamentals of direct level leadership and small unit tactics at the platoon level. At the conclusion of this course, you will be capable of planning, coordinating, navigating, motivating and leading a platoon in the execution of a mission.
Prerequisites: MIL 201

MIL 300 Apprentice Teaching 3 Credits

MIL 301 The Army Officer 3 Credits
It is an academically challenging course where you will develop knowledge, skills, and abilities to plan, resource, and assess training at the small unit level.
Prerequisites: MIL 202

MIL 302 Company Grade Leadership 3 Credits
An academically challenging course where you will develop knowledge, skills, and abilities required of junior officers pertaining to the Army in Unified Land Operations and Company Grade Officer roles and responsibilities.
Prerequisites: MIL 301

Sustainable Development

Program Director: Donald Morris, Ph.D. (Colorado)
Email: dpm2@lehigh.edu | Phone: 610-758-5175
Website: www.lehigh.edu/sdp
Supported by the Office of Interdisciplinary Programs, 610-758-3996; incasip@lehigh.edu
Williams Hall, 31 Williams Drive

** THIS PROGRAM IS CURRENTLY ON HIATUS. NO NEW MINORS ARE BEING ADMITTED INTO THE SUSTAINABLE DEVELOPMENT PROGRAM. **

Students of any discipline who are interested in helping solve the triple bottom line challenge of their generation: economic well-being, environmental protection, and social inclusion, are invited to join with like-minded students to collaborate in devising and implementing solutions to real-world challenges of Sustainable Development (SDEV).

MINOR IN SUSTAINABLE DEVELOPMENT
The minor in Sustainable Development (SDEV) consists of a minimum of at least 15 hours of study that includes a combination of core courses and approved electives.

The minor in Sustainable Development (SDEV) consists of a minimum of at least 15 hours of study that includes a combination of core courses and approved electives.

<table>
<thead>
<tr>
<th>Core Courses</th>
<th>Electives</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDEV 010 Challenges of Sustainable Development</td>
<td>8</td>
</tr>
<tr>
<td>SDEV 201 Sustainable Development Solutions, I or SDEV 307 International Social Entrepreneurship</td>
<td></td>
</tr>
</tbody>
</table>

Elective Courses
- SDEV 122 Sustainable Development Solutions, I 3
- SDEV 123 Oceans and Human Health 4
- SDEV 202 Sustainable Development Solutions, II 2-4
- SDEV 203 Research in Sustainable Development 2-4
- SDEV 372 Independent Study in Sustainable Development 1-4
- ECO 203 Microfinance: Financial Inclusion for the Poor 3
- ECO 303 Economic Development 3
- AAS/HIST/GS 341 Global Africa: Aid, Volunteerism, NGO’s and International Studies 3-4
- ANTH/AAS/GS 324 Globalization and Development in Africa 4
- ES 310 Foundations of Sustainable Development Practice 4
- ES 314 Urban Agriculture Policy, Planning and Practice 4
- POLS/ENTP 310 Social Entrepreneurship: How to Change the World 4
- POLS/GS/WGSS 342 Gender and Third World Development 3-4
- POLS 348 Land Use, Growth Management, and the Politics of Sprawl 3-4
- SOC/GS 319 The Political Economy of Globalization 4
- SOC/HMS/GS 322 Global Health Issues 4
- SOC/GS 328 Global Food Systems 4
- SOC/WGSS 341 Gender and Health 4

Courses
- SDEV 010 Challenges of Sustainable Development 4 Credits
  History and principles of sustainable development, including their application to projects in both rich and poor countries. Survey of current environmental, social and economic challenges to sustainable development. Philosophy and ethics of external intervention for poverty alleviation and green development, especially in poor societies. Integrated approaches to sustainable development practice, including the inter-relationship of the health sciences, natural sciences, social sciences and management.
  Attribute/Distribution: SS
- SDEV 011 Social Research for Engineering Projects 1-2 Credits
  Research project under the supervision of faculty.
  Repeat Status: Course may be repeated.
  Attribute/Distribution: SS
SDEV 122 Sustainable Dev:CR Experience 3 Credits
Investigation of the concept of sustainable development as currently being practiced in Costa Rica. Case studies in diverse areas (e.g., agriculture, bio-prospecting, ecotourism, energy, and land use) demonstrate how current approaches to sustainable development are influenced by the history and ecology of Costa Rica, as well as the structure of its political, social, and economic systems. Attention to theories of sustainable development and of consumption help to frame the Costa Rican experience. Students maintain individual “sustainability” journals based on their experiences from which they draw for team-based research and writing projects. The course is offered through Lehigh Abroad and consists of 5 evening classes during the fall semester and required course travel to Costa Rica between the fall and winter semesters (approximately 18 days). Final course projects are due early in the spring semester. Course participation will require additional fees as described by Lehigh Abroad (airfare and program fee).
Prerequisites: SDEV 010
Attribute/Distribution: SS

SDEV 123 (HMS 123) Oceans and Human Health 4 Credits
The world’s oceans affect human health in many ways: they provide food and water to human populations; they are a point of exposure to pollutants, toxins, and diseases; and they provide pharmaceuticals and animals used in biomedical research. This course explores the interactions between oceans and human health by studying the ways in which they interconnect. This summer study abroad course is based at the Bermuda Institute of Ocean Sciences (BIOS).
Attribute/Distribution: NS

SDEV 201 Sustainable Development Solutions, I 3 Credits
Projects practicum in which cross-disciplinary teams of 5-6 students focus on understanding the context of a particular NGO amidst the broader social, economic, and scientific challenges to sustainable development. Analytic techniques for designing, implementing and evaluating projects. Nuts and bolts of development practice. Teams work on needs assessment related to their NGO’s proposed goals and devise innovative solutions for implementing development projects. On-the-ground field experience, whether international or domestic, is required. Fee may apply. Oral presentations and written reports.
Prerequisites: SDEV 010
Can be taken Concurrently: SDEV 010
Attribute/Distribution: SS

SDEV 202 Sustainable Development Solutions, II 2-4 Credits
Continuation and extension of projects begun in SDEV 201. Refine implementation strategies and develop project evaluation protocol. Oral presentations and written reports.
Prerequisites: SDEV 201
Attribute/Distribution: SS

SDEV 203 Research in Sustainable Development 2-4 Credits
Students will work on sustainable development research projects not involving field work. Consent of instructor required.
Repeat Status: Course may be repeated.
Prerequisites: SDEV 010
Attribute/Distribution: SS

SDEV 300 Apprentice Teaching 1-4 Credits
Repeat Status: Course may be repeated.

SDEV 307 (ENTP 307) International Social Entrepreneurship 4 Credits
International social entrepreneurship aims to change the world through innovation in solving social problems. Focus on the nexus between social entrepreneurship and development practice, especially in relation to NGOs. Emphasis on acquiring tools and conceptual frameworks to launch new social ventures through real hands-on international fieldwork and team-oriented learning by doing. Exposure to best practices of how to affect meaningful social change in poor countries, to generate and evaluate innovative ideas to develop them into concrete on-the-ground startups.
Attribute/Distribution: SS

SDEV 310 (ES 310) Foundations of Sustainable Development Practice 4 Credits
The broad goal of this course is to introduce students to the foundations of key sectoral and thematic knowledge for important challenges to sustainable development: food and nutritional security, social service delivery, energy policy, water resource management, urbanization, infrastructure, human rights, biodiversity, adaptation to climate change, mitigating GHGs, sustainable business, good governance, and more. Through the Global Classroom we will do this together virtually with academic partners from around the world.
Attribute/Distribution: SS

SDEV 372 Independent Study in Sustainable Development 1-4 Credits
Opportunity for students to pursue individual sustainable development projects or continue work begin in SDEV 201/202. May not count towards minor’s credit requirements. Consent of department required.
Repeat Status: Course may be repeated.
Prerequisites: SDEV 010
Attribute/Distribution: HU, SS

Technical Entrepreneurship Program
The Technical Entrepreneurship (TE) program helps students develop the entrepreneurial mindset needed to create, refine and commercialize new products and services, whether in an established company or a start-up. Students enrolled in TE courses learn by experiencing the idea-to-venture process in an education environment that is hard-wired to support the development of novel, innovative, and commercially-viable technologies. The TE programs are based on our 20 years of experience with Lehigh’s award-winning Integrated Product Development (IPD) program. In 2012 IPD was recognized by the National Academy of Engineering for providing real-world entrepreneurial experiences to our students. In 2015 the IPD named courses were replaced by TE 211 and TE 212.

TE Undergraduate Program
At the undergraduate level the technical entrepreneurship program offers introductory skill building courses, such as TE 250: Creativity Methods, and TE 304: Software Ventures, as well as capstone projects courses such as TE 211/212: Capstone Design Projects I/II. While the capstone projects courses satisfy ABET requirement for many engineering majors, TE 211/212 are open to all junior level students from any undergraduate major.

UNDERGRADUATE TE COURSES

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TE 211</td>
<td>Capstone Design Projects-1</td>
<td>3</td>
</tr>
<tr>
<td>TE 212</td>
<td>Capstone Design Projects-2</td>
<td>2</td>
</tr>
<tr>
<td>TE/ENTP 250</td>
<td>Systematic Creativity Techniques</td>
<td>3</td>
</tr>
<tr>
<td>TE/ENTP 304</td>
<td>Technology and Software Ventures</td>
<td>3</td>
</tr>
</tbody>
</table>

Graduate TE Program: See Masters of Engineering in Technical Entrepreneurship

Professors Of Practice. Marc de Vinck, BFA (Parsons School of Design); Michael Lehman, MD (Penn State College of Medicine); Marsha Wender Timmerman, MS (Rutgers University)

Courses

TE 211 Capstone Design Projects-1 3 Credits
Students work in cross disciplinary teams on conceptual design projects with realistic constraints including marketing, financial and economic planning, and economic and technical feasibility including industrial, business and engineering standards for new products. Teams typically work on projects from industry or entrepreneurial start-ups. Oral presentations and written reports.
TE 212 Capstone Design Projects-2 2 Credits
Students work in cross disciplinary teams students on the detailed design, including fabrication and testing of a prototype following industrial, business and engineering standards for the new products or processes designed in Capstone Design Experiences-1. Additional deliverables include a detailed production plan, marketing plan, and base-case financial models. Teams typically work on projects from industry or entrepreneurial start-ups. Oral presentations and written reports.
Prerequisites: TE 211
Attribute/Distribution: ND

TE 250 (ENTP 250) Systematic Creativity Techniques 3 Credits
ENTP 250/TE 250 -- Systematic creativity methods including anthropological research, painstorming, bisociation, the Kano model, trimming technique, DeBono's Six Hats technique, biomimicry, lateral benchmarking, Blue Ocean Strategy, & the art of tinkering, along with other innovation methods. This course includes hands-on labs, individual & team projects, & the creation of a creativity portfolio. Open to students in any college and major. (ND).
Attribute/Distribution: ND

TE 301 Creativity and Systematic Innovation Methods 3 Credits
Creativity methods, anthropological research, painstorming, bisociation, the Kano model, axiomatic design, the trimming technique, parameter analysis, decomposition, nonlinear design, Taguchi's method, DeBono's Six Hats technique, biomimicry, TRIZ, lateral benchmarking, Blue Ocean Strategy, the art of tinkering and other innovation methods. Hands-on labs, individual and team projects.

TE 302 Methods in Visual Thinking 2 Credits
Visualization techniques, visual thinking and envisioning information as taught by Edward Tufte and others, multimedia tools and methods. Appropriate use of technology as applied to new product development, no programming required.

TE 303 Methods in Prototyping, Modeling and Testing 2 Credits
Generation of mock-ups and looks-like prototypes, electro-mechanical-optical bread-boards design, fabricate, build and test multiple generations of prototypes, computer modeling methods, shop methods, testing, sensors and data collection.

TE 304 (CSB 304, ENTP 304) Technology and Software Ventures 3 Credits
Designed from the perspective of functional leaders, course provides a holistic perspective of developing successful software ventures across various industries in an interdisciplinary and experiential environment. Students develop a software-oriented idea, concurrent with module delivery containing best practices, case studies, and subject-matter experts. Examines business model fundamentals, customer discovery, translating requirements to a minimum viable product, agile development, user acquisition, and traction. ENTP Capstone. Prior programming experience or technical background not required. Open to students in any college and major.
Prerequisites: ENTP 101 or CSE 002 or BIS 111

TE 310 (ME 310) Directed Study 1-3 Credits
Project work on any aspect of technical entrepreneurship, performed either individually or as a member of a team made up of students, possibly from other disciplines. Project progress is reported in the form of several planning and project reports. Direction of the project may be provided by faculty from several departments (possibly interacting with outside consultants, communities and industries). Consent of the Technical Entrepreneurship program director is required.
Repeat Status: Course may be repeated.

TE 400 Technical Entrepreneurship Projects 1 1 Credit
An introduction to technical entrepreneurship projects, customer discovery in selected industry segments, research of target technologies, industries and markets.

TE 401 Integrated Product Development (IPD) Process -1 3 Credits
An integrated and interdisciplinary approach to engineering design, concurrent engineering, design for manufacturing, industrial design and the business of new product development. Topics include design methods, philosophy and practice, the role of modeling and simulation, decision making, risk, cost, material and manufacturing process selection, platform and modular design, mass customization, quality, planning and scheduling, business issues, teamwork, group dynamics, creativity and innovation. Case studies and semester-long team projects.

TE 402 Integrated Product Development (IPD) Process-2 3 Credits
Continuation of TE 401, the parallel development of the product, the development of the marketing and manufacturing system, manufacturing and marketing launch, sales, service and customer support. Case studies and semester-long team projects.
Prerequisites: TE 401

TE 403 Entrepreneurial Startup Process-1 3 Credits
Key aspects surrounding company startups, including feasibility analysis, business model development and evaluation, formation of new venture teams, financial forecasts, sources of financing. Readings, financial templates, live case studies and guest entrepreneurs.

TE 404 Entrepreneurial Startup Process-2 3 Credits
Continuation of TE 403, integration of key business components to form and launch your venture: industry analysis, marketing plan and sales strategy; mobilization of the new venture team; operations, including space, legal and insurance consideration; and financial management. Selected topics related to respective venture types (i.e. social entrepreneurship, family business, franchising, immigrant entrepreneurs). Lectures, workshops and guest entrepreneurs.
Prerequisites: TE 403

TE 405 Entrepreneurial Startup Projects-1 1 Credit
Applying the concepts and processes developed in parallel with TE 403. Developing your business platform including business model, start-up team, and financial plan to launch and grow your venture.
Prerequisites: TE 400

TE 406 Entrepreneurial Startup Projects-2 3 Credits
Applying the concepts off entrepreneurial startup process, building upon the business model, entrepreneurial team and financing plan developed in TE 405. Developing a comprehensive business plan and investor’s pitch, finalize the steps necessary to launch the company and start operations.
Prerequisites: TE 400 and TE 405

TE 407 Intellectual Property (IP) Creation and Management 2 Credits
Intellectual property issues: confidentiality, nondisclosure, agreement not to compete, founders agreements, patents, copyrights, trademarks, trade secrets both domestic and international.

TE 450 Special topics 1-3 Credits
An intensive study of some aspect of technical entrepreneurship not covered in other general courses. Consent of the program director is required.
Repeat Status: Course may be repeated.

TE 461 Integrated Product Development (IPD) Projects-1 1 Credit
Technical and economic feasibility study of new products. Selection and content of the project is determined by the faculty project adviser in consultation with the student, progress and final reports, oral and posters presentations. Consent of the program director and faculty project adviser required.
Prerequisites: TE 400

TE 462 Integrated Product Development (IPD) Projects-2 3 Credits
Detailed design specification, fabrication, building and testing prototype new products and plan for production, selection and content of the project is determined by the faculty project advisor in consultation with individual students or student teams. Progress and final reports, oral and poster presentations. Consent of program director and faculty project adviser required.
Prerequisites: TE 400 and TE 461
Interdisciplinary Graduate Study and Research

In addition to offering graduate degrees within academic departments, Lehigh University offers interdisciplinary graduate degrees in the fields of American studies, business administration and educational leadership, business administration and engineering, energy systems engineering, environment policy design, financial engineering, manufacturing systems engineering, photonics, polymer science and engineering, and technical entrepreneurship.

Lehigh University also offers graduate certificate programs in certain specialized fields of study. Graduate certificates consist of a minimum of twelve credits, at least six of which must be at the 400-level. Such certificates are specific to Lehigh and do not constitute official certification, as might be required to be employed professionally. Students are admitted to certificate programs in the same way as to degree programs. More specific information on admission criteria and completion requirements are available in certificate program administrators.

In addition, Lehigh’s interdisciplinary research centers and institutes address the research needs of government, industry, and society. Organized to recognize research efforts in interdisciplinary problem areas, they supplement the university’s academic departments. Graduate students pursuing M.S. and Ph.D. degrees in academic departments, as well as students enrolled in interdisciplinary degree programs, may pursue research opportunities in the various centers.

A complete listing of research centers, institutes, and other research organizations appears following the section on interdisciplinary graduate programs.

FINANCIAL ASSISTANCE
Teaching assistantships and fellowships are provided by individual academic departments, while research assistantships are available through both academic departments and research centers. Students interested in research are encouraged to seek appointments with members of the faculty working in their areas of special interest, with department chairpersons, or with center or institute directors.

Environmental Policy
Right now is a pivotal time to be grappling with environmental issues and studying the policies and tools necessary to create the communities and world we want to see as the 21st century continues to unfold. The M.A. in Environmental Policy prepares students to act on the challenges presented by climate change and urbanization. The program’s interdisciplinary coursework covers the legal and political structures that do (or might) oversee, regulate, manage, subsidize, or otherwise affect environmental sustainability, justice and health, as well as the social practices, moral authority and economic dynamics that affect interventions. Students gain further insights through independent research, community outreach and internships.

For more information visit Environmental Initiative

Financial Engineering
The Master of Science in Financial Engineering (MSFE) program provides students with a strong education in advanced finance and quantitative financial analysis tools to develop graduates who can create innovative solutions for real financial problems, using state of the art analytical techniques and computing technology. Students with undergraduate degrees in computer science, economics, engineering, finance, mathematics and the hard sciences should have the quantitative background needed for success in this field.

This program equips students with the necessary skill set to prepare for the Financial Risk Manager® examination offered by The Global Association of Risk Professionals (GARP). (http://www.garp.org)

PREREQUISITES
Applicants must show basic competency in the following areas: corporate finance, investments, financial accounting, statistics, linear algebra, and calculus. These courses will not count toward the master degree.

Entrance Prerequisites
(Examples given from Lehigh courses)
Must show basic competency in the following areas: (Does not count towards the 30 credit minimum degree requirement)

Corporate Finance
FIN 328  Corporate Financial Policy (OR)  3
FIN 419  Financial Management  3
Equivalent course

Investments
FIN 323  Investments (OR)  3
GBUS 420  Investments  3
Equivalent course

Financial Accounting
ACCT 151  Introduction to Financial Accounting (OR)  3
ACCT 108  Fundamentals of Accounting (OR)  3
GBUS 401  Financial Reporting for Managers and Investors  3
Equivalent accounting course

Statistics and Probability
MATH 231  Probability and Statistics (OR)  3
ISE 328  Engineering Statistics  3
Equivalent introductory calculus based statistics and probability course

Calculus Series
MATH 021  Calculus I (AND)  4
MATH 022  Calculus II (AND)  4
MATH 023  Calculus III  4
Equivalent calculus series

Linear Algebra
MATH 205  Linear Methods (OR)  3
MATH 242  Linear Algebra  3-4
Equivalent course

Note: Accepted applicants at Lehigh typically have several prerequisites that must be fulfilled.

Note: Prerequisites do not have to be taken at Lehigh University.

Note: ECO 045 or an equivalent introductory statistics course including simple regression analysis is not rigorous enough preparation for MATH 467 and therefore is not adequate for the Statistics and Probability prerequisite.

Required Courses
The 30 credit hour program is a joint venture of the College of Business, the P.C. Rossin College of Engineering and Applied Science and the College of Arts & Sciences. Required courses are as follows:

Analytical Core
MATH 467  Stochastic Calculus (fall)  3
MATH 468  Financial Stochastic Analysis (spring)  3
Select one of the following Statistics courses:  3
STAT 410  Random Processes and Applications (fall)
STAT 412  Advanced Applied Statistics  3
Select one of the following computation modeling courses:  3
ECO 415  Econometrics I (fall)
STAT 438  Linear Models In Statistics with Applications (spring)
Select one of the following Industrial Engineering courses:  3
ISE 426  Optimization Models and Applications
ISE 429  Stochastic Models and Applications

Finance Core
GBUS 421  Advanced Investments (Fixed Income - spring)  3
GBUS 422  Derivatives and Risk Management (fall)  3
ANALYTICAL FINANCE CERTIFICATE PROGRAMS

The M.S. in Financial Engineering Program offers three certificate programs to candidates in the MSFE program. Certificates are available in Data Science & Financial Analytics, Quantitative Risk Management or Financial Operations Research and may be earned by completing an additional two courses for a total of 36 credit hours. Candidates for the MSFE degree do not need to apply initially for certificate programs. Students meet with any Program Director to select their certificate choice (if any) once they are enrolled in the program.

Certificate programs enhance skills and development by allowing additional exploration in three main functional areas.

For the three (3) proposed Certificate Programs, the description for the Catalog of the Certificate Programs are the following:


The objective is to provide students with a unique skillset preparing them for careers in the interdisciplinary field of Data Science and Financial Analytics, with particular application to the financial services industry. Skills developed include working with massive data sets, data-driven analytical methodologies, SAS and R programming, Data Mining, and Machine Learning.

Curriculum: (12 credits)

- ISE 465 Applied Data Mining (3 Credits)
- One of the two courses below:
  - ISE 469 Mining of Large-scale Datasets (3 Credits)
  - ISE 444 Optimization Methods in Machine Learning (3 Credits)
- STAT 412 Statistical Computing and Applications (3 Credits)
- One of the two data-intensive Finance courses below:
  - ISE 447 Financial Optimization
  - ISE 455. Optimization Algorithms and Software (3 Credits)
- One of the following MATH/STAT courses:
  - ISE 407. Computational Methods in Optimization (3 Credits)
  - MATH 461 (STAT 461) Topics In Mathematical Statistics (3 Credits)

2. Quantitative Risk Management (QRM) Certificate

The objective is to train students in the quantitative methodologies and regulatory practices that are essential for risk management functions within a financial institution. Prepares students for and reinforces material from the FRM examination. The Financial Risk Manager (FRM) designation is the premier certification for professionals in financial risk management. The two part exam contains the following topics, many of which overlap the curriculum of the MSAF program: Financial Markets and Products, Valuation and Risk Models, Quantitative Analysis, Foundations of Risk Management, Market Risk, Credit Risk, Operational Risk, Risk Management and Investment Management, and Current Regulatory Issues. Furthermore, Lehigh’s MSAF program is an Academic Partner of the Global Association of Risk Professionals (GARP) who administers the FRM certification.

Curriculum: (12 credits)

- GBUS 422 Derivatives and Risk Management (3 Credits)
- GBUS 424 Adv Topics in Financial Management – Risk Management (3 Credits)
- GBUS 426 Financial Markets and Institutions (3 Credits)
- One of the following MATH/STAT courses:
  - STAT 434 / MATH 334 Mathematical Statistics (3,4 Credits)
  - MATH 461 (STAT 461) Topics In Mathematical Statistics (3 Credits)
  - STAT 438/MATH 338 Linear Models in Statistics w/ Applications (3,4 Credits)

3. Financial Operations Research

The objective is to provide the student with an understanding of the fundamental techniques underlying Operations Research Techniques that are of ubiquitous use in all areas of business today like Linear Programming, Game Theory, Dynamic Programming, Integer Programming, Nonlinear Programming, and Machine Learning.

Curriculum: (12 credits)

- ISE 426. Optimization Models and Applications (3 Credits)
- ISE 447. Financial Optimization (3 Credits)
- Two (2) electives from the following courses:
  - ISE 458. (ECO 463) Game Theory (3 Credits)
  - ISE 455. Optimization Algorithms and Software (3 Credits)
  - ISE 407. Computational Methods in Optimization (3 Credits)
  - ISE 416. Dynamic Programming (3 Credits)
  - ISE 444. Optimization Methods in Machine Learning (3 Credits)
  - ISE 467 Mining of Large-scale Datasets (3 Credits)

ADMISSIONS

Applications are accepted through the graduate online application system at https://applyweb.lehigh.edu/msaf. Applicants must take either the GRE or GMAT. International students must have 18 years of schooling with four years at the University level to be considered for admission. Applicants whose native language is not English are required to take either the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IELTS) exam. Deadline for international applicants to apply is April 15. U.S. Citizens may apply until July 15.

Further information about the M.S. in Financial Engineering Program may be obtained by visiting http://cbe.lehigh.edu/msaf, contacting the Graduate Programs Office of the College of Business or one of the following Co-Directors:

Dr. Richard Kish, Perella Department of Finance, College of Business, Lehigh University, 621 Taylor Street, Bethlehem, PA 18015, phone (610) 758-4205, email: rjk7@lehigh.edu

Dr. Daniel Conus, Department of Mathematics, Lehigh University, 14 E. Packer Avenue, Bethlehem, PA 18015, phone (610) 758-3749, email: dac311@lehigh.edu

Dr. Luis Zuluaga, Department of Industrial and Systems Engineering, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA 18015, phone (610) 758-5182, email: luis.zuluaga@lehigh.edu

Graduate Certificates in Arts and Sciences

CERTIFICATE IN AFRICANA STUDIES

(For details see "Africana Studies" (p. 59))

CERTIFICATE IN COGNITIVE SCIENCE

(For details see "Cognitive Science" (p. 113))

CERTIFICATE IN DOCUMENTARY FILM

(For details see "Film and Documentary Studies (http://catalog.lehigh.edu/coursesprogramsandcurricula/artsandsciences/filmanddocumentarystudies")")

CERTIFICATE ENVIRONMENTAL HEALTH

(For details see "Environmental Initiative (p. 138)")

CERTIFICATE IN ENVIRONMENTAL JUSTICE

(For details see "Environmental Initiative (p. 138)")

CERTIFICATE IN ENVIRONMENTAL LAW AND POLICY

(For details see "Environmental Initiative (p. 138)")
CERTIFICATE IN NANO TECHNOLOGY
(For details see materials science and engineering (http://www.lehigh.edu/~inmatsci/graduate/certificate.htm):

 CERTIFICATE IN STEREOTYPES, PREJUDICE, DISCRIMINATION, AND INTERGROUP RELATION
(For details see "Psychology (p. 240")

 CERTIFICATE IN SUSTAINABLE DEVELOPMENT
(For details see "Environmental Initiative (p. 138")

 CERTIFICATE IN URBAN ENVIRONMENTAL POLICY AND PLANNING
(For details see "Environmental Initiative (p. 138")

 CERTIFICATE IN WOMEN, GENDER AND SEXUALITY STUDIES
(For details see "Women, Gender and Sexuality Studies (p. 272")

Graduate Certificates in Engineering

Certificate in Healthcare Systems Engineering
(For details see healthcare systems engineering (https://hse.lehigh.edu/degrees/certificate-option))

Certificate in Management Science & Engineering
(For details see industrial systems and engineering (https://engineering.lehigh.edu/ise/academics/certificates/#mgmt))

Certificate in Nanotechnology
(For details see materials science and engineering (https://engineering.lehigh.edu/matsci/graduate/certificates))

Certificate in Polymer Science & Engineering
(For details see materials science and engineering (https://engineering.lehigh.edu/matsci/graduate/certificates))

CERTIFICATE IN TECHNICAL ENTREPRENEURSHIP
(For details see technical entrepreneurship (https://te.lehigh.edu/parttimecertificateprogram))

Graduate Certificates in Intercollegiate Programs

CERTIFICATE IN WOMEN, GENDER AND SEXUALITY STUDIES
(For details see "Women, Gender and Sexuality Studies (p. 272")

Graduate Certificates in Intercollegiate Programs

Certificates in Data Science & Financial Analytics, Quantitative Risk Management or Financial Operations Research are available to Lehigh graduate students, provided prerequisites are met. Students may meet with any Program Director listed below to select their certificate choice upon enrollment in a graduate degree program.

Certificate programs enhance skills and development by allowing additional exploration in three main functional areas.


Students develop a unique skill set preparing them for careers in the interdisciplinary field of Data Science and Financial Analytics, with particular application to the financial services industry. Skills developed include working with massive data sets, data-driven analytical methodologies, SAS and R programming, Data Mining, and Machine Learning.

Curriculum: (12 credits)
ISE 465 Applied Data Mining (3)
STAT 412 Statistical Computing and Applications (3)

One of the two courses below:
ISE 469 Mining of Large-scale Datasets (3)
ISE 444 Optimization Methods in Machine Learning (3)

One of the two data-intensive finance courses below:
GBUS 422 Derivatives and Risk Management (3)
GBUS 424 Advanced Topics in Financial Management-Risk Management (3)

2. Quantitative Risk Management (QRM) Certificate

Students are trained in the quantitative methodologies and regulatory practices that are essential for risk management functions within financial institutions.

Curriculum (12 credits)
GBUS 422 Derivatives and Risk Management (3)
GBUS 424 Advanced Topics in Financial Management-Risk Management (3)
GBUS 426 Financial Markets and Institutions (3)

One of the following courses:

STAT 434/MATH 334 Mathematical Statistics (3,4)
MATH 461 (STAT 461) Topics in Mathematical Statistics (3)
STAT 438/MATH 338 Linear Model in Statistics with Applications (3,4)

3. Financial Operations Research

Students gain an understanding of the fundamental techniques underlying Operations Research that are of ubiquitous use in all areas of business today, such as Linear Programming, Game Theory, Dynamic Programming, Integer Programming, Nonlinear Programming, and Machine Learning.

Curriculum (12 credits)
ISE 426 Optimization Models and Applications (3)
ISE 447 Financial Optimization (3)
Select 2 courses from the following:
ISE 458 (ECO 463) Game Theory (3)
ISE 455 Optimization Algorithms and Software (3)
ISE 407 Computational Methods in Optimization (3)
ISE 416 Dynamic Programming (3)
ISE 444 Optimization Methods in Machine Learning (3)
ISE 467 Mining or Large-scale Datasets (3)

Information may be obtained from any co-director below:
Dr. Richard Kish, Perella Department of Finance, College of Business, Lehigh University, 621 Taylor Street, Bethlehem PA 18015, phone (610) 758-4205, email rjkl7@lehigh.edu
Dr. Daniel Conus, Department of Mathematics, Lehigh University, 14 E. Packer Avenue, Bethlehem PA 18015, phone (610) 758-3749, email dac311@lehigh.edu
Dr. Luis Zuluaga, Department of Industrial and Systems Engineering, Lehigh University, 200 W. Packer Avenue, Bethlehem PA 18015, phone (610) 758-5182, email luis.zuluaga@lehigh.edu

Manufacturing Systems Engineering

The M.S. in Manufacturing Systems Engineering (MSE) Program is no longer accepting new applicants.

Program advisers: John P. Coulter, Ph.D., professor of mechanical engineering; Gregory L. Tonkay, Ph.D., associate professor of industrial and systems engineering.

The world renowned, cross-disciplinary manufacturing systems engineering program develops engineers who can design, install, operate, and modify systems involving materials, processes, equipment, facilities, logistics and people using leading edge technologies. It integrates systems perspectives with interdisciplinary course offerings from Lehigh’s colleges of engineering and applied science, and business and economics.

Lehigh’s award-winning graduate program leading to the cross-disciplinary master of science degree in manufacturing systems engineering (MSE) is administered by the Center for Manufacturing Systems Engineering within the P.C. Rossin College of Engineering and Applied Science. In addition, the College of Business participates in teaching accounting, business, finance, management, and marketing aspects affecting manufacturing systems.

DISTANCE EDUCATION
It is possible for distance students to earn the MS in MSE degree remotely.

MAJOR REQUIREMENTS
For further information contact: Carolyn Jones, MSE Program Coordinator, 310 Packard Lab, Bethlehem, PA 18015 (610) 758-5157, FAX (610) 758-5623, Email ccj1@lehigh.edu

The degree requires completion of 30 credits of graduate level work, including:

ADMISSION REQUIREMENTS

- A bachelor’s degree in engineering or an appropriate science is required.
- All candidates must have at least six months work experience in industry.
- All candidates must follow admission procedures and standards established by Lehigh University.

ccj1@Lehigh.edu or visit the MSE web site at https://mse.lehigh.edu
Courses

MSE 356 Micromanufacturing Systems & Technologies 3 Credits
Manufacturing engineering in microelectronics, microelectromechanical, nano-, opto- and micro-scale manufacturing. Examination of systems design, equipment, process and operational issues and linkages to business strategies. Crystal growth, thin film deposition processes and patterning, removal processes, vacuum engineering, contamination control, clean room practices etc. Individual research assignments. Note: 300 level course may not be repeated at the 400 level for credit.

MSE 362 (ISE 362) Logistics and Supply Chain Management 3 Credits
Modeling and analysis of supply chain design, operations, and management. Analytical framework for logistics and supply chains, demand and supply planning, inventory control and warehouse management, transportation, logistics network design, supply chain coordination, and financial factors. Industry case studies and a comprehensive final project.

MSE 401 (ME 401) Integrated Product Development 3 Credits
An integrated and interdisciplinary approach to engineering design, concurrent engineering, design for manufacturing, industrial design and business of product development. Design methods, philosophy and practice, the role of modeling and simulation, decision making, risk, cost, materials and manufacturing process selection, platform and modular design, mass customization, quality, planning and scheduling, business issues, teamwork, group dynamics, creativity and innovation. Case studies and team projects with geographically dispersed team members.

MSE 402 Introduction to the Organization and Its Environment 2 Credits
Designed to provide a thorough understanding of business organizations by examining strategies middle and senior managers use to create and sustain organizational competitive advantage. The course examines the organization from an overall perspective within the context of the firm's internal and external environment. The second aspect of the course deals with the ability to communicate effectively in today's business environment. Students will examine and practice communications strategies and skills that are essential to their success in business.

MSE 403 Global Competitive Environment 1 Credit
Experimental projects in selected fields of manufacturing systems engineering, approved by the instructor that discuss the global competitive environment in the context of material covered in MBA 401/ MSE 402.

Repeat Status: Course may be repeated.

MSE 431 Marketing & the Invention to Innovation Process 3 Credits
Organizational issues and decision-making for capital investments in new technologies. The commercialization process is traced from research and development and marketing activities through the implementation phase involving the manufacturing function. Term project is a commercialization plan for a new manufacturing technology.

MSE 438 Agile Organizations & Manufacturing Systems 3 Credits
Analysis of the factors contributing to the success of manufacturing enterprises in an environment characterized by continuous and unpredictable change. Fundamentals of lean production: aspects of systems design, value stream analysis, flow, set-up and cycle time reduction, kaizen, elimination of waste. Fundamentals of agility: global enterprises, virtual organizations, adapting to change, mass customization, manufacturing flexibility, activity-based management.

MSE 443 (ISE 443) Automation and Production Systems 3 Credits
Principles and analysis of manual and automated production systems for discrete parts and products. Cellular manufacturing, flexible manufacturing systems, transfer lines, manual and automated assembly systems, and quality control systems.

MSE 446 International Supply Chain Management 3 Credits
Financial and managerial issues. Evaluation, selection, development and management of suppliers; business models, financial reporting strategies, earnings, quality, risk assessment and internal control, team based new product development. Selected readings, case studies, discussions, lectures, group projects, and presentations.

MSE 451 Manufacturing Systems Engineering Project 1-3 Credits
MSE 456 Micromanufacturing Systems & Technologies 3 Credits
Manufacturing engineering in microelectronics, microelectromechanical, nano-, opto- and micro-scale manufacturing. Examination of systems design, equipment, process and operational issues and linkages to business strategies. Crystal growth, thin film deposition processes and patterning, removal processes, vacuum engineering, contamination control, clean room practices etc. Individual research assignments. Note: 300 level course may not be repeated at the 400 level for credit.

MSE 472 Special Topics 1-3 Credits
Special Topics 1-3 credits.

MSE 482 Aspects of Sustainable Systems Design 3 Credits
Design of sustainable systems for manufacturing that fulfill human needs and generate wealth. Demographic, ecological, economic, environmental, ergonomic, health and global or local socio-political impacts on design and operation of future systems. Conservation of resources in the design, manufacture and use of products, processes, and implementation systems; life cycle engineering, reclamation, recycling, remanufacture. Research-based term paper.

MSE 490 Manufacturing Systems Engineering Thesis 1-6 Credits
MSE 499 Dissertation 0-15 Credits

Master of Engineering in Technical Entrepreneurship

Lehigh's 11-month, 30-credit, full-time professional Master's program (M.Eng.) in technical entrepreneurship helps young entrepreneurs to develop an entrepreneurial mindset through a process we call "Learn by Doing, Learn by Making and Learn by Launching." Entrepreneurial minded students from any undergraduate major are encouraged to apply. Students in the program learn by experiencing the idea-to-venture process in an educational environment that's features a dedicated curriculum offered by a dedicated faculty in a dedicated, intellectual property secure maker space. The business community -- from young start-ups to the Fortune 500 -- recognizes the need for curious, creative and innovative young minds with the skills to lead and manage product development teams to create social and economic value. Graduates of the TE MEng program will find themselves well-positioned to take on complex product development roles and assignments in both large and small companies.

Graduate TE Course Sequence
The TE academic calendar begins with the start of the second summer session with 6 credits. Students complete 12 credits each during the fall and spring semesters ending in May of the following year.

Students complete five credits in the second summer session, ten credits in the fall, ten credits in the spring and then five credits in summer session 1

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<tr>
<th>First Year</th>
<th>Second Semester</th>
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<td>TE 403</td>
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<th>Second Year</th>
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<td>TE 401</td>
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<td>TE 403 or GBN 424 (Only with TE program director's approval)</td>
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<td>TE 404</td>
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<td>TE 302</td>
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453
TE 405 | 1
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| Credits | 12 | 12 |
Total Credits: 30

Further information can be obtained from: http://www.lehigh.edu/~innovate/

Professor Marsha Wender Timmerman
Director
P.C. Rossin College of Engineering & Applied Science
(610) 758-4770

Ms. Jodie L. Johnson
Assistant Director
P.C. Rossin College of Engineering & Applied Science
(610) 758-4789

Professors Of Practice. Marc de Vinck, BFA (Parsons School of Design); Michael Lehman, MD (Penn State College of Medicine); Marsha Wender Timmerman, MS (Rutgers University)

Courses

TE 211 Capstone Design Projects-1 3 Credits
Students work in cross disciplinary teams on conceptual design projects with realistic constraints including marketing, financial and economic planning, and economic and technical feasibility including industrial, business and engineering standards for new products. Teams typically work on projects from industry or entrepreneurial start-ups. Oral presentations and written reports.

TE 212 Capstone Design Projects-2 2 Credits
Students work in cross disciplinary teams on the detailed design, including fabrication and testing of a prototype following industrial, business and engineering standards for the new products or processes designed in Capstone Design Experiences-1. Additional deliverables include a detailed production plan, marketing plan, and base-case financial models. Teams typically work on projects from industry or entrepreneurial start-ups. Oral presentations and written reports.

Prerequisites: TE 211
Attribute/Distribution: ND

TE 250 (ENTP 250) Systematic Creativity Techniques 3 Credits
ENTP 250/TE 250 -- Systematic creativity methods including anthropological research, painstorming, biocision, the Kano model, trimming technique, DeBono's Six Hats technique, biomimicry, lateral benchmarking, Blue Ocean Strategy, & the art of tinkering, along with other innovation methods. This course includes hands-on labs, individual & team projects, & the creation of a creativity portfolio. Open to students in any college and major. (ND).

Attribute/Distribution: ND

TE 301 Creativity and Systematic Innovation Methods 3 Credits
Creativity methods, anthropological research, painstorming, biocision, the Kano model, axiomatic design, the trimming technique, parameter analysis, decomposition, nonlinear design, Taguchi's method, DeBono's Six Hats technique, biomimicry, TRIZ, lateral benchmarking, Blue Ocean Strategy, the art of tinkering and other innovation methods. Hands-on labs, individual and team projects.

TE 302 Methods in Visual Thinking 2 Credits
Visualization techniques, visual thinking and envisioning information as taught by Edward Tufte and others, multimedia tools and methods. Appropriate use of technology as applied to new product development, no programming required.

TE 303 Methods in Prototyping, Modeling and Testing 2 Credits
Generation of mock-ups and looks-like prototypes, electro-mechanical-optical bread-boards design, fabricate, build and test multiple generations of prototypes, computer modeling methods, shop methods, testing, sensors and data collection.

TE 304 (CSB 304, ENTP 304) Technology and Software Ventures 3 Credits
Designed from the perspective of functional leaders, course provides a holistic perspective of developing successful software ventures across various industries in an interdisciplinary and experiential environment. Students develop a software-oriented idea, concurrent with module delivery containing best practices, case studies, and subject-matter experts. Examines business model fundamentals, customer discovery, translating requirements to a minimum viable product, agile development, user acquisition, and traction. ENTP Capstone. Prior programming experience or technical background not required. Open to students in any college and major.

Prerequisites: ENTP 101 or CSE 002 or BIS 111

TE 310 (ME 310) Directed Study 1-3 Credits
Project work on any aspect of technical entrepreneurship, performed either individually or as a member of a team made up of students, possibly from other disciplines. Project progress is reported in the form of several planning and project reports. Direction of the project may be provided by faculty from several departments (possibly interacting with outside consultants, communities and industries). Consent of the Technical Entrepreneurship program director is required.

Repeat Status: Course may be repeated.

TE 400 Technical Entrepreneurship Projects 1 1 Credit
An introduction to technical entrepreneurship projects, customer discovery in selected industry segments, research of target technologies, industries and markets.

TE 401 Integrated Product Development (IPD) Process -1 3 Credits
An integrated and interdisciplinary approach to engineering design, concurrent engineering, design for manufacturing, industrial design and the business of new product development. Topics include design methods, philosophy and practice, the role of modeling and simulation, decision making, risk, cost, material and manufacturing process selection, platform and modular design, mass customization, quality, planning and scheduling, business issues, teamwork, group dynamics, creativity and innovation. Case studies and semester-long team projects.

Prerequisites: TE 401

TE 402 Integrated Product Development (IPD) Process-2 3 Credits
Continuation of TE 401, the parallel development of the product, the development of the marketing and manufacturing system, manufacturing and marketing launch, sales, service and customer support. Case studies and semester-long team projects.

Prerequisites: TE 401

TE 403 Entrepreneurial Startup Process-1 3 Credits
Key aspects surrounding company startups, including feasibility analysis, business model development and evaluation, formation of new venture teams, financial forecasts, sources of financing. Readings, financial templates, live case studies and guest entrepreneurs.

Prerequisites: TE 403

TE 404 Entrepreneurial Startup Process-2 3 Credits
Continuation of TE 403, integration of key business components to form and launch your venture: industry analysis, marketing plan and sales strategy; mobilization of the new venture team; operations, including space, legal and insurance considerations; and financial management. Selected topics related to respective venture types (i.e. social entrepreneurship, family business, franchising, immigrant entrepreneurs). Lectures, workshops and guest entrepreneurs.

Prerequisites: TE 403

TE 405 Entrepreneurial Startup Projects-1 1 Credit
Applying the concepts and processes developed in parallel with TE 403. Developing your business platform including business model, start-up team, and financial plan to launch and grow your venture.

Prerequisites: TE 400

TE 406 Entrepreneurial Startup Projects-2 3 Credits
Applying the concepts off entrepreneurial startup process, building upon the business model, entrepreneurial team and financing plan developed in TE 405. Developing a comprehensive business plan and investor’s pitch, finalize the steps necessary to launch the company and start operations.

Prerequisites: TE 400 and TE 405
TE 407 Intellectual Property (IP) Creation and Management 2 Credits
Intellectual property issues: confidentiality, nondisclosure, agreement not to compete, founders agreements, patents, copyrights, trademarks, trade secrets both domestic and international.

TE 450 Special topics 1-3 Credits
An intensive study of some aspect of technical entrepreneurship not covered in other general courses. Consent of the program director is required.
Repeat Status: Course may be repeated.

TE 461 Integrated Product Development (IPD) Projects-1 1 Credit
Technical and economic feasibility study of new products. Selection and content of the project is determined by the faculty project adviser in consultation with the student, progress and final reports, oral and poster presentations. Consent of the program director and faculty project adviser required.
Prerequisites: TE 400

TE 462 Integrated Product Development (IPD) Projects-2 3 Credits
Detailed design specification, fabrication, building and testing prototype new products and plan for production. Selection and content of the project is determined by the faculty project advisor in consultation with individual students or student teams. Progress and final reports, oral and poster presentations. Consent of program director and faculty project adviser required.
Prerequisites: TE 400 and TE 461

PHOTONICS

The Master of Science Degree in Photonics is an interdisciplinary program designed to provide students with a broad training in the various aspects of photonics, including topics in electrical engineering, materials science, and physics. Admission to the program requires a B.S. or M.S. in either the engineering or physical sciences.
Applications should be directed to one of the three sponsoring departments (Electrical and Computer Engineering, Materials Science and Engineering, or Physics). Procedures and admission criteria are the same as those followed by the home department. International students must satisfy minimum university language requirements. The admissions process is under the supervision of the individual department to which you apply.

Polymer Science and Engineering

Lehigh has a diverse group of faculty members with strong, primary interest in polymer science and engineering. In order to provide better opportunities for courses and research in this interdisciplinary field, activities are coordinated through the Polymer Science and Engineering (PSE) graduate program. Polymer faculty from traditional departments of chemical engineering, chemistry, materials science and engineering, physics, and mechanical engineering and mechanics, are participants of the PSE graduate program.

There are two ways in which qualified graduate students, with degrees in the above or related fields, may participate in polymer science and engineering. Students may pursue graduate studies within an appropriate department. Departmental procedures must be followed for the degree sought. The student’s adviser must be in that department and the student receives a normal departmental degree, with emphasis in polymer courses and research. Such students are encouraged to pursue a graduate certificate in polymer science and engineering.

Alternatively, students may elect to pursue studies toward an interdisciplinary M.S., M.E., or Ph.D. degree in polymer science and engineering. Such students are directly admitted into the PSE graduate program and must follow the program’s procedures for the degree sought. The student’s adviser must be a member of the PSE graduate program.

Master of Science Degree in Polymer Science and Engineering
The Master of Science Degree in Polymer Science and Engineering requires a total of 24 credits in course work and six credits in research. The masters thesis is directed and signed by a faculty member of the Center for Polymer Science and Engineering and co-signed by the chairman of the Polymer Education Committee or the director of the CPSE.

Master of Engineering Degree in Polymer Science and Engineering
Master of Engineering Degree in Polymer Science and Engineering requires a total of 30 credits of course work. This option is intended for those students who do not work in a laboratory setting, or for whom thesis research is not practical, but who wish to obtain an advanced education in polymer science and engineering.

Ph.D. in Polymer Science and Engineering
For the Ph.D., the student must satisfactorily complete a qualifying examination administered by the Polymer Education Committee; satisfactorily complete graduate course work determined in consultation with the doctoral committee; pass a general examination administered by the Polymer Education Committee; and defend to the satisfaction of the doctoral committee, a dissertation in the field of polymer science and engineering. Students deficient in polymer science or related topics may be required by their committee to take remedial course work.

The doctoral committee consists of the research adviser, at least two other members of the polymer science and engineering graduate program, and at least one outside person. The committee’s composition is subject to approval by the PSE Director and the Dean of the Rossin College of Engineering and Applied Science.

For more information, write to Dr. Raymond A. Pearson, Director, Polymer Science and Engineering graduate program, Whitaker Laboratory, 5 E. Packer Avenue, Lehigh University, Bethlehem, PA 18015 or Ms. Lisa Arechiga, Graduate Coordinator, Whitaker Laboratory, 5 E. Packer Avenue, Lehigh University, Bethlehem, PA 18015.
Lehigh University is independent, nondenominational, and coeducational. Founded in 1865 as a predominantly technical four-year school, the university now has approximately 4,700 undergraduates within its three major units, the College of Arts and Sciences, the College of Business, and the P. C. Rossin College of Engineering and Applied Science, and approximately 2,100 students enrolled in graduate programs offered through the graduate schools in these colleges and in the College of Education. There are undergraduates from nearly every state and U.S. territory and more than 40 foreign nations.

The university is primarily situated on the Asa Packer Campus on the north slope of South Mountain overlooking Bethlehem, Pennsylvania. Sayre Park, the wooded refuge located toward the top of the mountain, is the setting for many living groups. The residences are reached via winding private roads. Many residential units on campus command a panoramic view of the Lehigh Valley. The Appalachians are visible to the west, with an especially good view from The Lookout on the Packer Campus. Both the tower and dining room in Iacocca Hall on the Mountaintop Campus afford panoramic views of the Lehigh Valley. The campus at its highest point is 971 feet above sea level.

A substantial portion of the upper level of Lehigh’s campus is maintained as a nature preserve. The preserve supports deer, squirrels, chipmunks, raccoons, wild turkeys, and other birds.

Besides the Asa Packer Campus, the university has extensive athletic fields and facilities on the Murray H. Goodman Campus, two miles to the south in Saucon Valley. The university acquired the Mountaintop Campus in 1986; it linked the Packer and Goodman campuses. In 2012, the university received a gift from the Donald B. and Dorothy L. Stabler Foundation: 755 acres in nearby Upper Saucon Township. That brought total land holdings to 2,358 acres, making Lehigh one of the largest private universities in the country.

The board of trustees and university officers have established and enforce policies designed to preserve Lehigh’s natural beauty. It is their contention that the environment in which the young adult university student pursues knowledge can make the total educational experience more meaningful, and that the ideal environment is separate and unique from the distractions of the nonacademic community.

There are approximately 480 full-time members of the faculty, teaching a total of more than 2,000 course titles (not all of which are offered every semester). Among faculty members who are tenured and to whom the university has a permanent commitment, nearly all hold the doctorate degree (typically Ph.D. or Sc.D.).

In total, there are more than 2,000 employees of the university, making it the second-largest employer in the community.

History and Purpose

The principal author of the brief history of Lehigh University that follows, Dr. W. Ross Yates, holds the bachelor of arts and master of arts degrees from the University of Oregon, his native state. He received the doctor of philosophy degree from Yale University and studied in France on a Fulbright Scholarship. He joined the Lehigh staff in 1955 and served as dean of the College of Arts and Science from 1963 to 1972.

When the sound of the last cannon of the Civil War died away, statesmen, educators, and industrial pioneers marshalled the victorious forces of the North and turned their attention to education. They wanted to increase the number of trained scientists, engineers, and other skilled people so they could transform the vast natural resources of the country into a strong and independent national economy.

Asa Packer was one of the industrial pioneers. He built the Lehigh Valley Railroad and controlled a coalmining empire in the mountains of eastern Pennsylvania. He knew, as did many others, that a strong national economy depended on more than technical skills. It needed above all people broadly educated in the liberal arts and sciences — people who could combine practical skills with informed judgments and strong moral self-discipline. He kept this in mind when founding and endowing Lehigh University.

The site that Packer chose for his university was a railroad junction across the Lehigh River from Bethlehem, a community founded in 1741 by Moravian missionaries. William Bacon Stevens, Episcopal bishop of the Diocese of Pennsylvania and the first president of the university’s board of trustees, in 1869 described the origin of the university as follows:

“In the fall of 1864 an interview was requested of me by the Hon. Asa Packer, of Mauch Chunk (now Jim Thorpe), Pa. He came to my house in Philadelphia, and said that he had long contemplated doing something for the benefit of his State, and especially of the Lehigh Valley. From that valley he said he had derived much of the wealth which GOD had given to him, and to the best interests of that valley he wished to devote a portion of it in the founding of some educational institution, for the intellectual and moral improvement of the young men of that region.

“After conversing with him a little while, and drawing out his large and liberal views, I asked him how much money he proposed to set aside for this institution, when he quietly answered that he designed to give $500,000. At the time of this interview no one in this country, it is believed, had offered in a single sum such an endowment for a literary institution. It was the noblest offering which an American had ever laid on the altar of learning, and more than equaled many royal donations which have carried down the names of kings as patrons of European universities.

“Filled with profound emotions at the mention of such a gift for such an object, I asked the noble donor what specific plans he had dreamed in his own mind in reference to it. His reply was, ‘I am not much acquainted with these matters, but you are, and I want you if you will to devise a plan which I can put into effective operation.’ I told him that I would make the attempt. I did so. I drew up the outline sketch of such an institution as I thought would give the largest results for the means used, and submitted it in a few weeks to his inspection.

“He examined it with the practical judgment and business habits with which he deals with all great questions, and adopted the scheme as the basis of his future university.

“The first meeting of the Board of Trustees, selected by Judge Packer, met at the Sun Hotel, in Bethlehem, July 27th, 1865, and began to organize the work before them.”

The trustees followed several principles in setting up the university. One was that of combining scientific and classical education. They considered both to be practical. The principle carried forward an ideal of the great 17th-century Moravian educator, John Amos Comenius. A motto taken from the works of Francis Bacon was used to summarize this principle, namely, Homo minister et interpres naturae — man, the servant and interpreter of nature, to use a free translation. That motto lives on at Lehigh, being an element in the university seal.

The trustees chose as first president a man whose education and habits expressed this principle, Henry Coppee. They established five schools, including a school of general literature in addition to four scientific schools of, respectively, civil engineering, mechanical engineering, mining and metallurgy, and analytical chemistry.

Another principle upon which the trustees insisted was that of keeping the size of the student body proportionate to the abilities of the faculty to teach them well. The university would admit only as many freshmen each year as it could be assured of providing with the highest quality of education. In the 19th century the total enrollment never exceeded several hundred students; the size has increased significantly in recent decades, along with the number of faculty members.

The trustees also insisted that Lehigh was to be nondenominational and would have an admission policy based on merit. Competitive examinations were held for applicants for admission. From 1871 to 1891 no tuition was charged, but the national financial crisis at the turn of the century decimated the value of the Lehigh Valley Railroad stock that Packer had given to Lehigh, which was the principal source of income.

At first the student body was entirely male. The contemporary ideological climate would permit nothing else. But around 1916, women were admitted to graduate programs. In 1971, the university opened its
undergraduate program to them as well. Today men and women applicants are considered on an equal basis.

From the first, the students were serious-minded. In 1824, Catherine Drinker Bowen, daughter of president Drinker and later a famous biographer, published a brief history of Lehigh University, in which she commented:

“Ask any college professor which brand of boy he would prefer to teach, the cigarette brand or the flannel shirt variety. Right here we offer ten to one the flannel shirts...Lehigh still holds to the emblem of the flannel shirt—long may it wave! Engineers come to college to work. A writer in the Syracuse Post in 1895 spoke truly when he said, ‘From the first, Lehigh’s characteristic has been her earnestness. It is the boast of her graduates, the inspiration of her students. Men go there to learn to take a useful part in the economy of life.’ The university community was constantly infused with new faculty and students determined to renew and rework the original principles in the light of changing times. The students’ ambition and zeal bore fruit; as alumni they carried the university’s educational goals into the work of nation-building. And, having received, they gave to perpetuate Lehigh’s work of service.

Today, Lehigh University still adheres to Asa Packer’s goal of a liberal and scientific education for practical service. Faculty and students work to maintain high quality in instructional programs. Generous support from individuals, foundations, industry, and government help Lehigh to retain high quality of education and faculty while keeping tuition as low as possible. (Tuition covers only a part of the cost of a Lehigh education.)

Presidents of the University

The presidents of Lehigh University are described and their achievements cited in the following paragraphs. The years in parentheses are those served in the presidency.

Henry Coppee (1866-1875). Coppee served as a railroad engineer in Georgia, a captain in the Army during the Mexican War, and taught at West Point and at the University of Pennsylvania before becoming first president in 1866.

Much building was done on the new university campus. A Moravian church on Packer Avenue was remodeled into Christmas Hall; a house for the president was erected on campus; and Packer Hall, the university center, was built.

Coppee lectured in history, logic, rhetoric, political economy, and Shakespeare.

John McDowell Leavitt (1875-1880). Leavitt was an Episcopal clergyman who graduated from Jefferson College and taught at Kenyon College and Ohio University. During his incumbency, the university was divided into two schools, General Literature and Technology. As of 1876, a student could receive two engineering degrees by taking a longer course, and beginning in 1877 the master of arts, doctor of philosophy, and doctor of science degrees were established.

Linderman Library rotunda was completed in 1877. Asa Packer died in May 1879, and Founder’s Day was held in his honor the following October.

Robert Alexander Lamberton (1880-1893). Lamberton, a graduate of Dickinson College, practiced law in Harrisburg, Pa., and was a university trustee when asked to become president. During his administration, students and the community witnessed the first Mustard and Cheese dramatic presentation.

A gymnasium (now Coppee Hall) was erected, and Chandler Chemistry Laboratory was built, now known as Chandler-Ullmann Hall. Lehigh was also building its reputation for academic excellence; the mechanical engineering department was established in 1881 and the Lehigh chapter of Phi Beta Kappa was founded in 1887.

Thomas Messinger Drown (1895-1904). Drown studied medicine at the University of Pennsylvania and went abroad to study chemistry. Thereafter he was professor of chemistry at Lafayette College. In 1895 he assumed the presidency of Lehigh and was greatly interested in furthering the university’s development as a technical school.

His first years were difficult ones because the Panic of 1893 decimated the university’s stock holdings in the Lehigh Valley Railroad.

Nevertheless, Lehigh managed to grow in enrollment, academics, and in physical plant. Williams Hall was completed. The curriculum leading to a degree in arts and engineering was established, as was the department of zoology and biology. New curricula were adopted in metallurgical engineering, geology, and physics.


Henry Sturgis Drinker (1905-1920). Drinker, an 1871 Lehigh graduate, was the only university alumnus ever to become president. In 1907, the alumni endowment fund began, the Lehigh Alumni Bulletin was first published in 1913, and the Alumni Association was incorporated in 1917.

Drinker, besides being a lawyer, was a mechanical engineer and had been largely instrumental in solving the problems of constructing the two-mile-long Musconetcong Tunnel, an engineering feat that made possible a railroad line between Easton, Pa., and New York City. He started a tradition of businesslike management of university affairs.

During Drinker’s years, more buildings were completed: the original section of Fritz Engineering Laboratory, Drown Hall, Coxe Mining Laboratory, Taylor Hall, Taylor Gymnasium and Field House, Taylor Stadium, and Lamberton Hall. Drinker’s interest in horticulture led to the planting of many rare trees and plants.

A teacher’s course and business administration course were begun in 1909 and in 1918 the university was divided into three colleges: liberal arts, business administration, and engineering — the roots of the colleges of today. Army ROTC was established in 1919.

Drinker’s daughter, Catherine Drinker Bowen, went on to become a historical writer of note. Her experiences as the daughter of a Lehigh president and occupant of the President’s House are recorded in Family Portrait (Atlantic Little-Brown).

Drinker resigned in 1920 and Natt M. Emery, vice president, served as chief executive officer until 1922.

Charles Russ Richards (1922-1935). Richards took office in 1922. During his presidency, the first graduate degrees were awarded to women. Lehigh faced a shortage of students from 1929 to 1936 as a result of the Depression, but the newly established office of admission, as well as university scholarships, fellowships, and deferred tuition payments, helped to ease the shortage.

Changing concepts of education were evident in several newly organized academic offerings: philosophy, music, psychology, journalism, history, and fine arts. The majors system was instituted as were the senior comprehensive examinations in the Arts College. The placement bureau, a public relations office, and a student health service were organized.

The Alumni Memorial Building, a memorial to the Lehigh alumni who served in World War I, was opened in 1925 and Packard Laboratory was completed in 1929. In the same decade, a major addition to Linderman Library also was completed.

Clement C. Williams (1935-1944). Williams, a civil engineer, was president during an era of unprecedented alumni support. Undergraduate enrollment rose to an all-time high, passing 2,000 in 1938. Richards and Drinker residential houses, and the Ullmann wing adjoining the Chandler Chemistry Laboratory, were built. Grace Hall, the first arena-type facility of any size on campus, was completed in 1940, the gift of Eugene G. Grace, an 1899 graduate, who headed the board of trustees. A Graduate School implemented the programs in the three colleges. Williams retired in 1944, and the university was without a president for approximately two years.

Martin Dewey Whitaker (1946-1960). Dr. Whitaker, who had been director of the Atomic Energy Commission Laboratory at Oak Ridge, Tenn., and had worked in developing the atomic bomb, faced the responsibility of helping the university community readjust to peacetime conditions after World War II.

During his time as president, Lehigh’s assets nearly tripled; the endowment more than doubled to $18 million. Many buildings were renovated, and the Dravo House and McClintic-Marshall House residence halls were built. The faculty increased in number by 75 percent and the first endowed distinguished professorships were established.
The Centennial development program was begun in 1959. It raised more than $22 million for faculty salaries and construction that later included Whitaker Laboratory.

An extensive renovation and enlargement project associated with Packer Hall was undertaken in 1957, and, upon completion in 1958, the building became a university center.

Whitaker died in office.

Harvey A. Neville (1961-1964). Dr. Neville was the only faculty member ever elected president. His association with the university began in 1927 as an assistant professor of chemistry. During his three-year term as president, the first phase of the Saucon Valley athletic complex was completed, and Sayre Field was opened atop South Mountain. The Center for Information and Computing Science was established.

Neville, a strong supporter of research who fostered its growth on the campus, died in 1983.

Deming Lewis (1964-1982). Willard Deming Lewis became Lehigh’s 10th president after a distinguished career as a space engineer and research administrator.

Dr. Lewis earned three degrees at Harvard and two from England’s Oxford University, where he was a Rhodes Scholar in advanced mathematics. In 1941, he joined Bell Telephone Laboratories, and in 1962 he became general manager of systems development with Bellcomm Inc., which engineered systems for the Apollo project that placed the first man on the moon.

Lewis, who died in 1989, received 33 U.S. patents on such devices as microwave antennas and filter and digital error detection systems. He helped write the equations describing a stylus sliding through a warped groove.

During Lewis’ tenure as Lehigh president, women were admitted as undergraduate students in 1971. New majors were begun in natural science, biology, social relations, geological sciences, environmental science and resource management, religion studies, computer engineering, computing and information science, applied mathematics, management science, American studies, and other fields. Six research centers and seven institutes were established.

Capital campaigns brought in more than $130 million, and construction was completed on Maginnis Hall, Whitaker Lab, Mart Science and Engineering Library, Sinclair Lab, the Seeley G. Mudd Building, Neville Hall, Rathbone Hall dining room, 13 fraternity houses, the Centennial I and Centennial II residential complexes, the Brodhead House residence hall, the Trembley Park student apartments, the Saucon Village Apartments, the Philip Rauch Field House, and the Stabler Athletic and Convocation Center. The restoration of Packer Memorial Church was completed, and Packard Lab was renovated.

The original Physics Laboratory is now named in Lewis’ honor, as is the indoor tennis center.

Peter Likins (1982-1997). Dr. Likins, who earned a B.S. and Ph.D. from Stanford, and an M.S. from the Massachusetts Institute of Technology, became Lehigh’s 11th president in 1982. He sought balanced excellence in undergraduate programs while pursuing focused objectives in graduate study and research.

Under Likins, Lehigh nearly doubled in size with the purchase in 1986 of 742 acres of land and a research complex from Bethlehem Steel Corp. The new Mountaintop Campus links the Asa Packer and Goodman campuses.

Lehigh also added many new buildings and facilities. Perhaps most notable was the $33 million Zoellner Arts Center, which provided a new home to Lehigh’s departments of music and theatre and to the University Art Galleries, and made Lehigh a center for the fine arts. The arts center and the new Rauch Business Center, home of the College of Business, were built on the site of Taylor Stadium, which was replaced by Goodman Stadium on Lehigh’s athletic campus.

Also during Likins’ term, Lehigh built a $20 million, state-of-the-art telecommunications system, the E.W. Fairchild-Martindale Library and Computing Center, one of the most automated libraries anywhere, and the Harold S. Mohler Lab, which honors the former chairman of the board of trustees.

Likins’ term also saw the establishment of the Lehigh Valley Center for Jewish Studies at Lehigh, the Center for Advanced Technology for Large Structural Systems, largest of its kind in North America, and centers in integrated circuits, management studies, chemical process modeling and control, and international studies.

Likins, an expert in spacecraft dynamics and control who has written textbooks in engineering mechanics, was one of 13 science advisers to President George H.W. Bush. He came to Lehigh after serving as dean of engineering and provost at Columbia, and left to become president of the University of Arizona.

William C. Hittinger (1997-1998). A former chairman of the university’s board of trustees, Hittinger became interim president after the departure of Peter Likins. A member of the National Academy of Engineering, Hittinger served for 22 years on the board of trustees. He graduated from Lehigh in 1944 with a B.S. in metallurgical engineering, and received an honorary doctor of engineering degree from Lehigh in 1973.

Over a 40-year career in the electronics industry, Hittinger worked for Western Electric Co., National Union Radio Corp., Bell Telephone Laboratories, Bellcomm Inc., General Instrument Corp., and RCA Corp. At Bellcomm, he oversaw systems engineering for NASA’s manned spaceflight program, and at RCA, where he became executive vice president, he was responsible for corporate technology, patents, licensing, international business and marketing development, and corporate technology planning.

Hittinger was a member of President Reagan’s National Security Telecommunications Advisory Committee from 1982-86. He was also a member of the U.S.-Brazil Presidential Committee on Science and Technology and a member of the board of directors for eight companies.

Hittinger served as national president of the Lehigh Alumni Association in 1971-72 and received the prestigious L-in-Life Award in 1979. An ROTC student at Lehigh, he served in the U.S. Army in 1943-46 during World War II, rising to the rank of captain.

During Hittinger’s term as chairman of the board of trustees, Lehigh began construction of the Zoeller Arts Center, completed the Ulrich Student Center, aggressively improved its financial aid for undergraduates, and completed the $300 million Campaign for Preserving The Vision. As president, Hittinger realigned the Iacocca Institute into the College of Business, oversaw the construction of the new Sayre Park Village residential complex, and helped Lehigh move forward during a time of presidential transition.

Gregory C. Farrington (1998-2006). Dr. Farrington was appointed Lehigh’s 12th president in May 1998 and served the university for eight years before stepping down in June 2006. Proclaiming on many occasions that “the only thing good enough for Lehigh is the best,” Farrington promoted academic excellence, improved facilities, and fostered collaborative relationships between Lehigh and the surrounding community.

Farrington earned his B.S. from Clarkson University and his A.M. and Ph.D. from Harvard, all in chemistry and specializing in solid state electrochemistry. Before joining the University of Pennsylvania’s Department of Materials Science and Engineering in 1979, he was a research chemist for General Electric Company’s Corporate Research and Development Center in New York State. At Penn, he served as dean of the School of Engineering and Applied Science. He holds or shares more than two dozen patents and has written or edited books and book chapters, as well as 100 technical papers.
While at Lehigh, Farrington established the university’s bold and creative Lehigh 2020 Initiative. Launched in October 2000, the $75-million academic venture capital fund focused investment on attracting and retaining the best faculty and students, creating distinctive academic programs, funding critical research fields, and stimulating cross-curricular collaboration. New programs created through the 2020 program include those in bioscience, bioengineering, applied life science, computer science and engineering, information systems and engineering, and bioeconomics.

Along with the reinvigoration of academics and the promotion of interdisciplinary learning, Farrington also literally changed the face of Lehigh’s historic campus. More than 20 major campus enhancement projects were completed during his term, among them the construction of Campus Square, a new Alumni Building Arrival Court and parking garage, and a pedestrian walkway through the heart of the campus green, transforming it into a central gathering place. In addition, Coppee Hall, Lamberton Hall, Maginnes Hall, Wilbur Powerhouse, Grace Hall, the A. Haigh Cundey Varsity House, and Linderman Library were renovated.

Under Farrington’s leadership, Shine Forever: The Campaign for Lehigh generated more than half of its $500 million goal to endow faculty chairs, scholarships, academic programs, and facilities.

He also advocated collaborations with the city of Bethlehem, the state and federal governments, industry, and other partners to strengthen the university and spur regional economic development. His commitment to the Lehigh Valley was evident in his participation on various boards as well. He actively participated on the board of trustees of St. Luke’s Hospital & Health Network, the National Museum of Industrial History, and Lehigh Valley Partnership.

Alice P. Gast (2006-2014) became the 13th president of Lehigh University on August 1, 2006.

Before coming to Lehigh, Dr. Gast served as the vice president for research and associate provost at the Massachusetts Institute of Technology, where she was also the Robert T. Haslam chair in chemical engineering. Prior to joining MIT in 2001, she spent 16 years as a professor of chemical engineering at Stanford University and at the Stanford Synchrotron Radiation Laboratory.

The focus of Dr. Gast’s research career was the study of surface and interfacial phenomena, in particular the behavior of complex fluids. Her areas of research include colloidal aggregation and ordering, protein lipid interactions, and enzyme reactions at surfaces. She is the co-author of Physical Chemistry of Surfaces, a classic textbook on colloid and surface phenomena, and has presented named lectures at several of the nation’s leading research institutions.

Dr. Gast received her B.S. in chemical engineering from the University of Southern California. After earning her Ph.D. in chemical engineering from Princeton University, she spent a postdoctoral year on a NATO fellowship at the Ecole Superieure de Physique et de Chimie Industrielles in Paris.

Dr. Gast has served on numerous advisory committees and boards, including the Board of the American Association for the Advancement of Science and the National Research Council Committee for Science, Technology, and the Law. In 2010, Dr. Gast was named to the prestigious post of science envoy by U.S. Secretary of State Hillary Rodham Clinton and the U.S. State Department. In 2012, she was appointed to the board of directors of Chevron Corporation.

Kevin L. Clayton (2014-2015), former vice-chair of the university’s Board of Trustees, became interim president after the departure of Alice Gast. Mr. Clayton retired from the global investment management firm Oaktree Capital Management, L.P., where he had a distinguished 19-year career. He joined Oaktree in 1995 and founded their Marketing and Client Relations Department; he retired as principal and director of the firm.

Clayton earned his B.A. in government from Lehigh in 1984 and his M.B.A. from St. Joseph’s University in 1988. During his time at Lehigh, he served as a four-year class president; as a member of the Newman Association and Alpha Tau Omega; and was elected to Omicron Delta Kappa, the national leadership honor society. He continued his service to Lehigh as a member of the Board of Trustees during the period 1993-1999 and again from 2005-2014. As a member of the Board, Clayton served on the Finance Committee, Endowment Fund Investment Committee, Campus Planning and Operations Committee, Student Affairs Committee, and Advancement Committee. He also served on the Dean’s Advisory Council for the College of Business.

Clayton and his family have long-standing ties to Lehigh. His late father, William Clayton ’51, was a Lehigh trustee for more than 20 years and was a member of the Executive Committee of the Board. In honor of his parents, Clayton and his wife, Lisa, established the William L. and Carol L. Clayton Endowed Scholarship Fund in 2003. In 2008 they established the Lisa A. and Kevin L. Clayton ’84 Endowed Scholarship Fund to support students enrolled in Lehigh’s South Mountain College. Their contributions also include supporting the Annual Fund, the Athletics Partnership Program, and the Dean’s Strategic Initiative. The Claytons’ son, Patrick ’13, became a member of the third generation of Claytons to earn a Lehigh degree.

John D. Simon (2015-present) was installed as Lehigh’s 14th president during the annual Founder’s Day ceremony on October 2, 2015. Before coming to Lehigh, Dr. Simon was executive vice president and provost at the University of Virginia. Previous to that, he was vice provost of academic affairs at Duke University.

During his tenure at UVA, Dr. Simon spearheaded a number of global initiatives, including the establishment of a new major in global studies and the opening of a physical presence for the university in Asia. He played a leading role in the launch of the university’s cutting-edge Data Science Institute as well as its Advanced Research Institute, and in creating the university's Endowment for the Arts. He also appointed several deans and oversaw the hiring of several hundred faculty.

At Duke, Dr. Simon guided the university's strategic planning process and drove initiatives aimed at connecting the humanities, social sciences, and sciences. He was chairman of Duke’s department of chemistry from 1999-2004, and also held appointments in the Duke University Medical Center in both biochemistry and ophthalmology.

Dr. Simon received his B.A. in chemistry from Williams College in 1979 and his Ph.D. from Harvard University in 1983. After a postdoctoral fellowship at UCLA, he joined the department of chemistry and biochemistry at the University of California-San Diego in 1985, then moved to Duke as the George B. Geller Professor of Chemistry in 1998.

Dr. Simon has been the recipient of numerous fellowships and awards for his scientific work, including the Presidential Young Investigator Award, Alfred P. Sloan Fellowship, Camille and Henry Dreyfus Teacher Scholar Award, and the Fresenius Award. He is a fellow of the American Association for the Advancement of Science and the American Physical Society, and has authored or co-authored nearly 250 academic papers and four books.

University Campuses

Lehigh University’s three campuses are located in Bethlehem, Pa., and comprise 1,600 acres.

Asa Packer Campus. Lehigh’s main academic campus, encompassing approximately 360 acres on the north slope of South Mountain overlooking Bethlehem, is a wooded area where most students attend class and live. This contains the original campus of the university.

Murray H. Goodman Campus. During the 1960s, the university acquired extensive acreage in the Saucon Valley just south of South Mountain. Development of one of the nation’s finest collegiate athletic complexes has continued since that time. The 500-acre campus now includes the Murray H. Goodman Stadium and other athletic fields, as well as the 6,000-seat Stabler Athletic and Convocation Center, the Philip Rauch Field House, the Cundey Varsity House, the Lewis Indoor Tennis Facility, and the Ulrich Sports Complex. The campus is named for a major benefactor, Lehigh alumnus Murray H. Goodman, of West Palm Beach, Fla.

Mountaintop Campus. Lehigh bought this campus from Bethlehem Steel Corp. in 1986. It contains 670 acres of woods and a 72-acre research site with 8 buildings, including a landmark tower building visible for miles around. Acquisition of the facilities connected the two older campuses. The Mountaintop Campus houses the College of Education; the departments of Biological Sciences and Chemical Engineering;
programs in biochemistry, biotechnology, bioengineering, ATLSS (Advanced Technology for Large Structural Systems) center, Energy Research Center, the Military Science and Leadership program (Army ROTC), and Ben Franklin TechVentures headquarters and incubator companies. This campus is also home to the Mountaintop Experience, where students work together beyond the traditional classroom setting on innovative projects that can potentially become business ventures.

University Buildings

Lehigh has a major collection of 19th century buildings designed by such prominent architects as Addison Hutton (1834-1916), Edward T. Potter (1851-1904), A. W. Leh (1848-1918), and the firm of Furness and Evans (Frank Furness, 1839-1912).

Zoeller Arts Center (1996), designed by Dagit Saylor Architects and located just east of the Rauch Business Center (1990), houses a 1,000-seat music auditorium, a 300-seat theatre, a permanent art gallery and museum store, and the departments of music and theatre. A 350-car parking garage is on the same site.

The university has seen numerous buildings constructed and renovated since 2000 on all three campuses. New Mountaintop construction includes an addition to babcock Hall for biological sciences (2003), and ongoing renovations in Building C (since 2013) for the Mountaintop Experience.


New buildings on the Asa Packer Campus include a new Police Station at Taylor and E. Packer Streets (2016); the STEPS building for science, technology, environment, policy and society (2010), Lehigh's first LEED-certified building (Leadership in Energy and Environmental Design), which achieved Gold status in 2011; and the newly renamed Farrington Square (2002), a residential and retail complex. Williams Hall (2015) was completely renovated to become a global hub for students, achieving Silver LEED status. There was also an addition to Sinclair Lab (2005).

New campus enhancements have eliminated vehicular traffic and created landscaped walkways in the historic core of the Asa Packer Campus. A 350-car parking garage pavilion and visitors arrival court (2005) at the west entrance to the Alumni Memorial Building completed the project.

Altogether, the three campuses contain more than 160 buildings with more than 4.5 million square feet of floor space.

Campus Landmarks

In the following list, the first date after the name of each building indicates the year of construction. The second date indicates the year of a major addition.

Alumni Memorial Building (1925). This edifice of Gothic design, housing the Visitor Center, Admissions and other administrative offices, and those of the Alumni Association, represents a memorial to the 1,921 Lehigh alumni who served in World War I and the 46 who died. The building was designed by Theodore G. Visscher, Class of 1899, and James Lindsey Burley, Class of 1894.

E. W. Fairchild-Martindale Library and Computing Center (1985). The high-technology building houses science and engineering holdings, The Media Center, library and technology services staff, and a computer center. Construction was made possible by a major gift from Harry T. Martindale, a 1927 Lehigh graduate, and his wife, Elizabeth, daughter of the late Edmund W. Fairchild, founder of a business publications and communications empire.

Linderman Library (1877). The rotunda, designed by Addison Hutton, was built as a gift to the university by founder Asa Packer as a memorial to his daughter, Lucy Packer Linderman. The rotunda is surrounded except on the south by a major addition constructed in 1929. The building houses more than 20,000 rare books and volumes related to the humanities and social science. The Bayer Galleria of Rare Books, made possible by a gift from Curtis F. Bayer ’35, was dedicated in 1985. The building reopened in the spring of 2007 as the intellectual and humanities hub of the university after being closed for renovations for nearly two years. Major new features include more seminar and group study rooms, wireless Internet access throughout, central air conditioning, new furniture and finishes, and a cafe.

Packer Memorial Church (1887). The church was the gift of Mary Packer Cummings in memory of her father, founder Asa Packer. It was dedicated on Founder’s Day, October 13, 1887. The building was designed by Addison Hutton; the building is on the National Register of Historic Places.

President’s House (1868). This 21-room residence, designed by Edward Potter, is the home of university presidents and is often used for receptions on special university occasions.

Packer Hall, The University Center (1868). When construction of the building began in 1865, a railroad was built to transport stone to the site. The building, designed originally by Potter, was extensively renovated and enlarged in 1958.

The building was constructed at the expense of the founder, who vetored a plan to erect it of brick. “It will be built of stone,” Asa Packer responded.

Today the building houses student and faculty dining facilities, a food court, deans’ offices, student activities offices, the Women’s Networking Center, The Center for Academic Success, a bank office, and conference facilities.

Academic and Research Facilities

In the following list, the first date after the name of each building indicates the year of construction. The second date indicates the year of a major addition.

Building C (1968, 2013, 2018). Once Bethlehem Steel's 1960s-era industrial-research facility, Building C is now being transformed (high-bay by high-bay since 2013) into a 21st Century learning environment initiative where Lehigh student’s pursue creative and innovative answers to challenges and open-ended questions. In 2018, a beautifully restored three-story crescent welcomed faculty from Computer Science and Engineering and Industrial Systems Engineering departments, Mountaintop Initiative, and the Institute for Data Science and Computational Intelligence. In 2019, the Department of Art, Architecture and Design moved into Highbays C1 and C3, as well as, a portion of the crescent.

Chandler-Ullmann Hall (1893, 1938, 2019). These adjoining buildings formerly were the William H. Chandler Chemistry Building (designed by Hutton) and the Harry M. Ullmann Chemistry Laboratory. Chandler served as acting university president, 1904 and 1905, and taught chemistry from 1871 to 1906. Ullmann served as chairman of the chemistry department. The building has been named a National Historic Chemical Landmark by the American Chemical Society. A major renovation, completed Summer 2019, welcomes the Department of Psychology and the Department of Mathematics.

Christmas-Saucon Hall (1865 and 1872, respectively). Christmas Hall is the university’s oldest building. When Asa Packer acquired the South Mountain site for the university in 1865, a Moravian church was being constructed. The newly formed university took over the building and completed it for use in recitations and as a dormitory and chapel. The name Christmas Hall was chosen in keeping with Moravian religious tradition. In 1872, Saucon Hall was constructed a few feet to the east of Christmas Hall. The buildings were connected with the construction of a “hyphen” in 1926. The building houses The University Press, and classrooms.

Coppee Hall (1883). The building was the original university gymnasium. It is named in honor of Henry Coppee, first president. The building was renovated in 2002 and houses the Weinstock Center for Journalism and Communication.

Coxe Hall (1910). Originally a mining laboratory, the structure is named for Eckley B. Cox, pioneer mining engineer and trustee of the university. The building houses the office of the Vice President for International Affairs, Study Abroad, International Students and Scholars, and the Global Union.
Memorial Church was constructed as a porter’s lodge. Today it houses Philosophy Building and computer science and engineering. An auditorium accommodates the Packard automobile (1898) is displayed in the lobby. The building is the Packard automobile who served as a university trustee. The first Packard Laboratory auditoriums used for lectures and events. The building is named for Dr. Neville Hall, a medical doctor. The Seeley G. Mudd Foundation, of Los Angeles, made a major gift toward the building.

Imbt Laboratories (1958). This facility houses the military science and leadership program (Army ROTC) and the distance education department.

Lamberton Hall (1907). The structure served as the university commons and dining room until the renovation of Packer Hall in 1958. The building honors the memory of Robert A. Lamberton, third president. In January of 2006 it reopened as a late-night diner called the “Hawk’s Nest” and student programming facility in the Kenner Great Room.

Maginnes Hall (1970). The multilevel structure is headquarters for the College of Arts and Sciences and also houses the departments of history, international relations, and political science and ICAPE (formerly ESL). New classrooms opened on the ground floor in January 2004. The building is named for Albert B. Maginnes ’21, who was a lawyer and university trustee.

Mart Science and Engineering Library (1968). This structure honours the memory of Leon T. Mart ’13, and his son, Thomas ’51. It was incorporated into the E. W. Fairchild-Martindale Library and computing center in 1985.

Seeley G. Mudd Building (1975). This seven-story building houses the chemistry department. The late Seeley G. Mudd was a California medical doctor. The Seeley G. Mudd Foundation, of Los Angeles, made a major gift toward the building.

Neville Hall (1975). This building in the chemistry complex has three auditoriums used for lectures and events. The building is named for Dr. Harvey A. Neville, president from 1961 to 1964, who was a chemist.

Packard Laboratory (1929). The structure was the gift of James Ward Packard, Class of 1884, the electrical pioneer and inventor of the Packard automobile who served as a university trustee. The first Packard automobile (1898) is displayed in the lobby. The building is headquarters for the P. C. Rossin College of Engineering and Applied Science. It also houses classrooms and laboratories for mechanical engineering and mechanics, for electrical and computer engineering, and computer science and engineering. An auditorium accommodates large classes and various events.

Philosophy Building (1879). This small building just below Packer Memorial Church was constructed as a porter’s lodge. Today it houses the philosophy department.

Price Hall (1899) This structure formerly was a brewery named Die Alte Brauerei. In 1912 it was remodelled to serve as a dormitory, and it was named in honor of Henry Reese Price, president of the university board of trustees. It is currently vacant.

Rathbone Hall (1971). This building’s upper level is a major and recently renovated student dining facility, with window walls affording a panoramic view of the Lehigh Valley. The building bears the name of its donor, Monroe Jackson Rathbone ’21, president of the university board of trustees from 1957 to 1973. Rathbone was chairman of the board, Standard Oil Co. (New Jersey), now Exxon Corp., and was a major innovator in the oil industry. The lower level houses the Residential Services office and Conference & Special Housing Services.

Rauch Business Center (1990). Philip Rauch ’33, L.L.D. ’79, retired chairman of the board and director of the Parker-Hannifin Corp., made the principal contribution to build this facility. Lehigh’s Rauch Business Center was dedicated in 1990 as the state-of-the-art home of the university’s College of Business. The $17.8-million facility has 115,000 square feet of floor space on five stories and features a diverse array of classrooms, auditoria, conference rooms, as well as, the Center for Career and Professional Development, The Common Grounds Café, and the Perella Financial Services Lab.

Sayre Building (1869). Originally known as the Sayre Observatory, the dome that once housed the telescope can still be seen.

Sherman Fairchild Center for the Physical Sciences (1892, 1976, 1986). The center, completed with help from the Sherman Fairchild Foundation, houses classrooms and laboratories for undergraduates and graduate students in physics, faculty offices, and a 260-seat auditorium. The complex includes the Lewis Laboratory, the original five-story stone structure built in 1892, the Sherman Fairchild Laboratory for Solid-State Studies built in 1976, and the 1986 addition comprised of the Oberkotter Auditorium and research laboratories.

Sinclair Laboratory (1970). This facility houses Materials, Science & Engineering Department, Mechanical Engineering & Mechanics Department, The Center for Photonics and Nanoelectronics, The International Materials Institute, and other research laboratories. It is named for Francis MacDonald Sinclair, and was the gift of his widow, Jennie H. Sinclair. A 12,000-square-foot research addition was completed in 2005.

STEPS Building (2010). This facility is the cornerstone of the new STEPS Initiative, which was founded to strengthen Lehigh’s commitment to collaboration, innovation, and scholarship in the areas of science, technology, environment, policy, and society. The new 137,000-square-foot building is at the corner of Packer Avenue and Vine Street on Lehigh’s Asa Packer campus. The building was designed to eliminate boundaries between the disciplines and features state-of-the-art teaching and research areas mingled with seminar rooms, study lounges, and faculty offices. The $60 million facility is the university’s first “green” building having been awarded LEED gold certification (Leadership in Energy and Environmental Design). It incorporates features such as heat recovery systems, a radiant-floor heating system, an abundance of natural lighting, an automated daylight harvesting system, an Energy Star roof membrane, and an 8,000-square-foot vegetated roof. It is home to the Earth and Environmental Sciences department and the Energy Systems Engineering institute (ESEI) and contains research labs for environmental engineering and teaching labs for biological sciences and chemistry.

University Police (2014). Located at 321 East Packer Avenue, the station operates around the clock throughout the year. The department is accredited by the Pennsylvania Chiefs of Police Association and the International Association of Campus Law Enforcement Administrators.

Whitaker Laboratory (1965). This five-story structure with an adjoining two-level classroom-auditorium section honors the memory of Martin Dewey Whitaker, university president from 1946 to 1960. The building serves the Department of Materials Science and Engineering and Center for Advanced Materials and Nanotechnology. There are laboratories for high-pressure research and reaction kinetics, nuclear studies, analog computation, process control, optoelectronics, high-temperature thermodynamics and kinetics, and fine structures and metallography. The Baker Institute for Entrepreneurship, Creativity, & Innovation is located on the first floor.
Wilbur Powerhouse (1908). During most of its life, the building served as a power plant with some early engineering laboratory use. Renovated during the 1970s, it provided performing space for student theatrical productions, until the Zoellner Arts Center was built. It is now the new home for student shops and project studios serving as the hub of interdisciplinary programs on campus that is designed to give students and faculty tools and resources to go from idea to physical concept.

Williams Hall (1903). This brick structure was the gift of Edward H. Williams, Jr., Class of 1875. Dr. Williams was a professor of mining and geology and the founder of the Tau Beta Pi engineering society. The building was extensively renovated and a fourth story added in 1956 following a fire. Summer 2015 brings a refurbished and repurposed historical Williams Hall that reinforces the integration of academic programs and student support. It is a global hub for the Lehigh community complete with a Global Commons, a Global Cafe, as well as departments of modern languages and literature and political science. Williams Hall is the university’s second “green building” and attained Silver LEED certification upon completion.

Zoellner Arts Center (1997). With major gifts from Vickie and Robert Zoellner ’54, Dorothy and Dexter Baker ’50, and Claire and Theodore Diamond ’37, Dagit-Saylor Architects created a 105,000-sq.-ft. structure designed to showcase Lehigh’s rapidly growing programs in the performing and visual arts as well as the departments of music and theatre and 5,000 sq. ft. of exhibition space for the Lehigh University Art Galleries. Baker Hall has a seating capacity of more than 1,000, Diamond Theatre features a thrust stage and seating for 307; and a “black box” theater provides flexible space for experimental productions.

Athletic and Convocational Facilities

In the following list, the first date after the name of each building indicates the year of construction. The second date indicates the year of a major addition.

Taylor Gymnasium (1904 and 1913). This structure was the gift of Charles L. Taylor, Class of 1876, who was a friend and business associate of steel magnate Andrew Carnegie. There are two indoor swimming pools, two basketball courts, the Welch Fitness Center, men’s and women’s locker rooms, two racquetball and two squash courts, a multipurpose dance/aerobics room, a dance studio, a dance/spin studio, a climbing wall, a Sports Medicine Complex, and the Penseke Hall of Fame. The athletic department offices are also housed in the Warren (Pete) Musser wing.

Grace Hall (1940 and 2013). The building is named for its donor, Eugene G. Grace, Class of 1899, who was chairman of Bethlehem Steel Corp. and president of the university’s board of trustees, 1924 to 1956. Grace Hall serves as the headquarters and offices for Lehigh intramural and club sports. The lower level houses the Leeman-Turner Arena, and the upper level houses the recently renovated Caruso Wrestling Complex.

Sayre Field (1961). Located atop South Mountain, the field is used for intramural sports.

Cundey Varsity House (1963; expanded in 2002 & 2015). The building, expanded and renovated in 2002, houses a modern weight training facility, sports medicine and equipment areas, team meeting and reception areas, and locker rooms for several varsity teams. The Varsity House is located on the Murray H. Goodman Campus adjacent to the John C. Whitehead Football Practice Facility. The 2015 expansion of the west side of the building will accommodate Lehigh’s growing athletic programs to better serve the student-athletes.

Philip Rauch Field House (1976). Philip Rauch ’33, L.L.D. ’79, made a gift toward the facility. The building has 62,000 square feet of uninterrupted floor space, the equivalent of two football fields, for a variety of athletic and non-athletic activities. It has a six-lane, one-eighth-mile flat track.

Stabler Athletic & Convocation Center (1979). This arena provides seating for 6,000 people for concerts, spectator sports, including Lehigh’s basketball teams, and other events. University trustee Donald B. Stabler ’30 made a major financial contribution toward the facility.

Murray H. Goodman Stadium (1988, 2019). Joanie and Murray Goodman ’48, L.L.D. ’88, were the principal benefactors. On October 1, 1988, Lehigh opened the gates to Murray H. Goodman Stadium, located on the Goodman Campus with picturesque South Mountain in the background. Capacity is 16,000, and the stadium features a three-tiered press box, limited chair back seating, and a newly constructed VIP Suite.

Lewis Tennis Facility (1994). An anonymous donor made possible the construction of four indoor tennis courts for recreational use as well as team practice, and is named for former Lehigh President W. Deming Lewis. The building also includes men’s and women’s locker room facilities.

Ulrich Sports Complex (1999; expanded in 2009 & 2015). Lehigh chairman of the board of trustees, Ronald J. Ulrich ’66, provided the principal funding for the construction of a multi-field game complex used for men’s and women’s soccer, men’s and women’s lacrosse, and field hockey. The complex features a natural grass and two artificial surface fields: Frank Banko Field and Ronald J. Ulrich Field. The complex has permanent seating, press boxes, and lighting for night contests. A group of students enrolled in the University’s distinctive ILE (Integrated Learning Experience) program collaborated in the design of the original complex, illustrating the strong partnership between athletics and academics at Lehigh. The new Gould Shenfeld Half-Time building (2015) is a place for the competing teams to meet at halftime as well as pre and post game.

Mulvihill Golf Learning Center (2007). A USGA Qualified Training Facility with a driving range with five target greens, large practice green, and chipping green with three sand bunkers. The indoor facility houses a 672 square foot practice green and three indoor driving range bay providing year round training for the Men’s and Women’s Golf programs.

Leadership Field, New Softball Field Complex (2015). Located near the Goodman campus entrance, the complex includes a new playing field, video platforms, modern stands, enhanced dugouts, bullpens, batting cages, and a press box.

J. David Walker Field at Legacy Park, Baseball Field Complex (2015). This newly renovated baseball includes larger and enhanced dugouts, a synthetic infield and a natural grass outfield, bullpens and batting cages, modern stands, a press box, and a cable and netting system.

Residential Facilities

In the following list, the first date after the name of each building indicates the year of construction. The second date indicates the year of a major addition.

Brodhead House (1979). This structure is the university’s first high-rise residential facility. The six-story building includes 4-person suites on the upper floors, with a dining facility and lobby on the entrance level. The building is named in memory of Albert Brodhead, a member of the Class of 1888 who died in 1933, leaving 51 Bethlehem properties to his alma mater.

Farrington Square (2002). In August of 2002, Lehigh opened a 250-bed residential complex that includes the campus bookstore, the university post office, and several retail stores. Air-conditioned, two-, three-, and four-bedroom apartments are complete with full kitchen, private bedrooms and fully furnished living room/dining room areas. Attached to the complex is a parking garage for 350 cars for residents’ convenience.

Dravo House (1948). This 5-story stone edifice is the university’s largest residential facility. It bears the name of two brothers, Ralph M. Dravo, Class of 1889, and Francis F. Dravo, Class of 1887, who founded the Dravo Corp., a Pittsburgh-based international construction company. Both men served as university trustees.

Drinker House (1940). This stone building honors the memory of Henry S. Drinker, Class of 1871, university president from 1905 to 1920.

McClintic-Marshall House (1957). This U-shaped stone structure was built in memory of Howard H. McClintic and Charles D. Marshall, both Class of 1888, who founded the McClintic-Marshall Construction Co. The firm was the world’s largest independent steel fabricating firm before its acquisition by Bethlehem Steel Corp. in 1931. It built locks for the Panama Canal and constructed the Golden Gate Bridge in San Francisco Bay.
Packer House. The Graduate Student Center and Office of Graduate Life moved here in the summer of 2009, offering multipurpose social programming and meeting space as well as residential space for graduate students.

Richards House (1938). The building honors the memory of Charles Russ Richards, president of the university from 1922 to 1935. The building is constructed of stone in modified Gothic design.

Sayre Park Village (1998). This residential complex is comprised of three apartment buildings and houses students in three- and four-person apartments. Included is a fourth multipurpose community building and outdoor recreation facilities.

Taylor House (1907, 1984). The U-shaped building is one of the earliest concrete structures ever built. It was the gift of industrialist Andrew Carnegie in honor of his friend and associate, university trustee Charles L. Taylor, Class of 1876. The interior of the building was reconstructed and the exterior refinished prior to the facility becoming Lehigh’s first residential college in 1984.

Trembley Park (1975). This seven-building undergraduate apartment complex is named in memory of Francis J. Trembley, Lehigh professor and pioneer ecologist.

Umoja House. The Umoja House was established in 1989 to enhance the campus atmosphere for underrepresented students at Lehigh. The U House offers a safe and comfortable environment for any student who values multiculturalism.

Warren Square Complex. This cluster of four residence halls is located on Warren Square and Summit Street. They are upperclass facilities and some are used as special-interest houses.

CENTENNIAL I COMPLEX (1965)
Congdon House. Located at the east end of the Centennial I complex. Dr. Wray H. Congdon served as dean of students, dean of the graduate school, and special assistant to the president.

Emery House. It is named for Dr. Natt M. Emery, who was vice president and controller.

Leavitt House. The Rev. Dr. John McD. Leavitt was the second president, 1875 to 1879.

McConn House. C. Maxwell McConn was dean of the university from 1923 to 1938.

Smiley House. Dr. E. Kenneth Smiley served as vice president from 1945 to 1964.

Thornburg House. Dr. Charles G. Thornburg was professor and head of the Department of Mathematics, 1895 to 1923.

CENTENNIAL II COMPLEX (1970)
Beardslee House. Dr. Claude G. Beardslee was chaplain from 1931 to 1947.

Carothers House. Dr. Neil Carothers was dean of business.

Palmer House. Dr. Philip M. Palmer was dean of the arts.

Stevens House. The Rt. Rev. William Bacon Stevens, of Philadelphia, was Protestant Episcopal bishop of the Diocese of Pennsylvania and first president of the university board of trustees. He was the principal architect of the university’s original academic plan.

Stoughton House. Dr. Bradley Stoughton was dean of the engineering college, 1936 to 1939.

Williams House. Dr. Clement C. Williams was president of the university, 1935 to 1944.

SAUCON VILLAGE APARTMENTS (1974)
The five-building garden apartment complex includes housing for married, graduate, and undergraduate students.

Diamond. Dr. Herbert M. Diamond, professor emeritus of economics, retired in 1964.

Gipson. Dr. Lawrence Henry Gipson, research professor of history, bequeathed his estate to the university to establish the Lawrence Henry Gipson Institute for Eighteenth-Century Studies. Dr. Gipson wrote a monumental 15-volume history, The British Empire before the American Revolution. He won the Pulitzer Prize for volume 10, The Triumphant Empire: Thunderclouds Gather in the West, 1763-1766.

Hartman. Dr. James R. Hartman was chairman of the department of mechanical engineering and mechanics.

More. Dr. Robert P. More ’10, dean of the College of Arts and Sciences, who also taught German for forty years, bequeathed to the university his $746,000 estate, amassed after investing $3,000 in IBM stock. The university child care center is located in this building.

Severs. Dr. J. Burke Severs, of Bethlehem, is distinguished professor emeritus of English. He is a Chaucerian scholar.

FRATERNITIES AND SORORITIES
The university has a strong fraternity tradition, dating back to 1872. Since the admission of undergraduate women in 1971, several sororities have come into being. Some 450 men live in 14 fraternities. All of the fraternities have houses located on Asa Packer campus. All are chapters of national fraternities.

An alphabetical listing follows. The date of the founding of the chapter is given in the first column. The second column lists the date the chapter occupied its present house; any additional date indicates the most recent addition or major renovation.

<table>
<thead>
<tr>
<th>Fraternity</th>
<th>Chapter Founded</th>
<th>Present House Occupied</th>
<th>Recent Addition or Renovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha Tau Omega</td>
<td>1882</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chi Phi</td>
<td>1872</td>
<td>1923</td>
<td>1968</td>
</tr>
<tr>
<td>Chi Psi</td>
<td>1893</td>
<td>1915</td>
<td>2005</td>
</tr>
<tr>
<td>Delta Chi</td>
<td>1952</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delta Upsilon</td>
<td>1885</td>
<td>1968</td>
<td></td>
</tr>
<tr>
<td>Phi Delta Theta</td>
<td>1879</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phi Kappa Theta</td>
<td>1919</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phi Sigma Kappa</td>
<td>1901</td>
<td>1956</td>
<td>1970</td>
</tr>
<tr>
<td>Psi Upsilon</td>
<td>1884</td>
<td>1909</td>
<td>1966</td>
</tr>
<tr>
<td>Sigma Phi Epsilon</td>
<td>1907</td>
<td></td>
<td>1963</td>
</tr>
<tr>
<td>Theta Chi</td>
<td>1942</td>
<td>1964</td>
<td></td>
</tr>
<tr>
<td>Theta Xi</td>
<td>1904</td>
<td>1967</td>
<td></td>
</tr>
</tbody>
</table>

There are nine sororities and all are nationally affiliated. Over 380 women live in sororities. The sororities are listed with year of establishment at Lehigh in the first column and year of moving into their present house in the second column.

<table>
<thead>
<tr>
<th>Sorority</th>
<th>Establishment at Lehigh</th>
<th>Present House Occupied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha Chi Omega</td>
<td>1988</td>
<td>2007</td>
</tr>
<tr>
<td>Alpha Epsilon Pi</td>
<td>2019</td>
<td>2019</td>
</tr>
<tr>
<td>Alpha Gamma Delta</td>
<td>1975</td>
<td>2000</td>
</tr>
<tr>
<td>Alpha Omicron Pi</td>
<td>1983</td>
<td>2004</td>
</tr>
<tr>
<td>Alpha Phi</td>
<td>1975</td>
<td>1996</td>
</tr>
<tr>
<td>Gamma Phi Beta</td>
<td>1975</td>
<td>1998</td>
</tr>
<tr>
<td>Kappa Alpha Theta</td>
<td>1984</td>
<td>2006</td>
</tr>
<tr>
<td>Kappa Delta</td>
<td>2013</td>
<td>2013</td>
</tr>
<tr>
<td>Pi Beta Phi</td>
<td>1997</td>
<td>2008</td>
</tr>
<tr>
<td>Zeta Tau Alpha</td>
<td>2010</td>
<td>2011</td>
</tr>
</tbody>
</table>
Administration, Faculty and Staff

This section lists the people whose talents and abilities constitute the university's most important resource. Members of the board of trustees contribute their expertise to establish the policies of the university. Also listed are the administration, the members of the faculty and staff, and the members of the visiting committees who help to keep courses of instruction current and of maximum value to the students and their prospective employers.

Board of Trustees

For information on Members of the Board of trustees, please refer to this Link: https://www1.lehigh.edu/trustees

Principal Officers

The highest degree earned is given here. All offices, unless otherwise noted, are located at Bethlehem, PA 18015; the area code, unless otherwise noted, is (610).

PRINCIPAL OFFICERS
John D. Simon, Ph.D., president; 758-3156
Patrick V. Farrell, Ph.D., provost and vice president for academic affairs; 758-3605
Fred J. McGarr, B.A., vice president for communications and public affairs; 758-4487
Frank A. Roth, J.D., general counsel, secretary to the board; 758-3572
Joseph E. Buck, M.S.Ed., vice president for development and alumni relations; 758-4711
Erik J. Walker, M.A., chief of staff, Office of the President; 758-3131
Patricia A. Johnson, M.B.A., vice president for finance and administration; 758-3178
Ricardo Hall, Ph. D., vice provost for student affairs; 758-3890
Denise M. Blew, B.S., CMA, CPA, associate vice president for finance and administration and assistant secretary to the board; 758-3179
Alan J. Snyder, Ph.D., vice president & associate provost for research & graduate studies; 758-6964
Joseph D. Sterrett, Ed.D., Murray H. Goodman dean of athletics; 758-4320
Kristin Agatone, M.B.A., chief investment officer; 758-3034
Cheryl Ann Matherly, Ed.D., vice president and vice provost for international affairs; 758-4709
Georgette Phillips, J.D., Kevin L. and Lisa A. Clayton dean, College of Business; 758-6725
Maria Donoghue Velleca, Ph.D., Herbert J. and Ann L. Siegel dean, College of Arts and Sciences; 758-3300
William Gaudelli, Ph.D., dean, College of Education; 758-3221
Stephen DeWeerth, Ph.D., dean, P.C. Rossin College of Engineering and Applied Science; 758-4025
Whitney Witt, Ph.D., inaugural dean, College of Health; 758-1888
Robert Flowers, Ph.D., deputy provost for faculty affairs; 758-3165
Jennifer Jensen, Ph.D., deputy provost for academic affairs; 758-3705
Dan Warner, B.S., vice provost of admissions and financial aid; 758-3100
Bruce M. Taggart, Ph.D., vice provost for library and technology services; 758-3025
Donald Outing, Ph.D., vice president for equity and community; 758-3133
Yenny Anderson, Ed.D., vice provost for institutional research; 758-5890

Khanjan Mehta, Ph.D., vice provost for creative inquiry and director of the Mountaintop Initiative

College Offices

College of Arts and Sciences
Maginnes Hall
9 West Packer Avenue; 758-3300
Maria Donoghue Velleca, Ph.D., Herbert J. and Ann L. Siegel dean
Diane Hyland, Ph.D., senior associate dean for faculty and staff
Jackie Krasas, Ph.D., associate dean, interdisciplinary programs and international initiatives
Dominic Packer, Ph.D., associate dean, research and graduate programs

College of Business
Rauch Business Center
621 Taylor Street; 758-3000
Georgette C. Phillips, J.D., Kevin L. and Lisa A. Clayton dean
Kathrina Zalatan, Ph.D., associate dean and director of the undergraduate programs
Andrew Ward, Ph.D., associate dean, graduate programs

College of Education
Iacocca Hall
111 Research Drive; 758-3221
William Gaudelli, Ph.D., dean
Thomas Hammond, Ph.D., associate dean

College of Health
Alumni Memorial Building (temporary)
27 Memorial Drive West; 758-1888
Whitney Witt, Ph.D., inaugural dean

P.C. Rossin College of Engineering and Applied Science
Packard Laboratory
19 Memorial Drive West; 758-4025
Stephen DeWeerth, Ph.D., dean
Donna Mohr, Ph.D., assistant dean
John Coulter, Ph.D., associate dean, research and operations
Gregory L. Tonkay, Ph.D., associate dean, academic affairs
Raymond Pearson, Ph.D., senior advisor, faculty affairs

Offices and Resources

In this section, only the principal officers are listed. For degree information, consult the alphabetical listing that follows.

Admissions
27 Memorial Drive West; 758-3100
Dan Warner, vice provost for admissions and financial aid

Advancement
27 Memorial Drive West; 758-4711
Joseph E. Buck, vice president for development and alumni relations

Alumni Association
27 Memorial Drive West; 758-5799
Jennifer Cunningham, assistant vice president, alumni engagement

Art Galleries/Museum Operations
420 East Packer Avenue; 758-4862
William B. Crow, director/curator

Athletics
641 Taylor Street; 758-4300
Joseph D. Sterrett, Murray H. Goodman dean of athletics

Ben Franklin Technology Center
125 Goodman Drive; 758-5200
R. Chad Paul, president & chief executive officer

Bookstore
9 West Packer Avenue; 758-3383
Brian Adler, General Manager

Budget Office
422 Brodhead Avenue; 758-4204
Stephen J. Guttmann, director of budget
Bursar
27 Memorial Drive West; 758-3160
Michael J. King, bursar

Business Services
516 Brodhead Avenue; 758-3840
Mark R. Ironside, executive director

Career Services
621 Taylor Street, 484 RBC; 758-3710
Lori Kennedy, director

Center for Gender Equity
29 Trembley Drive; 758-6484
Rita Jones, director

Center for Writing, Math and Study Skills
35 Sayre Drive; 758-3098
Edward E. Lotto, director

Chaplaincy Services
661 Taylor Street; 758-3877
Rev. Dr. Lloyd H. Steffen, university chaplain and professor of religion studies

Child Care Center
5 Duh Drive #21; 758-5437
Kathy N. Calabrese, director

Community and Regional Affairs
343 Whitaker Lab, 5 E. Packer; 758-5801
Adrienne Washington, assistant vice president, community relations

Computing Center (see Information Resources)

Conference Services
63 University Drive, Rathbone Hall; 758-5306
Mary Kay Baker, director

Controller’s Office
524 Brodhead Avenue; 758-3140
Kathleen J. Miller, controller

Corporate and Foundation Relations
27 Memorial Drive West; 758-6845
Cameron J. McCoy, assistant vice president, economic engagement

Counseling & Psychological Services
36 University Drive; 758-3880
Ian T. Birky, director

Dean of Students
29 Trembley Drive, C108 University Center; 758-4156
Richard Hall, vice provost for student affairs

Development (see Advancement)

Distance Education (see Special Academic Programs)

Environmental Health and Safety
616 Brodhead Avenue; 758-4251
Barbara A. Plohocki, director

Facilities Services and Planning
461 Webster Street; 758-3970
Brent Stringfellow, associate vice president/university architect

Finance and Administration
27 Memorial Drive West; 758-3180
Denise M. Blew, associate vice president

Financial Aid
218 W. Packer Avenue; 758-3181
Jennifer Mertz, director

Fraternity and Sorority Affairs
29 Trembley Drive B004; 758-4157
Phoebe Galbraith, assistant director

General Counsel
27 Memorial Drive West, Room 307; 758-3572
Frank A. Roth, Esq., general counsel
Heather K. Hosfeld, Esq., deputy general counsel

Government Relations and Economic Development
301 Broadway, Suite 301; 758-5802
Christopher Carter, associate vice president; 758-5802
Vito G. Gallo, assistant vice president for state relations; 758-5801

Graduate Student Life
217 W. Packer Ave.; 758-4722
Kathleen S. Hutnik, director of graduate student life

Health Center
36 University Drive, Johnson Hall; 758-3870
Thomas Novak, M.D., interim director

Human Resources
428 Brodhead Avenue;
758-3900
Chris Chris Halladay, associate vice president

Institutional Research
422 Brodhead Ave.; 758-5890
Yenny Anderson, vice provost for institutional research

Internal Audit
526 Brodhead Avenue; 758-5012
Mark Laccetti and Adrienne Larmett

International Affairs
32 Sayre Drive, Coxe Hall; 758-4709
Cheryl Ann Matherly, vice president and vice provost for international affairs

Library and Technology Services
6A East Packer Avenue; 758-3025
Bruce M. Taggart, vice provost

Manufacturers Resource Center
125 Goodman Drive; 758-5599
Jack E. Pfunder, executive director

Parking Services
36 University Drive, 106 Johnson Hall; 758-3893
Sharon Field, manager

Personnel (see Human Resources)

Police (see University Police)

President’s Office
27 Memorial Drive West; 758-3156
John D. Simon, president

Provost’s Office
27 Memorial Drive West; 758-3605
Patrick V. Farrell, provost and vice president for academic affairs

Purchasing
516 Brodhead Avenue; 758-3840
Mark Ironside, executive director

Registration & Academic Services
27 Memorial Drive West; 758-3200
Linda Bell and Allen Taylor, directors

Research
7 Sinclair Laboratory, Rm. 305; 758-6964
Alan J. Snyder, vice president & associate provost for research & graduate studies

Research and Sponsored Programs
526 Brodhead Avenue; 758-3021
Thomas J. Meischeid, director

Residential Services
63 University Drive, Rathbone Hall; 758-3500
Ozzie Breiner, director

Risk Management
616 Brodhead Ave.; 758-3899
Kim Nimmo, director

Special Academic Programs (Distance Education and Summer Studies)
436 Brodhead Avenue;
758-3966 (Summer); 758-4373 (Distance)
Margaret Portz, director

Sports Communications
641 Taylor Street; 758-3174
Steve Lomangino, director

**Student Affairs**
29 Trembley Drive, University Center; 758-3890
Ricardo Hall, vice provost for student affairs

**Student Auxiliary Services**
63 Rathbone Hall; 758-5339
David M. Joseph, executive director

**Summer Studies (see Special Academic Programs)**

**Transportation Services**
126 Goodman Drive; 758-4410
Bob Bruneio, manager

**Treasurer (see Finance and Administration)**

**University Communications and Public Affairs**

321 East Packer Avenue; 758-4200
Jason D. Schiffer, chief

**Zoellner Arts Center**
420 East Packer Avenue; 758-5323
Andrew Cassano, administrative director

**Faculty and Emeriti**

The first date after the name is the date of appointment to continuous service on the Lehigh University faculty; the second date, when the first fails to do so, indicates the date of appointment to the present professional rank. Where the name of the institution awarding a high-level degree is not given, the institution is the same one that awarded the previous degree listed.

P.E. indicates certification as a professional engineer; C.P.A. indicates certified public accountant. A.P.R. indicates accreditation by Public Relations Society of America.


**Joshua Carl Agar** (2018), assistant professor of materials science and engineering. University of Illinois at Urbana-Champaign, BS, 2009; Georgia Institute of Technology, MS, 2011; University of Illinois at Urbana-Champaign, PhD, 2015.

**Sirry M. Alang** (2015), assistant professor of sociology and anthropology and health, medicine and society. University of Buea, BS, 2004; Lehigh University, MA, 2008; University of Minnesota Minneapolis, MS, 2013, PhD, 2015.


**J. Richard Aronson** (1965, 1972), professor emeritus of economics. Clark University, BEd, 1959; Stanford University, MA, 1961; Clark University, PhD, 1964.

**Catherine M. Arrington** (2005, 2011), associate professor of psychology and cognitive science. Furman University, BA, 1994, BS, 1994; Wake Forest University, MA, 1996; Michigan State University, PHD, 2002.


**Nicholas W. Balabkins** (1957), professor emeritus of economics. Institution George-August (Germany), DRERPO, 1949; Rutgers University, MA, 1953, PHD, 1956.

**Ganesh Balasubramanian** (2017), assistant professor of mechanical engineering and mechanics. Jadavpur University (India), BS, 2007; Virginia Polytechnic Institute and State University, PHD, 2011.

**Jonas Baltusaitis** (2014), P.C. Rossin Assistant Professor and assistant professor of chemical and biomolecular engineering. Kaunas University of Technology (Lithuania), BS, 1998, MS, 2000; University of Iowa, PHD, 2007.


**Arindam Banerjee** (2012, 2016), associate professor of mechanical engineering and mechanics. Jadavpur University (India), BS, 1999; Florida Institute of Technology, MS, 2002; Texas A&M University, PhD, 2006.

**Henri J. Barkey** (1987, 1999), Bernard L and Bertha Cohen Chair in International Relations and professor of international relations. City University London (United Kingdom), BS, 1975; University College London (United Kingdom), MS, 1976; University of Pennsylvania, PHD, 1984.


Floyd D. Beachum (2009), Peter E. Bennett ’63 Chair in Urban Principalship and program director of Educational Leadership and associate professor of educational leadership. Alabama State University, BA, 1995, MS, 1999; Bowling Green State University, PHD, 2002.


William Andrew Best (2008), program director of Integrated Degree in Engineering, Arts and Sciences and professor of practice of mechanical engineering and mechanics. Tufts University, BS, 1981; Virginia Polytechnic Institute and State University, MS, 1984.


Javier Buceta Fernandez (2014), associate professor of bioengineering and chemical and biomolecular engineering. University Complutense de Madrid(Spain), BS, 1994, MS, 1994; National University of Distance Education(Spain), PHD, 2000.


Megan Ann Cream (2019), professor of practice of mathematics. Wake Forest University, BS, 2010; Emory University, PHD, 2015.

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