Engineering

P.C. ROSSIN COLLEGE OF ENGINEERING AND APPLIED SCIENCE
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 the Rossin 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.

The Rossin College provides many opportunities for study in a wide variety of fields. In addition, multiple technical minors and interdisciplinary opportunities exist. The Rossin College also offers an accelerated path towards a master's degree. See this page (https://engineering.lehigh.edu/academics/undergraduate/special-opportunities/accelerated/) for more information.

See additional information on the P.C. Rossin College of Engineering and Applied Science (http://catalog.lehigh.edu/coursesprogramsandcurricula/engineeringandappliedscience/).

ENGINEERING MINOR
See additional information on the Engineering Minor under the heading of the P.C. Rossin College of Engineering and Applied Science (http://catalog.lehigh.edu/coursesprogramsandcurricula/engineeringandappliedscience/).

Core Prerequisites to begin the program

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</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>
</tbody>
</table>

Required Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>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>Group A - Engineering Fundamentals</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC 105</td>
<td>Engineering Structures and Motion</td>
</tr>
<tr>
<td>EMC 110</td>
<td>Energy Engineering</td>
</tr>
<tr>
<td>EMC 115</td>
<td>Engineering Materials and Electronics</td>
</tr>
<tr>
<td>EMC 120</td>
<td>Systems Engineering</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Group B - Integrated Engineering</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC/CSE 042</td>
<td>Game Design</td>
</tr>
<tr>
<td>EMC 150</td>
<td>Information and Knowledge Engineering</td>
</tr>
<tr>
<td>EMC 155</td>
<td>Enterprise Engineering</td>
</tr>
<tr>
<td>EMC 156</td>
<td>Embedded Systems</td>
</tr>
<tr>
<td>EMC 160</td>
<td>Computer Aided Engineering and Control Systems</td>
</tr>
<tr>
<td>EMC/ISE 168</td>
<td>Production Analysis</td>
</tr>
<tr>
<td>EMC 170</td>
<td>Software Engineering and Collaborative Environments</td>
</tr>
<tr>
<td>EMC/CHE/CEE/ES 171</td>
<td>Fund of Environmental Technology</td>
</tr>
<tr>
<td>EMC 174</td>
<td>Process Engineering</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.
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) 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.

EMC 300 Apprentice Teaching 1-3 Credits
Repeat Status: Course may be repeated.

Engineering Courses
ENGR 005 Introduction to Engineering Practice 0.2 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 0.2 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 089 Introduction to Design Thinking for Innovation 3 Credits
Design Thinking is a proven process for identifying problems and creating solutions to address them. Key tools and terminology of Design Thinking and related processes that encourage creativity as a way to innovate will be explored. The emphasis is on learning by doing and focusing on practicing the 5 steps in Design thinking: Empathize, Define, Ideate, Prototype, Test that can be applied to virtually any area where new solutions are needed.
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 211 (BIOE 211, MAT 211, ME 211) Capstone Design Project I 3 Credits
Students work on teams, integrating knowledge and skills acquired in their prior course work, to design practical solutions to real-world problems, typically in collaboration with industry, entrepreneurs, faculty, or campus departments. Teams perform in-depth engineering design while considering engineering standards and the project business case. Constraints, including technical, financial, environmental, societal, supply chain, regulatory, and others are considered throughout. Teams produce written reports, oral presentations, and prototypes appropriate for the project.
ENGR 212 (BIOE 212, MAT 212, ME 212) Capstone Design Project II 2 Credits
Students continue developing their solutions from ME 211 through prototype fabrication and testing, iteration, and failure mode analysis. New information about the project, as well as new knowledge, standards, and constraints, may be identified, considered and integrated into the solution. Teams are expected to produce a final project-specific prototype, an implementation plan appropriate to the project, as well as related business case financial models. Additional deliverables include written reports and presentations.
ENGR 300 Apprentice Teaching 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 methods, 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 440 Intensive Teaching Workshop 0 Credits
Two-day intensive teaching workshop designed to prepare doctoral students for a teaching practicum experience. Various faculty will discuss a range of topics including fundamentals of effective teaching, motivating students, inclusive teaching, principles of teaching under a research perspective, explaining difficult topics, assessing student learning and enhancing learning with instructional technology. Students will be required to prepare and lead micro-teaching sessions. Course requires Dean’s office permission and may not be repeated.

ENGR 441 Teaching Practicum 1-3 Credits
Mentored teaching experience focused on the design, organization, pedagogy and assessment of university courses in engineering. Students will work with a faculty member to develop teaching and communication skills and apply best practices in university teaching while receiving feedback. Specific course assignments will be determined by the student’s home department and must be approved by the department chair. Course may be repeated for credit.

Repeat Status: Course may be repeated.
Prerequisites: ENGR 440

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.