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>TE Course</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 250/TE 211 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