

# Integrated Innovation Institute

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## About Integrated Innovation

The Integrated Innovation Institute at Carnegie Mellon University breaks down the silos that impede innovation. The Institute believes that by uniting the disciplines of engineering, business and design we can create build impactful product and service solutions that create real value for real people.

For over 30 years, the institute has imparted to students a tried-and-true methodology to innovating products and services. Through dynamic projects, students learn to create solutions that: function effectively with the right technologies (engineering); improve the lives of individuals (design); and create economic value in the marketplace (business).

## Engineering Design, Innovation, and Entrepreneurship (EDIE) Additional Major Overview

As humanity grapples with dilemmas of extraordinary complexity throughout the globe, our world needs engineers who are leaders and change makers. Our world needs engineers who seek to push the boundaries in their education, and carry their passion for technological innovation forward.

The Engineering Design, Innovation, and Entrepreneurship (EDIE) additional major will provide students the know-how to innovate products around that technology and deliver product solutions to the people who need them.

EDIE students will have expertise in technology and the ability to design, develop, and deliver economically viable solutions to the real-world challenges of today and tomorrow.

**Students who elect Engineering Design, Innovation & Entrepreneurship (EDIE) as a major must also declare a major in one of the traditional engineering disciplines:**

- Chemical Engineering
- Civil Engineering
- Electrical & Computer Engineering
- Environmental Engineering
- Materials Science & Engineering
- Mechanical Engineering

The curriculum, demanding but readily feasible to complete in four years, is highly rewarding to motivated students.

## Common Requirements for the Additional Major:

The EDIE additional major program takes advantage of curricular overlaps between EDIE and traditional engineering majors, such that the additional major can be completed in four years with only a modest increase in course requirements. The courses requirements for EDIE consist of foundational skills, Engineering Design and Innovation, Engineering Entrepreneurship and two capstone experiences. The foundational skill courses focus on the fundamentals of microeconomics and public speaking. With core courses in engineering design, innovation and entrepreneurship are designed for engineers to learn with engineers, building on the fundamentals in their primary degree. Finally, students complete two capstone courses to explore real-world applications.

**The additional major in Engineering Design, Innovation & Entrepreneurship should be declared at the same time when declaring a traditional engineering major.**

**Some courses for the EDIE additional major may also satisfy requirements for traditional engineering courses or for general education courses.**

## Course Requirements for the Additional Major

### Curriculum Details

The EDIE additional major isn't just for students who want to create a startup—it will help to prepare hands-on, get-it-done leaders who are in demand in all sectors of society and industry, for-profit and not-for-profit. Given the applied focus of our curriculum, courses will equip our students with mindsets, skills, and capabilities to identify and shape opportunities and develop economically sustainable solutions.

Students in the EDIE additional major must also satisfy the core requirements of their primary major typically following the standard schedule of courses each semester. EDIE core requirements are fulfilled in addition to the course requirements of their primary major, mainly using various elective units. The side-by-side curriculum charts for each primary major show how the requirements for the stand-alone majors and the primary major plus EDIE additional major compare.

## Course Requirements

### Introductory Course

49-101	Introduction to Engineering Design, Innovation, and Entrepreneurship	12
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### Engineering Design and Innovation Courses

49-305	Customer Discovery for Tech Innovation	4.5
49-306	Engineering Design Methods & Tools	4.5
49-405	Leading Engineering Innovation Teams	4.5

### Engineering Entrepreneurship Courses

49-205	Tech Venture Marketing for Engineers	4.5
49-206	Tech Business Planning	4.5
49-406	Tech Venture Formation	4.5

### Foundation Skills Courses

73-102	Principles of Microeconomics	9
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### One (1) of the following Writing & Expression courses:

70-347	Entrepreneurship Communication	9
70-340	Business Communications	9
70-345	Business Presentations	9
70-350	Acting for Business	9

### Home Department Engineering Design Capstone (12 units)

Please consult with your home engineering department to confirm the specific Engineering Design Capstone course(s) that apply to your primary engineering degree. 12 units will count towards your EDIE degree requirements.

49-420	EDIE Innovation Capstone	9
49-421	EDIE Entrepreneurship Capstone	9

## Educational Objectives and Outcomes

The Integrated Innovation Institute breaks down the silos that impede innovation. We believe that by uniting the disciplines of engineering, business, and design, we can create impactful product and service solutions that create real value for real people.

Students emerge from our programs with hard and soft skills that empower them to solve complex real-world problems, regardless of industry, technology, or discipline.

#### Our graduates will become:

- Technology Entrepreneurs who utilize their specialized skills and ability to collaboratively explore and exploit scientific and technological change to benefit the firm.
- Leaders with relevant skills in technology-driven industries; becoming people who proactively see opportunities and know how to take action to fulfill them by developing products and launching ventures.
- Complex Problem Solvers who can leverage the skills in the core disciplines of innovation, entrepreneurship, and engineering design to create real value for real people while collaborating in a team environment.
- Futurists who are forward-thinking and eager to leave an impact on society

#### Student Learning Outcomes

1. An ability to formulate, articulate, and execute processes to discover new technology innovations and create entrepreneurial ventures.
2. Understand how the interdependence between technological change and new product development differentiates technological entrepreneurship from other entrepreneurship styles.
3. An ability to apply fundamentals learned in disciplines of innovation, entrepreneurship, and engineering design to produce solutions that meet specific needs that create and capture value for a firm.
4. An ability to communicate project learnings effectively using oral, written, and/or prototyping and other non-verbal communication methods.
5. An ability to collaborate on a multidisciplinary team, such as in EDIE capstone projects, based on a shared vision of future challenges in technology.
6. An ability to grow leadership skills and personal capacity for leadership while working effectively on teams to foster a collaborative and inclusive environment.
7. An ability to apply the program's active learning methodology in a repeatable continuous process of innovation, critical thinking, and active learning.
8. An ability to recognize the attributes of a growth mindset and to apply the principles in a professional context.

#### How does EDIE make you a better engineer?

Complementing your core engineering training, the practical expertise you acquire from the EDIE program will equip you to be a more effective, well-rounded, and adaptable engineer in the real world. Coupling your technical engineering training with the design, innovation, and entrepreneurship skills you'll acquire in the EDIE program will give you a significant advantage in your career preparation and post-graduation options and marketability.

## Course Descriptions

#### About Course Numbers:

*Each Carnegie Mellon course number begins with a two-digit prefix that designates the department offering the course (i.e., 76-xxx courses are offered by the Department of English). Although each department maintains its own course numbering practices, typically, the first digit after the prefix indicates the class level: xx-1xx courses are freshmen-level, xx-2xx courses are sophomore level, etc. Depending on the department, xx-6xx courses may be either undergraduate senior-level or graduate-level, and xx-7xx courses and higher are graduate-level. Consult the Schedule of Classes (<https://enr-apps.as.cmu.edu/open/SOC/SOCservlet/>) each semester for course offerings and for any necessary pre-requisites or co-requisites.*

#### 49-101 Introduction to Engineering Design, Innovation, and Entrepreneurship

Fall and Spring: 12 units

This course will introduce formal innovation and design methods to form new opportunities, product/service solutions, and ventures within a team-based project, with particular emphasis on the translation and integration of technologies into products, services, and venture solutions. As engineers we are trained to develop solutions. Solving problems is good. Solving the right problems is better. This course will teach the skills, processes, and mindset to identify the right problems that need to be solved and then develop innovative solutions to those challenges, ensuring these solutions provide value for those using it. With this ability, the technical and problem solving skills of the other engineering disciplines can be brought to bear to create breakthrough products and services.

#### 49-205 Tech Venture Marketing for Engineers

Spring: 4.5 units

Designed for engineers, this course will cover key strategic and tactical marketing concepts and methods: product adoption life cycle, customer segmentation, strategic market planning and tactical considerations, with special considerations for new high-tech engineering products and innovations. This course will equip technologists with a marketing perspective, equipping them to achieve market adoption and sales growth.

#### 49-206 Tech Business Planning

Spring: 4.5 units

Tech Business Planning focuses on the design of a technology-based venture. Students will learn to craft a business plan: fleshing out a value proposition for key customer segments, specifying how that value is delivered and by whom, designing key activities of the business, identifying business relationships, working through the cost structure, and estimating revenue streams. Students will base their business planning on information provided to them in this course (technology context, customer data, regulatory constraints, etc.) The skills taught in this applied course are relevant to both startups and to new ventures within existing organizations.

#### 49-300 Integrated Product Conceptualization

Fall: 12 units

The Integrated Product Conceptualization course focuses on introducing students to some of the thinking, basic skills and methods used by industrial design, engineering, and business to generate new consumer product proposals within integrated teams. Teams will progress through three phases 1) identifying opportunities for new products or services, 2) understanding those opportunities through stakeholder research, value opportunity analysis, and competitive landscape assessment, then selecting one of which to focus, 3) conceptualizing the opportunity with the goal of meeting the value proposition. This course will combine lecture and studio activities including the generation of 2D visual representation skills and 3D low-fidelity physical modeling in support of course work. An important part of this course is a design project that is carried out by interdisciplinary teams. In order to effectively contribute to their team, each student should have experience or coursework in at least one of the following: design, the arts, engineering/technology, or business. This course is reserved for junior and senior level students. Freshmen and sophomores will be admitted as space allows and with instructor permission.

#### 49-305 Customer Discovery for Tech Innovation

Spring: 4.5 units

This course guides students through determining the need for research, planning and executing several iterations of stakeholder (e.g., end users, customers, ...) engagements with different UX research methods, analysis of data, analyzing impact of findings on product design in technology domains. Given that extant data often are not prevalent to aid early product innovation decisions, the course is focused primarily on qualitative data, although some time is spent to source quantitative data and leverage a mixed approach.

#### 49-306 Engineering Design Methods & Tools

Fall: 4.5 units

This course will teach engineering design methods and tools from concept to realization. Topics include embodiment design, product architecture and platform design, decision making, design for production, cost analysis, quality and total quality management. The course will address systems design, physical embodiment, and interaction design.

**49-405 Leading Engineering Innovation Teams**

Spring: 4.5 units

Innovation teams are not like other teams because innovation is different; the problem objective may have been outlined, but the teams workflow journey and output destination are full of unknowns and un-trieds. The innovation team must be led at each key step along the way with the goal of engineering an innovation that delivers market success. Based on research and practice, this course covers leadership principles that specifically apply to leaders of innovation, which can considerably improve the chances of a successful innovation team.

**49-406 Tech Venture Formation**

Spring: 4.5 units

The course will cover key aspects for venture formation: intellectual property; deal structures, term sheets and contracts; venture financing and financial statements. Although presented in the context of technology startups, these frameworks and methodologies are useful for corporate new-business-development and new-market-entry as well.

**49-420 EDIE Innovation Capstone**

Fall: 9 units

In this course, students work in a team-based project, starting from an open-ended problem area and concluding with a refined product/service concept. Methods and skills from prior classes (e.g., innovation process and methods, customer discovery, engineering design) will be applied and practiced by the team. The skills learned in this course can be applied to the for-profit sector and also in the context of projects for social good.

**49-421 EDIE Entrepreneurship Capstone**

Spring: 9 units

In this course, students work in a team-based project, starting from a new product concept and concluding with a well-designed venture and a launch plan. Methods and skills from prior classes (e.g., customer discovery, engineering design, tech business planning) will be applied and practiced by the team.

## Part-Time Faculty

ELLEN AYOOB, Program Director, Master of Integrated Innovation for Products and Services – Master of Design in Communication Planning and Information Design, Carnegie Mellon University;

PETER BOATWRIGHT, Co-Founder, Director of iii, Allan D. Shocker Professor of Marketing and New Product Development – Doctor of Philosophy (PhD) in Business, University of Chicago;

BRANDON BODILY, Assistant Teaching Professor – Master of Science in Aerospace Engineering, Purdue University;

MARK SANDERS, EDIE Program Director & Distinguished Service Professor – PhD in Interdisciplinary Engineering, The University of Texas at Austin;

SUSANNA ZLOTNIKOV, Online Program Director & Assistant Teaching Professor – Master of Design, Carnegie Mellon University;

## Adjunct Faculty

FRANCINE GEMPERLE, Adjunct Professor – Master of Design, Interaction Design, Carnegie Mellon University;

CHRISTOPHER HOLLIDAY, Adjunct Professor – MIIPS (iii), Carnegie Mellon University;

JODY MADALA, Adjunct Professor – Tepper MBA, Carnegie Mellon University;

MITCHAM TUELL, Adjunct Professor – BS Electrical Engineering, Georgia Institute of Technology;