Minor in Innovation and Transformational Change

The global population has never been larger, and it’s still growing. We need students like you—now more than ever—to solve our most pressing problems in business, government, the non-profit sector, and academia. We need to solve Grand Challenges. Ending poverty, providing safe drinking water for all, and restoring our crumbling urban infrastructure might seem like daunting feats, but the Minor in Innovation and Transformational Change will teach you world-class methods and techniques to transform these challenges into opportunities to make a significant impact. Innovation is commonly associated with the creation of new and different technologies. While we certainly need to innovate technology, we must do so by seeing the bigger picture of how technologies interact with organizations and people; and we must be driven not just by the originality of our ideas but also by their potential to affect change. Innovation science provides insight into ways of thinking, planning, and acting that can be applied across a broad range of domains to drive impact. We can innovate business models, human behavior, and complex systems like cities and schools. Innovation is both an art and a science. It’s both creativity and pattern recognition. The Minor in Innovation and Transformational Change will equip you with the mindsets, behaviors, attributes, tools, and methods you need to obtain leadership roles and make large-scale, positive impact wherever you may go in your career.

Tailor Your Minor Plan of Study

Choose your own path to obtain the Minor in Innovation and Transformational Change. Achieving the Minor requires 18 credits drawn from three categories of classes: Core Courses, Selectives, and Electives, with the latter two categories offering numerous opportunities to ensure you are linking your new knowledge and skills to problems you care about.

CORE COURSES

The CORE COURSES are required, and bookend the Minor experience providing an introduction to problem framing, solution space development, innovation, and design fundamentals at the onset of the program, and an in-depth experiential learning opportunity to apply your skills to a real grand challenge problem as you prepare to graduate. There are no prerequisites for the core courses; however, ENGR490 must be the last course in the course sequence for the Minor.

- ENGR305 Fundamentals of Innovation Theory and Practice 3 credits
- ENGR490 Breakthrough Thinking for Complex Challenges 3 credits

SELECTIVES

SELECTIVES provide an opportunity for you to develop mindsets and capabilities that are critical to driving the innovative change necessary to address complex socio-technical challenges. You choose one course in each of three key areas to build your background:

- employ systems thinking and rigorous innovation processes to DESIGN HOLISTIC SOLUTIONS,
- help realize a shift in paradigm by MOTIVATING CHANGE, and
- ensure your ideas are viable by DEVELOPING STRATEGIES FOR FINANCIAL SUSTAINABILITY
DESIGN HOLISTIC SOLUTIONS  .........................................................3 credits

- AAE 56000  System-of-Systems Modeling and Analysis
- EEE 25000  Environmental, Ecological and Engineering Systems
- ME 55300  Product and Process Design
- TECH 53300  Design Theory and Technology
- TLI 52000  Foundations of Innovation Studies
- CE 39800  Intro CE Systems Design
- EPCS-Any level  Engr Proj Cmity Service

Prerequisites

- None
- None
- None
- None
- None
- > C- in (MA 26100, MA 26300, MA 27100, MA 18200, or MA 17400)
- None for EPCS 10100; for others, > D- in ENGR13300 AND prior EPCS level

MOTIVATE CHANGE. .................................................................3 credits

- COM 30300  Intercultural Communication
- COM 31800  Principles of Persuasion
- CSR 33100  Consumer Behavior
- MGMT 44362  Leadership and Organizational Change
- OBHR 33000  Introduction to Organizational Behavior
- PHIL 22100  Introduction to Philosophy Science
- TLI 25400  Leading Change in Technology Organizations
- TLI 31400  Leading Innovation in Organizations
- COM 21000  Debating Public Issues
- COM 44400  Introduction to Communication and Social Entrepreneurship
- ECON 47100  Behavioral Economics
- MGMT 42710  Digital and Social Media Marketing
- PSY 27200  Introduction to Industrial-Organizational Psychology
- TLI 35600  Global Technology Leadership

- None
- None
- None
- None
- None
- None
- None
- None
- None
- D- in (COM 11400, COM 21700, or COMM R1100)
- D- in (ENTR 20000 or ENTR 31000)
- > C- in ECON 34000 OR (MA 16200 or MA 16600)
- ≥ C- in MGMT 32400
- D- in PSY 12000
- C in TLI 31400

DEVELOP STRATEGIES FOR FINANCIAL SUSTAINABILITY  ........................................3 credits

- CE 59601  Entrepreneurship and Business Strategy in Engineering

- None
• ENTR 20000  Introduction to Entrepreneurship and Innovation  None
• IET 45100  Monetary Analysis for Industrial Decisions  None
• MGMT 30400  Introduction to Financial Management  None
• MGMT 42310  Global Marketing Management  None
• MGMT 48400  Management of New Enterprises  None
• POL 23500  International Relations Among Rich and Poor Nations  None
• SOC 33900  Introduction to the Sociology of Developing Nations  None
• ENTR 31000  Marketing and Management for New Ventures  > D- in (ENTR 20000 or Professional level ENTR 20000)
• MGMT 35200  Strategic Management  ≥ C- in MGMT 20100 AND ECON 25100
• SOC 31600  Industry and Society  ≥ D- in (SOC 10000, SOC S1610 or, SOC R1000)

ELECTIVES.................................................................................................................3 credits

ELECTIVES enable you to further contextualize your minor by gaining depth in an area that will enhance your potential to drive innovation and transformational change in industry, academia, or the non-profit sector. Accumulate 3 credits from any of the following areas:

Learn versatile RESEARCH METHODS to gain insight into human behavior....................... 
• ANTH 38000  Using Anthropology in the World  None
• ANTH 38500  Community Engagement in Anthropology  None
• SOC 38300  Introduction to Research Methods in Sociology  None
• AD 51200  Interaction Design Studies  Instructor approval
• AGEC 45100  Applied Econometrics  ≥ D- in (STAT 22500, STAT 26000, STAT 30100, STAT 30100, STAT 31100, STAT 35000, STAT 35000, STAT 41600, STAT 50100, STAT 50300, STAT 51100, STAT 51100, STAT 51600, or STAT E2700)
• ANTH 41800  Field Methods in Cultural Anthropology  ≥ D- in ANTH 20500
• COM 32500  Interviewing: Principles and Practice  ≥ D- in (COM 11400, COM 21700, or COMM R1100)
• ECON 36000  Econometrics  ≥ C- in (MGMT 30500, ECON E2700, STAT 35000, or STAT 51100)
• MGMT 42110  Marketing Analytics  ≥ C- in (MGMT 30500 or STAT 35000) AND (MGMT 32400)
Gain a deeper understanding of the cultural and social aspects of GRAND CHALLENGES

GENERAL

- **AGEC 20400**  Introduction to Resource Economics and Environmental Policy  None
- **ANTH 20500**  Human Cultural Diversity  None
- **ANTH 21000**  Technology and Culture  None
- **ANTH 32700**  Environment and Culture  None
- **ANTH 57500**  Economic Anthropology  None
- **ENE 55300**  Introduction to Globalization and Engineering  None
- **ENGR 31000**  Engineering in Global Context  None
- **HIST 33300**  Science and Technology in Western Civilization I  None
- **HIST 33400**  Science and Technology in Western Civilization II  None
- **ME 49200**  Technology and Values  None
- **PHAD 55600**  Healthcare Economics and Public Policy  None
- **SOC 57200**  Comparative Healthcare Systems  None
- **AGEC 34000**  International Economic Development  > D- in (AGEC 20300, AGEC 20400, AGEC 21700, ECON 21700, ECON 25100, ECON E1030, ECON E2010, ECON 25200, ECON E1040, or ECON E2020)
- **AGEC 40600**  Natural Resource and Environmental Economics  > D- in (AGEC 20300, AGEC 20400, ECON 25100, ECON E1030, or ECON E2010)

EDUCATION

- **EDCI 56500**  Principles of Adult Education  None
- **EDST 51200**  Foundations of Educational Policy  None
- **EDST 51400**  Economics of Education  None
- **EDPS 30102**  Social-Emotional Aspects of Learning in Diverse Environments  > D- in EDPS 23500

ENVIRONMENT

- **AGEC 52500**  Environmental Policy Analysis  None
- **ASM 33600**  Environmental Systems Management  None
- **BCM 41900**  Sustainable Construction  None
• BCM 51000  Topics in Environmentally Sustainable Construction, Design and Development  None
• EAPS 32700  Climate, Science And Society  None
• EEE 35500/CE 35500  Engineering Environmental Sustainability  None
• FNR 30200  Global Sustainability Issues  None
• FNR 48800  Global Environmental Issues  None
• HIST 39400  Environmental History of the United States  None
• HTM 37000  Sustainable Tourism And Responsible Travel  None
• PHIL 29000  Environmental Ethics  None
• POL 22300  Introduction to Environmental Policy  None
• POL 32700  Global Green Politics  None
• POL 42300  International Environmental Policy  None
• POL 32300  Comparative Environmental Policy  None
• BIOL 48300  Great Issues: Environmental And Conservation Biology  > D- in (BIOL 11000, BIOL 11100, BIOL 12100, BIOL 24100, BIOL 28600, or BIOL 58500)
• EAPS 36000  Great Issues In Science And Society  > D- in (COM 21700, BIOL 23200, or BIOL 27100)

ENERGY
• EAPS 37500  Great Issues-Fossil Fuels, Energy, and Society  None
• EAPS 30100  Oil!  > D- in (ENGL 10100, ENGL 10200, ENGL 10300, ENGL 10400, ENGL 10600, ENGL 10800, ENG W1310, ENG W1320, ENG W1400, ENG W1500, or ENG W2330)
• ME 44000  Automotive Prime Movers: Green Engines and Clean Fuel  > D- in ME 30000

FOOD
• AGEC 25000  Economic Geography of World Food and Resources  None
• AGEC 52800  Global Change and the Challenge of Sustainably Feeding a Growing Planet  None
• AGEC 41000  Agricultural Policy  > D- in AGEC 22000 AND (AGEC 21700, ECON 25200, ECON E1040, or ECON E2020)
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Requirement</th>
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<tr>
<td>ANTH 34000</td>
<td>Global Perspectives on Health</td>
<td>None</td>
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<tr>
<td>HK 58100</td>
<td>International Health</td>
<td>None</td>
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<tr>
<td>BIOL 31200</td>
<td>Great Issues Genomics And Society</td>
<td>Department consent</td>
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<tr>
<td>HK 36500</td>
<td>Principles of Community Health Promotion</td>
<td>&gt;D- in (HK 21500, HK 21900, or SPEA H1200)</td>
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Summary of Requirements

In order to complete the minor, you must:

- Accumulate 18 credits from the approved course options <Link available on Minor website>

- Complete ENGR 305: Fundamentals of Innovation Theory and Practice (3 credits, counts toward the 18 credit total)

- Achieve breadth by completing 3 credits in each category of approved SELECTIVES (9 credits in total)

- Achieve depth by completing 3 credits from approved ELECTIVES

- Complete ENGR490: Breakthrough Thinking for Complex Challenges (3 credits, counts toward the 18 credit total) after completing all other program requirements

- Achieve a grade point average of at least 2.0 across the courses pursued for the minor

Note that the majority of the course options listed above can likely be used to concurrently satisfy general education or technical elective requirements of your school.

Enroll

To learn more about the enrollment process and requirements, please speak with your academic advisor. Questions? Contact innovation@purdue.edu.
CORE COURSES

ENGR305: Fundamentals of Innovation Theory and Practice

The foundational course for the Minor in Innovation and Transformational Change is ENGR 305: Fundamentals of Innovation Theory and Practice, taught by Professor Joe Sinfield, the Director of the Innovation and Leadership Studies Program. This 3 credit course introduces you to the fundamental patterns and methods of innovation through the study and application of emerging innovation techniques that address technological, economic, and societal challenges. You will join a cross-disciplinary team to design solutions to a series of socio-technical challenges, in an experiential learning setting, addressing the full breadth of functional, social, and emotional factors that shape use and adoption of your solution. Through case discussions of historical and contemporary innovations, you will learn how to identify opportunities and design, test, and iterate solutions. By the end of the course, you will understand and effectively use techniques from many fields, such as business, design, problem-solving, engineering, and social sciences.

This course is currently offered in both Fall and Spring semesters.

Download the syllabus for ENGR305 <Link available on Minor website>

ENGR490: Breakthrough Thinking for Complex Challenges

Breakthrough Thinking for Complex Challenges is a 3-credit, experiential learning course which is typically taken in the final year of the Minor in Innovation and Transformational Change. In this course, you have the opportunity to reflect on the collection of courses that you have pursued for the Minor and selectively apply key learning from these experiences to a real-world challenge in an action-oriented group problem solving setting. The course focuses on developing solutions to major challenges - often referred to as complex problems, grand challenges, or wicked problems. These categories of problems require solutions that span technical, economic, social, and cultural domains and thus impede approaches derived from only one perspective. This course will enable you to apply methods from varying fields and integrate differing ways of thinking to frame major challenges and design and advance holistic solutions. You will have the opportunity to engage in problem exploration and participatory design in close partnership with an external organization. This experience will help you put your knowledge into practice and develop adaptive expertise. Conceived solutions must incorporate not only means to address technical challenges, but also aspects of stakeholder education and awareness, cultural adoption, resource availability and access, economic and operational sustainability, and governance. Collectively, co-designing holistic solutions inclusive of all of the aforementioned components, in collaboration with involved stakeholders, will help you build critical awareness and skills consistent with the College’s vision to prepare Purdue engineers for leadership roles in the 21st century.

Course projects vary year-to-year depending upon the portfolio of needs on- and off-campus that are being addressed more broadly in the Innovation and Leadership Studies Program. The course is typically offered in the Spring semester. Enquire at innovation@purdue.edu to learn more about the focal problem of the course this year.

Download the syllabus for ENGR490 <Link available on Minor website>
Breakthrough Thinking Project Example: Providing Potable Water in the Rural Dominican Republic

Almost 800 million people worldwide lack access to clean water. Students in Breakthrough Thinking addressed this problem holistically in the rural Dominican Republic by partnering with students in another course at Purdue, CE 597: Water Supply in Developing Countries. For two semesters, students utilized systematic innovation methods and techniques to:

- Understand the comprehensive set of issues that define the success of any water system
- Uncover hidden assumptions in current and prior attempts to provide potable water to those in need
- Map complex relationships among community members, local and national organizations, and the forces that shape the acquisition, delivery, perception, and awareness of water and sanitation
- Identify potential partnerships and conflicts in the water provision ecosystem based on stakeholders’ motivations
- Document circumstances specific to rural Dominican Republic that would affect the solution, such as intermittent electricity, significant wealth disparity among residents, and the cultural importance of extended family
- Integrate solution components into comprehensive, system-level solutions that simultaneously address all key issues across technical, economic, social, and cultural domains

These system-level solutions are now ready for rapid in-field testing, refinement, and eventual implementation at scale.