

# INDUSTRIAL ENGINEERING, B.S. (ENGINEERING)

**Begin Campus:** Any Penn State Campus

**End Campus:** University Park

## Program Description

The undergraduate program in industrial engineering, being the first established in the world, has a long tradition of providing a strong, technical, hands-on education in design, control, and operation of manufacturing processes and systems. The curriculum provides a broad-based education in manufacturing, operations research and ergonomics through a base of mathematics, physical and engineering sciences, and laboratory and industrial experiences. It builds a strong foundation for the development of a professionally competent and versatile industrial engineer, able to function in a traditional manufacturing environment as well as in a much broader economy, including careers in financial services, communication, information technology, transportation, health care, consulting, or academia.

After completing courses required for the core and fundamental competencies in the major, students can choose two IE technical elective courses from a department list. In addition, students must also complete the three-credit capstone design course.

## What is Industrial Engineering?

Industrial Engineering is rooted in the sciences of engineering, the study of systems, and the management of people. Industrial engineers are big-picture problem solvers who optimize complex engineering systems and processes. They bring together people, machinery, materials, information, energy, and financial resources to improve efficiency, performance, quality, and safety while reducing cost and waste. According to the Institute of Industrial & Systems Engineers, Industrial Engineers "work to eliminate waste of time, money, materials, energy, and other commodities." Because it is a broad and versatile discipline, study of industrial engineering prepares you for careers in every sector of the economy.

## You Might Like This Program If...

Largely based in math and science, while incorporating business and psychology, the industrial engineering program is designed to prepare students to become leaders in engineering. We provide students with a comprehensive education in human factors/ergonomics; manufacturing; operations research; and supply chain/service engineering through coursework and hands-on experience. Our students become innovators who discover new solutions that address evolving challenges in a wide variety of sectors including academia, banking, communications, consulting, healthcare, information technology, transportation, etc.

## Entrance to Major

In order to be eligible for entrance to this major, students must satisfy the following requirements by the end of the semester during which the admission to major process is carried out.

- Completed 29-55 cumulative credits (credits completed at Penn State for which a quality letter grade was earned)

- Completed with a C or better the following courses: EDSGN 100, CHEM 110, MATH 140, MATH 141, and PHYS 211
- Attained at least a 2.6 cumulative grade point average

\* In the event that the major is under enrollment control, a higher minimum cumulative grade-point average is likely to be needed and students must be enrolled in the College of Engineering or Division of Undergraduate Studies at the time of confirming their major choice.

## Degree Requirements

**For the Bachelor of Science degree in Industrial Engineering, a minimum of 129 credits is required:**

Requirement	Credits
General Education	45
Requirements for the Major	111

**27 of the 45 credits for General Education are included in the Requirements for the Major. This includes: 9 credits of GN courses; 6 credits of GQ courses; 3 credits of GS courses; 9 credits of GWS courses.**

## Requirements for the Major

To graduate, a student enrolled in the major must earn a grade of C or better in each course designated by the major as a C-required course, as specified by Senate Policy 82-44 (<https://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#82-44>).

Code	Title	Credits
<b>Prescribed Courses</b>		
CHEM 111	Experimental Chemistry I	1
IE 425	Stochastic Models in Operations Research	3
IE 453	Simulation Modeling for Decision Support	3
IE 460	Service Systems Engineering	3
IE 470	Manufacturing System Design and Analysis	3
IE 480W	Capstone Design Project	3
MATH 220	Matrices	2
MATH 231	Calculus of Several Variables	2
MATH 250	Ordinary Differential Equations	3
MATSE 259	Properties and Processing of Engineering Materials	3
PHYS 212	General Physics: Electricity and Magnetism	4
<i>Prescribed Courses: Require a grade of C or better</i>		
CHEM 110	Chemical Principles I	3
EDSGN 100	Cornerstone Engineering Design	3
EMCH 210	Statics and Strength of Materials	5
ENGL 202C	Effective Writing: Technical Writing	3
IE 302	Engineering Economy	3
IE 305	Product Design, Specification and Measurement	3
IE 322	Probabilistic Models in Industrial Engineering	3
IE 323	Statistical Methods in Industrial Engineering	3
IE 327	Introduction to Work Design	3
IE 330	Engineering Analytics	3
IE 405	Deterministic Models in Operations Research	3
MATH 140	Calculus With Analytic Geometry I	4
MATH 141	Calculus with Analytic Geometry II	4

PHYS 211	General Physics: Mechanics	4
<b>Additional Courses</b>		
Select 1 credit of First-Year Seminar		1
CMPSC 200	Programming for Engineers with MATLAB	3
or CMPSC 201 Programming for Engineers with C++		
ECON 102	Introductory Microeconomic Analysis and Policy	3
or ECON 104 Introductory Macroeconomic Analysis and Policy		
Select one of the following: <sup>1</sup>		3
IE 408	Cognitive Work Design	
IE 418	Human/Computer Interface Design	
IE 419	Work Design - Productivity and Safety	
<i>Additional Courses: Require a grade of C or better</i>		
CAS 100A	Effective Speech	3
or CAS 100B Effective Speech		
ENGL 15	Rhetoric and Composition	3
or ENGL 30H Honors Rhetoric and Composition		
<b>Supporting Courses and Related Areas</b>		
Select 3 credits as a science selection from department list		3
Select 6 credits as non-major electives from department list <sup>2</sup>		6
Select 3 credits in manufacturing processes from department list <sup>1</sup>		3
Select 6 credits of technical electives from the department list; all 6 credits must be IE credits		6

<sup>1</sup> The course not taken to satisfy this requirement can be taken as a technical elective. Please see the department list.

<sup>2</sup> Please see the department list.

## General Education

Connecting career and curiosity, the General Education curriculum provides the opportunity for students to acquire transferable skills necessary to be successful in the future and to thrive while living in interconnected contexts. General Education aids students in developing intellectual curiosity, a strengthened ability to think, and a deeper sense of aesthetic appreciation. These are requirements for all baccalaureate students and are often partially incorporated into the requirements of a program. For additional information, see the General Education Requirements (<https://bulletins.psu.edu/undergraduate/general-education/baccalaureate-degree-general-education-program/>) section of the Bulletin and consult your academic adviser.

The keystone symbol appears next to the title of any course that is designated as a General Education course. Program requirements may also satisfy General Education requirements and vary for each program.

### Foundations (grade of C or better is required and Inter-Domain courses do not meet this requirement.)

- **Quantification (GQ):** 6 credits
- **Writing and Speaking (GWS):** 9 credits

### Breadth in the Knowledge Domains (Inter-Domain courses do not meet this requirement.)

- **Arts (GA):** 3 credits
- **Health and Wellness (GHW):** 3 credits
- **Humanities (GH):** 3 credits
- **Social and Behavioral Sciences (GS):** 3 credits
- **Natural Sciences (GN):** 3 credits

## Integrative Studies

- **Inter-Domain Courses (Inter-Domain):** 6 credits

## Exploration

- **GN**, may be completed with Inter-Domain courses: 3 credits
- **GA, GH, GN, GS, Inter-Domain courses.** This may include 3 credits of World Language course work beyond the 12th credit level or the requirements for the student's degree program, whichever is higher: 6 credits

## University Degree Requirements

### First Year Engagement

All students enrolled in a college or the Division of Undergraduate Studies at University Park, and the World Campus are required to take 1 to 3 credits of the First-Year Seminar, as specified by their college First-Year Engagement Plan.

Other Penn State colleges and campuses may require the First-Year Seminar; colleges and campuses that do not require a First-Year Seminar provide students with a first-year engagement experience.

First-year baccalaureate students entering Penn State should consult their academic adviser for these requirements.

### Cultures Requirement

6 credits are required and may satisfy other requirements

- United States Cultures: 3 credits
- International Cultures: 3 credits

### Writing Across the Curriculum

3 credits required from the college of graduation and likely prescribed as part of major requirements.

### Total Minimum Credits

A minimum of 120 degree credits must be earned for a baccalaureate degree. The requirements for some programs may exceed 120 credits. Students should consult with their college or department adviser for information on specific credit requirements.

### Quality of Work

Candidates must complete the degree requirements for their major and earn at least a 2.00 grade-point average for all courses completed within their degree program.

### Limitations on Source and Time for Credit Acquisition

The college dean or campus chancellor and program faculty may require up to 24 credits of course work in the major to be taken at the location or in the college or program where the degree is earned. Credit used toward degree programs may need to be earned from a particular source or within time constraints (see Senate Policy 83-80 (<https://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#83-80>)). For more information, check the Suggested Academic Plan for your intended program.

## Program Educational Objectives

Within three to five years after graduation, we anticipate graduates will:

1. Participate in and lead cross-functionally defined project teams, designing, implementing and improving processes, products and systems in the manufacturing, service or government sectors.
2. Work effectively in managerial and leadership positions, to establish and execute engineering and business strategies.

3. Work and communicate effectively with internal and external stakeholders in the global environment, while satisfying engineering, business and financial goals, and the end customers.
4. Embrace the importance of continuous learning through varied work assignments, graduate school, professional training programs and independent study, for the purpose of ongoing professional development.
5. Demonstrate proficiency in data analysis using state-of-the art tools, to assist with decision-making.

## Student Outcomes

Student outcomes describe what students are expected to know and be able to do by the time of graduation. The Industrial Engineering program is designed to enable students to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. 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. Communicate effectively with a range of audiences
4. 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. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.

## Academic Advising

The objectives of the university's academic advising program are to help advisees identify and achieve their academic goals, to promote their intellectual discovery, and to encourage students to take advantage of both in-and-out-of class educational opportunities in order that they become self-directed learners and decision makers.

Both advisers and advisees share responsibility for making the advising relationship succeed. By encouraging their advisees to become engaged in their education, to meet their educational goals, and to develop the habit of learning, advisers assume a significant educational role. The advisee's unit of enrollment will provide each advisee with a primary academic adviser, the information needed to plan the chosen program of study, and referrals to other specialized resources.

READ SENATE POLICY 32-00: ADVISING POLICY (<https://senate.psu.edu/policies-and-rules-for-undergraduate-students/32-00-advising-policy/>)

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## Suggested Academic Plan

The suggested academic plan(s) listed on this page are the plan(s) that are in effect during the 2023-24 academic year. To access previous years' suggested academic plans, please visit the archive (<https://bulletins.psu.edu/undergraduate/archive/>) to view the appropriate Undergraduate Bulletin edition (*Note: the archive only contains suggested academic plans beginning with the 2018-19 edition of the Undergraduate Bulletin*).

## Industrial Engineering, B.S. at University Park Campus

The course series listed below provides **only one** of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an **Academic Requirements** or **What If** report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

**If you are starting at a campus other than the one this plan is ending at, please refer to:** <http://advising.engr.psu.edu/degree-requirements/academic-plans-by-major.aspx>

### First Year

Fall	Credits Spring	Credits
CHEM 110 (GN) <sup>*##†</sup>	3 CHEM 111	1
ECON 102 or 104 (GS) <sup>†</sup>	3 ENGL 15, 30H, or ESL 15 (GWS) <sup>††</sup>	3
EDSGN 100 <sup>*#</sup>	3 IE 100 (or First Year Seminar) <sup>†</sup>	1
MATH 140 or 140E (GQ) <sup>*†##†</sup>	4 MATH 141 or 141E (GQ) <sup>*†##†</sup>	4
General Education Course <sup>†</sup>	3 PHYS 211 (PHYS 211L and PHYS 211R (GN)) <sup>*##†</sup>	4
	General Education Course <sup>†</sup>	3
	<b>16</b>	<b>16</b>

### Second Year

Fall	Credits Spring	Credits
EMCH 210 <sup>*</sup>	5 CAS 100A or 100B (GWS) <sup>††</sup>	3
MATH 231	2 CMPSC 200 or 201	3
MATH 250	3 MATH 220	2-3
PHYS 212 (PHYS 212L and PHYS 212R (GN)) <sup>†</sup>	4 Engineering Elective	3
General Education Course <sup>†</sup>	3 Engineering Elective	3
	Science Elective	3
	<b>17</b>	<b>17-18</b>

### Third Year

Fall	Credits Spring	Credits
IE 302 <sup>*</sup>	3 ENGL 202C (GWS) <sup>††</sup>	3
IE 305 <sup>*</sup>	3 IE 323 <sup>*</sup>	3
IE 322 <sup>*</sup>	3 IE 330 <sup>*</sup>	3

IE 327*	3 IE 405*	3
MATSE 259	3 Manufacturing Process Elective	3
General Education Course (GHW) <sup>†</sup>	1.5 General Education Course (GHW) <sup>†</sup>	1.5
<b>16.5</b>		<b>16.5</b>
<b>Fourth Year</b>		
<b>Fall</b>	<b>Credits Spring</b>	<b>Credits</b>
IE 408, 418, or 419	3 IE 453	3
IE 425	3 IE 480W (Writing Intensive) <sup>†</sup>	3
IE 460	3 IE-Technical Elective	3
IE 470	3 General Education Course <sup>†</sup>	3
IE-Technical Elective	3 General Education Course <sup>†</sup>	3
<b>15</b>		<b>15</b>

**Total Credits 129-130**

\* Course requires a grade of C or better for the major

‡ Course requires a grade of C or better for General Education

# Course is an Entrance to Major requirement

† Course satisfies General Education and degree requirement

**University Requirements and General Education Notes:**

US and IL are abbreviations used to designate courses that satisfy Cultural Diversity Requirements (United States and International Cultures).

W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

General Education includes Foundations (GWS and GQ), Knowledge Domains (GHW, GN, GA, GH, GS) and Integrative Studies (Inter-domain) requirements. N or Q (Honors) is the suffix at the end of a course number used to help identify an Inter-domain course, but the inter-domain attribute is used to fill audit requirements. Foundations courses (GWS and GQ) require a grade of 'C' or better.

All incoming Schreyer Honors College first-year students at University Park will take ENGL 137H/CAS 137H in the fall semester and ENGL 138T/CAS 138T in the spring semester. These courses carry the GWS designation and satisfy a portion of that General Education requirement. If the student's program prescribes GWS these courses will replace both ENGL 15/ENGL 30H and CAS 100A/CAS 100B/CAS 100C. Each course is 3 credits.

**College Notes:**

- **Engineering Elective Notes:** Select from department list: <http://www.ime.psu.edu/students/undergraduate/electives.aspx>
- **Health and Physical Activity Elective:** Students who complete the ROTC Program may substitute 3 ROTC credits for the GHW requirement.
- **Manufacturing Processing Course:** Select from department list. <http://www.ime.psu.edu/students/undergraduate/electives.aspx>
- **Science Elective:** Select from department list. <http://www.ime.psu.edu/students/undergraduate/electives.aspx>
- **Technical Elective:** Select from department list. <http://www.ime.psu.edu/students/undergraduate/electives.aspx>

## Career Paths

An undergraduate degree in industrial engineering from Penn State is beneficial in a number of sectors, from finance and banking to manufacturing and material handling to ergonomics and workplace safety to a wide variety of industries within the service world (including theme parks, call centers, hospitals, etc.). Industrial engineers also have an attractive background to a number of graduate degrees that would compliment their skills including engineering design, operations research, mechanical engineering, supply chain management, business management, and more.

## Careers

- **Human Factors/Ergonomics:** Business intelligence team leader, cognitive engineer, ergonomics assessment specialist, ergonomics expert, design engineer, systems engineer, usability expert, user experience engineer.
- **Manufacturing:** Manufacturing operations manager, production engineer, process control analyst, quality engineering manager, lean Six Sigma manager, product design/specification specialist, cost analysis manager, supply chain manager.
- **Operations Research:** Operations research engineer, applied research manager, performance engineer, process improvement engineer, global business intelligence and analytics director, operations engineer, statistician.
- **Production, Supply Chain, and Service:** Enterprise Engineering Analytics manager, global statistics manager, quality assurance director, strategic sourcing manager, operations engineer, new product engineer, process engineer, e-commerce manager, material scientists, service business development manager, Six Sigma analyst.

MORE INFORMATION ABOUT POTENTIAL CAREER OPTIONS FOR GRADUATES OF THE INDUSTRIAL ENGINEERING PROGRAM (<https://career.engr.psu.edu>)

## Opportunities for Graduate Studies

Opportunities for students with an undergraduate degree in industrial engineering are vast. The following disciplines would highly value an education in industrial engineering in graduate studies: engineering science and mechanics, business management, supply chain management, mechanical engineering, statistics, computer systems, engineering design, operations research, systems engineering, engineering management, economics and more.

MORE INFORMATION ABOUT OPPORTUNITIES FOR GRADUATE STUDIES (<https://www.ime.psu.edu/students/graduate/>)

## Professional Resources

- Institute of Industrial and Systems Engineers (<https://www.iise.org/Home/>)
- Institute for Operations Research and the Management Sciences (<https://www.informs.org>)
- Human Factors and Ergonomics Society (<https://www.hfes.org>)
- Society of Manufacturing Engineers (SME) (<https://www.sme.org>)

## Accreditation

The Bachelor of Science in Industrial Engineering at University Park is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org>, under the General Criteria and the Industrial Engineering Program Criteria.

## Professional Licensure/Certification

Many U.S. states and territories require professional licensure/certification to be employed. If you plan to pursue employment in a licensed profession after completing this program, please visit the Professional Licensure/Certification Disclosures by State (<https://www.psu.edu/state-licensure-disclosures/>) interactive map.

## Contact

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