

INDUSTRIAL ENGINEERING, BS

for the degree of Bachelor of Science in Industrial Engineering

Industrial engineering is a discipline that encompasses the analysis, development, improvement, implementation, and evaluation of integrated systems and their components, including materials, information, energy, people, money, time, equipment, and associated processes. Industrial engineering draws upon a variety of disciplines, from mathematics to psychology, from communications to computer science, and from production management to process control. Industrial engineers design efficient, productive systems in a wide range of business, industrial, and governmental settings.

The technical portion of the Industrial Engineering curriculum is designed as a sequence of increasingly specialized experiences. The entering student's first year is spent mastering the basics of science: math, chemistry, and physics. Second-year students begin to take fundamental engineering courses such as statics, dynamics, statistics, and strength of materials. Third-year students take a core of industrial engineering courses and begin their chosen area of specialization in one of five tracks, including: Operations Research; Quality Engineering; Supply Chain, Manufacturing, and Logistics; Economics and Finance; and Industrial Engineering Fundamentals. The Track Option website (<https://ise.illinois.edu/undergraduate/industrial-engineering-degree/industrial-engineering-track-options/>) contains a full list of courses for each track option. During their senior year, students broaden and deepen their knowledge with additional technical elective courses. Engineering design, communication, teamwork, and laboratory experiences are integrated throughout all four years of the curriculum.

Track Options:

- Economics and Finance
- Human Factors/Ergonomics
- Industrial Engineering Fundamentals
- Operations Research
- Quality Engineering
- Supply Chain, Manufacturing, and Logistics

The capstone experience for Industrial Engineering undergraduates is the Senior Project Course. Students work collaboratively with industry and a team of faculty members on a real-world problem during their final semester. Students participate in the practice of engineering through the capstone senior design course in which they work in teams to solve problems submitted by industry partnering companies, and present their solutions in reports and presentations supported by complete economic analyses.

Current Program Educational Objectives

for the degree of Bachelor of Science in Industrial Engineering

Graduation Requirements

Minimum hours required for graduation: 128 hours.

Minimum Overall GPA: 2.0

Minimum Technical GPA (<https://go.grainger.illinois.edu/TechnicalGPA/>): 2.0

University Requirements

Minimum of 40 hours of upper-division coursework, generally at the 300- or 400-level. These hours can be drawn from all elements of the degree.

Students should consult their academic advisor for additional guidance in fulfilling this requirement.

The university and residency requirements can be found in the Student Code (<https://studentcode.illinois.edu/article3/part8/3-801/>) (§ 3-801) and in the Academic Catalog (<http://catalog.illinois.edu/general-information/degree-general-education-requirements/>).

General Education Requirements

Follows the campus General Education (Gen Ed) requirements (<https://courses.illinois.edu/gened/DEFAULT/DEFAULT/>). Some Gen Ed requirements may be met by courses required and/or electives in the program.

| Code | Title | Hours |
|------|--|-------|
| | Composition I | 4-6 |
| | Advanced Composition | 3 |
| | Fulfilled by SE 494 | |
| | Humanities & the Arts (6 hours) | 6 |
| | Natural Sciences & Technology (6 hours) | 6 |
| | fulfilled by CHEM 102, PHYS 211, PHYS 212 | |
| | Social & Behavioral Sciences (6 hours) | 6 |
| | fulfilled by ECON 102 or ECON 103 and any other course approved as Social & Behavioral Sciences | |
| | Cultural Studies: Non-Western Cultures (1 course) | 3 |
| | Cultural Studies: US Minority Cultures (1 course) | 3 |
| | Cultural Studies: Western/Comparative Cultures (1 course) | 3 |
| | Quantitative Reasoning (2 courses, at least one course must be Quantitative Reasoning I) | 6-10 |
| | fulfilled by MATH 220 or MATH 221; and MATH 231, MATH 241, MATH 285, PHYS 211, PHYS 212; and CS 101 or CS 124 | |
| | Language Requirement (Completion of the third semester or equivalent of a language other than English is required) | 0-15 |

Major Requirements

Orientation and Professional Development

| Code | Title | Hours |
|--------------------|---|----------|
| ENG 100 | Grainger Engineering Orientation Seminar (External transfer students take ENG 300.) | 1 |
| SE 100 | Introduction to ISE | 1 |
| SE 290 | ISE Undergraduate Seminar | 0 |
| Total Hours | | 2 |

Introductory Economics Elective

| Code | Title | Hours |
|-------------------------|--|----------|
| ECON 102 or ECON 103 | Microeconomic Principles Macroecomic Principles | 3 |
| Total Hours | | 3 |

Foundational Mathematics and Science

| Code | Title | Hours |
|--------------------|--|-----------|
| CHEM 102 | General Chemistry I | 3 |
| CHEM 103 | General Chemistry Lab I | 1 |
| MATH 221 | Calculus I (MATH 220 may be substituted. MATH 220 is appropriate for students with no background in calculus. 4 of 5 credit hours count towards degree.) | 4 |
| MATH 231 | Calculus II | 3 |
| MATH 241 | Calculus III | 4 |
| MATH 257 | Linear Algebra with Computational Applications | 3 |
| MATH 285 | Intro Differential Equations | 3 |
| PHYS 211 | University Physics: Mechanics | 4 |
| PHYS 212 | University Physics: Elec & Mag | 4 |
| PHYS 213 | Univ Physics: Thermal Physics | 2 |
| Total Hours | | 31 |

Industrial Engineering Technical Core

| Code | Title | Hours |
|--------------------|--|-----------|
| CS 101 | Intro Computing: Engrg & Sci (CS 124 may be substituted.) | 3 |
| ECE 110 | Introduction to Electronics | 3 |
| IE 300 | Analysis of Data | 3 |
| IE 310 | Deterministic Models in Optimization | 3 |
| IE 360 | Facilities Planning and Design | 3 |
| IE 361 | Production Planning & Control | 3 |
| IE 370 | Stochastic Processes and Applications | 3 |
| IE 371 | Simulation Modeling with Applications for Industrial Engineering | 3 |
| IE 400 | Design & Anlys of Experiments | 3 |
| ME 330 | Engineering Materials | 4 |
| SE 101 | Engineering Graphics & Design | 3 |
| SE 261 | Business Side of Engineering | 2 |
| SE 494 | Senior Engineering Project I | 3 |
| SE 495 | Senior Engineering Project II | 2 |
| TAM 211 | Statics | 3 |
| TAM 212 | Introductory Dynamics | 3 |
| TAM 251 | Introductory Solid Mechanics | 3 |
| Total Hours | | 50 |

Track Option Electives

| Code | Title | Hours |
|---|-------|-----------|
| Track options include courses selected from departmentally approved lists. Courses on these elective lists may only be used to fulfill one curricular requirement. | | 12 |

Computational Methods in IE

Track Core requirement - complete 2 courses:

| | | |
|--------|---------------------|---|
| CS 173 | Discrete Structures | 3 |
| CS 225 | Data Structures | 4 |

Track Electives - select remaining courses from this list:

All 200-, 300-, and 400-level CS courses excluding CS 210, CS 211, CS 397, CS 398, and CS seminar and senior project courses.

| | | |
|--------|-----------------|--------|
| SE 400 | Engineering Law | 3 or 4 |
|--------|-----------------|--------|

Economics and Finance (E&F)

Track Core - complete 2 courses from this list:

| | | |
|---------|--------------------------|---|
| ACE 427 | Commodity Price Analysis | 3 |
| IE 420 | Financial Engineering | 3 |
| SE 450 | Decision Analysis I | 3 |

Track Electives - select remaining courses from this list of courses. Of these courses, only 1 selected may be at the 100 or 200 level:

| | | |
|----------|----------------------------------|--------|
| ACE 410 | Energy Economics and Policy | 3 |
| ACE 427 | Commodity Price Analysis | 3 |
| ACE 428 | Commodity Futures and Options | 3 |
| ACCY 200 | Fundamentals of Accounting | 3 |
| ECON 302 | Inter Microeconomic Theory | 3 |
| ECON 303 | Inter Macroeconomic Theory | 3 |
| ECON 420 | International Economics | 2 to 4 |
| ECON 471 | Intro to Applied Econometrics | 2 to 4 |
| FIN 221 | Corporate Finance | 3 |
| FIN 300 | Financial Markets | 3 |
| FIN 411 | Investment & Portfolio Mngt | 3 |
| FIN 412 | Options and Futures Markets | 3 |
| FIN 415 | Fixed Income Portfolios | 3 |
| FIN 461 | Banking and Financial Regulation | 3 |
| SE 400 | Engineering Law | 3 or 4 |

Human Factors

Track Core - complete the following course:

| | | |
|--------|---------------|---|
| IE 340 | Human Factors | 4 |
|--------|---------------|---|

Track Electives - complete at least 3 of the following courses:

Physical Ergonomics Focus

| | | |
|------------|---|--------|
| BIOE 461 | Cellular Biomechanics | 4 |
| or TAM 461 | Cellular Biomechanics | |
| ETMA 421 | Industrial and Agricultural Safety-Injury Prevention | 3 |
| ETMA 422 | Industrial and Agricultural Occupational Illness Prevention | 3 |
| ETMA 425 | Managing Industrial and Agricultural Safety Risks | 3 |
| HK 353 | Biomechanics of Human Movement | 3 |
| HK 466 | Measure & Eval in Kinesiology | 3 or 4 |
| ME 481 | Whole-Body Musculoskel Biomech | 3 or 4 |
| ME 482 | Musculoskel Tissue Mechanics | 3 or 4 |

Cognitive Ergonomics Focus

| | | |
|--------|--|--------|
| SE 400 | Engineering Law | 3 or 4 |
| SE 450 | Decision Analysis I | 3 or 4 |
| IE 445 | Human Performance and Cognition in Context | 3 or 4 |

Organizational Ergonomics Focus

| | | |
|----------|---|--------|
| ANTH 411 | Research Methods in Socio-Cultural Anthropology | 3 or 4 |
| BADM 310 | Mgmt and Organizational Beh | 3 |
| BADM 312 | Designing and Managing Orgs | 3 |
| BADM 357 | Digital Making Seminar | 3 |
| HK 403 | Technology, Health, and Aging | 3 or 4 |
| PSYC 245 | Industrial Org Psych | 3 |

Optional Health Focus

Industrial Engineering Fundamentals (IEF)

Track Core - complete the following 4 courses:

| | | |
|--------|-------------------------------|--------|
| IE 330 | Industrial Quality Control | 3 |
| IE 411 | Optimization of Large Systems | 3 |
| IE 412 | OR Models for Mfg Systems | 3 |
| IE 340 | Human Factors | 4 |
| SE 400 | Engineering Law | 3 or 4 |

Operations Research (OR)

Track Core - complete the following 2 courses:

| | | |
|--------|--|---|
| IE 410 | Advanced Topics in Stochastic Processes & Applications | 3 |
| IE 411 | Optimization of Large Systems | 3 |

Track Electives - complete 2 courses from this list:

| | | |
|-------------------|-------------------------------|--------|
| ECE 490 | Introduction to Optimization | 3 |
| IE 420 | Financial Engineering | 3 |
| MATH 444 | Elementary Real Analysis | 3-4 |
| or MATH 447 | Real Variables | |
| MATH 484 | Nonlinear Programming | 3 or 4 |
| SE 400 | Engineering Law | 3 or 4 |
| SE 411 | Reliability Engineering | 3 |
| STAT 410 | Statistics and Probability II | 3 |
| or MATH 464 | Statistics and Probability II | |
| STAT 420/ASRM 450 | Methods of Applied Statistics | 3 |
| STAT 424 | Design of Experiments | 3 |
| STAT 425 | Statistical Modeling I | 3 |

Quality Engineering (QE)

Track Core - complete the following course:

| | | |
|--------|----------------------------|---|
| IE 330 | Industrial Quality Control | 3 |
|--------|----------------------------|---|

Track Core Elective - complete at least 1 of the following courses:

| | | |
|--------|-------------------------|--------|
| IE 431 | Design for Six Sigma | 3 |
| SE 400 | Engineering Law | 3 or 4 |
| SE 411 | Reliability Engineering | 3 |

Track Elective- complete remaining courses from this list:

| | | |
|-------------------|-------------------------------|---|
| STAT 410/MATH 464 | Statistics and Probability II | 3 |
| STAT 420/ASRM 450 | Methods of Applied Statistics | 3 |
| STAT 424 | Design of Experiments | 3 |
| STAT 426 | Statistical Modeling II | 3 |

Supply Chain, Manufacturing and Logistics (SC&L)

Track Core - complete the following course:

| | | |
|--------|---------------------------|---|
| IE 412 | OR Models for Mfg Systems | 3 |
|--------|---------------------------|---|

Track Electives - complete 3 of the following courses:

| | | |
|---------|------------------------------|---|
| ECE 470 | Introduction to Robotics | 4 |
| IE 330 | Industrial Quality Control | 3 |
| ME 270 | Design for Manufacturability | 3 |

| | | |
|--------|------------------------------|--------|
| ME 451 | Computer-Aided Mfg Systems | 3 |
| ME 452 | Num Control of Mfg Processes | 3 |
| SE 400 | Engineering Law | 3 or 4 |

Technical Electives

Code **Title** **Hours**

Courses on these elective lists may only be used to fulfill one curricular requirement.

Computer science elective selected from the departmentally approved list of Computer Science Electives below: **3**

| | | |
|--------|---------------------|---|
| CS 225 | Data Structures | 4 |
| CS 357 | Numerical Methods I | 3 |
| CS 411 | Database Systems | 3 |
| CS 450 | Numerical Analysis | 3 |
| IE 405 | Computing for ISE | 3 |

IE technical electives selected from the departmentally approved list of IE Technical Electives below: **3**

| | | |
|--------|--|---|
| IE 330 | Industrial Quality Control | 3 |
| IE 340 | Human Factors | 4 |
| IE 411 | Optimization of Large Systems | 3 |
| IE 412 | OR Models for Mfg Systems | 3 |
| IE 420 | Financial Engineering | 3 |
| IE 431 | Design for Six Sigma | 3 |
| IE 445 | Human Performance and Cognition in Context | 3 |
| SE 310 | Design of Structures and Mechanisms | 3 |
| SE 320 | Control Systems | 4 |
| SE 424 | State Space Design for Control | 3 |

Free Electives

Code **Title** **Hours**

Additional course work, subject to the Grainger College of Engineering restrictions to Free Electives, so that there are at least 128 credit hours earned toward the degree. (<https://go.grainger.illinois.edu/FreeElectives/>)

Total Hours of Curriculum to Graduate **128**

for the degree of Bachelor of Science in Industrial Engineering

Sample Sequence

This sample sequence is intended to be used only as a guide for degree completion. All students should work individually with their academic advisors to decide the actual course selection and sequence that works best for them based on their academic preparation and goals. Enrichment programming such as study abroad, minors, internships, and so on may impact the structure of this four-year plan. Course availability is not guaranteed during the semester indicated in the sample sequence. The curriculum sequence can also be viewed via dynamic and static curricular maps (<https://grainger.illinois.edu/academics/undergraduate/majors-and-minors/industrial-engineering-map/>), which include prerequisite sequencing.

Students must fulfill their Language Other Than English requirement by successfully completing a third level of a language other than English.

See the corresponding section on the Degree and General Education Requirements (<http://catalog.illinois.edu/general-information/degree-general-education-requirements/>). One of the SBS courses must be an introductory economics course (ECON 102 or ECON 103). SE 494 and SE 495 will satisfy a core course requirement and the Campus General Education Advanced Composition requirement.

Free Electives: Additional course work, subject to the Grainger College of Engineering restrictions to Free Electives (<https://go.grainger.illinois.edu/FreeElectives/>), so that there are at least 128 credit hours earned toward the degree.

First Semester

| Requirements | Hours |
|---|-----------|
| SE 100 - Introduction to ISE | 1 |
| MATH 221 - Calculus I (MATH 220 may be substituted) | 4 |
| CHEM 102 - General Chemistry I | 3 |
| CHEM 103 - General Chemistry Lab I | 1 |
| ENG 100 - Grainger Engineering Orientation Seminar | 1 |
| Composition I or SE 101 | 4 |
| Semester Hours | 14 |

Second Semester

| Requirements | Hours |
|---|-----------|
| CS 101 - Intro Computing: Engrg & Sci (CS 124 may be substituted) | 3 |
| MATH 231 - Calculus II | 3 |
| PHYS 211 - University Physics: Mechanics | 4 |
| ECE 110 - Introduction to Electronics | 3 |
| SE 101 - Engineering Graphics & Design (or Composition I) | 3 |
| Semester Hours | 16 |

First Semester

| Requirements | Hours |
|--|-----------|
| SE 261 - Business Side of Engineering | 2 |
| MATH 241 - Calculus III | 4 |
| PHYS 212 - University Physics: Elec & Mag | 4 |
| TAM 211 - Statics | 3 |
| ECON 102 - Microeconomic Principles or ECON 103 - Macroeconomic Principles | 3 |
| Semester Hours | 16 |

Second Semester

| Requirements | Hours |
|--|-------|
| IE 300 - Analysis of Data | 3 |
| MATH 285 - Intro Differential Equations | 3 |
| PHYS 213 - Univ Physics: Thermal Physics | 2 |
| TAM 212 - Introductory Dynamics | 3 |

| | |
|---|-----------|
| TAM 251 - Introductory Solid Mechanics | 3 |
| SE 290 - ISE Undergraduate Seminar | 0 |
| General Education course (Choose a Humanities or Social/ Behavioral Science course with Cultural Studies designation) | 3 |
| Semester Hours | 17 |

First Semester

| Requirements | Hours |
|---|-----------|
| IE 310 - Deterministic Models in Optimization | 3 |
| MATH 257 - Linear Algebra with Computational Applications | 3 |
| IE 360 - Facilities Planning and Design | 3 |
| ME 330 - Engineering Materials | 4 |
| General Education course (Choose a Humanities or Social/ Behavioral Science course with Cultural Studies designation) | 3 |
| Semester Hours | 16 |

Second Semester

| Requirements | Hours |
|--|-----------|
| IE 361 - Production Planning & Control | 3 |
| IE 370 - Stochastic Processes and Applications | 3 |
| Track Option course | 3 |
| Track Option course | 3 |
| IE Technical Elective course | 3 |
| Semester Hours | 15 |

First Semester

| Requirements | Hours |
|---|-----------|
| IE 400 - Design & Anlys of Experiments | 3 |
| Track Option course | 3 |
| SE 494 & SE 495 or Language Other Than English (3rd level) | 5 |
| Computer Science Elective course | 3 |
| General Education course (Choose a Humanities or Social/ Behavioral Science course with Cultural Studies designation) | 3 |
| Semester Hours | 17 |

Second Semester

| Requirements | Hours |
|---|-------|
| IE 371 - Simulation Modeling with Applications for Industrial Engineering | 3 |
| Language Other Than English (3rd level) or SE 494 & SE 495 | 4 |

| | |
|-----------------------|-----------|
| Track Option course | 3 |
| Free Elective course | 4 |
| Free Elective course | 3 |
| Semester Hours | 17 |

Total Hours: 128

for the degree of Bachelor of Science in Industrial Engineering

Student learning outcomes are based on learning outcomes in line with the ABET accreditation process.

Industrial Engineering graduates will have:

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

for the degree of Bachelor of Science in Industrial Engineering

Industrial & Enterprise Systems Website (<https://ise.illinois.edu/directory/faculty.html>)

Industrial & Enterprise Systems Faculty

The Grainger College of Engineering Admissions (<https://grainger.illinois.edu/>)

The Grainger College of Engineering