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 Technical GPA (https://go.grainger.illinois.edu/TechnicalGPA/): 2.0
TGPA is required for required Engineering and Technical Elective courses, as well as MATH 257. See Technical GPA to clarify requirements.

Minimum Overall GPA: 2.0
Minimum hours required for graduation: 128 hours
General education: Students must complete the Campus General Education (https://courses.illinois.edu/gened/DEFAULT/DEFAULT/) requirements including the campus general education language requirement. 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.

Orientation and Professional Development

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<th>Code</th>
<th>Title</th>
<th>Hours</th>
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<tr>
<td>ENG 100</td>
<td>Grainger Engineering Orientation Seminar (External transfer students take ENG 300.)</td>
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<tr>
<td>SE 100</td>
<td>Introduction to ISE</td>
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<tr>
<td>SE 290</td>
<td>ISE Undergraduate Seminar</td>
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Total Hours: 2

Foundational Mathematics and Science

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<tr>
<td>CHEM 102</td>
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<tr>
<td>CHEM 103</td>
<td>General Chemistry Lab I</td>
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<tr>
<td>MATH 221</td>
<td>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.)</td>
<td>4</td>
</tr>
<tr>
<td>MATH 231</td>
<td>Calculus II</td>
<td>3</td>
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<tr>
<td>MATH 241</td>
<td>Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>MATH 257</td>
<td>Linear Algebra with Computational Applications</td>
<td>3</td>
</tr>
<tr>
<td>MATH 285</td>
<td>Intro Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 211</td>
<td>University Physics: Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 212</td>
<td>University Physics: Elec &amp; Mag</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 213</td>
<td>Univ Physics: Thermal Physics</td>
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Total Hours: 31

Industrial Engineering Technical Core

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<th>Code</th>
<th>Title</th>
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<tr>
<td>CS 101</td>
<td>Intro Computing: Engrg &amp; Sci (CS 124 may be substituted.)</td>
<td>3</td>
</tr>
<tr>
<td>ECE 110</td>
<td>Introduction to Electronics</td>
<td>3</td>
</tr>
<tr>
<td>IE 300</td>
<td>Analysis of Data</td>
<td>3</td>
</tr>
<tr>
<td>IE 310</td>
<td>Deterministic Models in Optimization</td>
<td>3</td>
</tr>
<tr>
<td>IE 360</td>
<td>Facilities Planning and Design</td>
<td>3</td>
</tr>
<tr>
<td>IE 361</td>
<td>Production Planning &amp; Control</td>
<td>3</td>
</tr>
<tr>
<td>IE 370</td>
<td>Stochastic Processes and Applications</td>
<td>3</td>
</tr>
<tr>
<td>IE 371</td>
<td>Simulation Modeling with Applications for Industrial Engineering</td>
<td>3</td>
</tr>
<tr>
<td>IE 400</td>
<td>Design &amp; Anlys of Experiments</td>
<td>3</td>
</tr>
<tr>
<td>ME 330</td>
<td>Engineering Materials</td>
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Information listed in this catalog is current as of 06/2024
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<th>Code</th>
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<th>Hours</th>
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<tr>
<td>SE 101</td>
<td>Engineering Graphics &amp; Design</td>
<td>3</td>
</tr>
<tr>
<td>SE 261</td>
<td>Business Side of Engineering</td>
<td>2</td>
</tr>
<tr>
<td>SE 494</td>
<td>Senior Engineering Project I</td>
<td>3</td>
</tr>
<tr>
<td>SE 495</td>
<td>Senior Engineering Project II</td>
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</tr>
<tr>
<td>TAM 211</td>
<td>Statics</td>
<td>3</td>
</tr>
<tr>
<td>TAM 212</td>
<td>Introductory Dynamics</td>
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</tr>
<tr>
<td>TAM 251</td>
<td>Introductory Solid Mechanics</td>
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**Total Hours**: 50

### Track Option Electives

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
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<tbody>
<tr>
<td></td>
<td>Track options include courses selected from departmentally approved lists. Courses on these elective lists may only be used to fulfill one curricular requirement.</td>
<td></td>
</tr>
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</table>

#### 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.

#### Economics and Finance (E&F)

- **Track Core - complete 2 courses from this list:**
  - ACE 427 Commodity Price Analysis 3
  - IE 420 Financial Engineering 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 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

#### 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

- **Cognitive Ergonomics Focus**
  - 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

- **ARCH 423**
  - BADM 310 Mgmt and Organizational Beh 3
  - BADM 312 Designing and Managing Orgs 3
  - BADM 357 Digital Making Seminar 3

- **PSYC 245**
  - Industrial Org Psych 3

- **Optional Health Focus**
  - CHLH 470 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

- **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 or MATH 447 Real Variables 3-4
  - MATH 484 Nonlinear Programming 3 or 4
  - SE 411 Reliability Engineering 3
  - STAT 410 or MATH 464 Statistics and Probability II 3
  - 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 411 Reliability Engineering 3

- **Track Elective - complete remaining courses from this list:**

*Information listed in this catalog is current as of 06/2024*
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

Supplemental 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

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

Code Title Hours
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

Code Title Hours
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 Curriculm 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 Year

First Semester Hours Second Semester Hours
SE 100 14 16

Second Year

Second Semester

SE 261 1 IE 300 3
MATH 241 4 MATH 285 3
PHYS 212 4 PHYS 213 2
TAM 211 3 TAM 212 3
ECON 102 or ECON 103 (Counts as General Education course) 3 TAM 251 3
SE 290 0
General Education course (choose a Humanities or Social/Behavioral Science course with Cultural Studies designation) 3

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<td>ME 330</td>
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<th>Second Semester</th>
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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 Major 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