Industrial Engineering, B.S.E.

The Department of Industrial and Systems Engineering offers a host of options for each engineering student. From the undergraduate engineering degree, a dual Undergraduate to Graduate (U2G) degree, elective focus areas, and extracurricular activities, there are many options available to explore and develop professional skills. The industrial and systems engineering (ISE) undergraduate program emphasizes a broad education in engineering fundamentals and the opportunity for in-depth learning in an elective focus area.

Educational Objectives

The following educational objectives of the program are defined in conjunction with the accreditation process.

- Within a few years of graduation, industrial engineering graduates will:
  - continue learning,
  - lead and inspire others, and
  - engage in the community and society.

Elective Focus Areas and Specialized Opportunities

As part of the mission to help students be engineers and something more, the Department of Industrial and Systems Engineering offers elective focus area options so that students can pursue specialized interests, such as big data analytics, design and manufacturing, computer and information systems, entrepreneurship, human factors, and management in order to complement their undergraduate degree in industrial engineering.

Student Organizations

Student organizations can have an enormous impact on an undergraduate student's career. The College of Engineering is home to a number of student organizations and clubs. Popular organizations for industrial and systems engineering students include the Institute for Industrial and Systems Engineers and the Human Factors and Ergonomics Society.

Undergraduate Resources

A plethora of resources are available to students to pursue research, access professional services available in the college and across the University, and participate in or view sports and arts events on campus and around town.

Scholarships

A variety of scholarships and funding opportunities are available to industrial and systems engineering students.

Accreditation

The undergraduate program in industrial engineering is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET).

Elective Focus Areas

The industrial engineering program offers a variety of elective focus area (EFA) options, including big data analytics, computer and information systems, design and manufacturing, entrepreneurship, human factors and ergonomics, management, wind energy, and an option to tailor an EFA to an individual student's interests. For more detailed information about elective focus areas, see the Bachelor of Science in Engineering in the Catalog.

Students must select elective focus area courses specific to the Department of Industrial and Systems Engineering.

Requirements

The Bachelor of Science in Engineering requires a minimum of 128 s.h. Students must have a g.p.a. of at least 2.00 on all college work used to satisfy degree requirements as well as on all work undertaken at the University of Iowa.

The major in industrial engineering requires a strong foundation of courses in engineering science, mathematics, design, manufacturing, social science, and humanities. Advanced work includes specialty courses in human factors and ergonomics, management, information systems, manufacturing, quality control, and operations research. Design is an integral part of the undergraduate program; all students complete a comprehensive design experience.

All engineering students complete the B.S.E. core requirements, which include RHET:1030 Rhetoric, ENGR:1100 Introduction to Engineering Problem Solving, ENGR:1300 Introduction to Engineering Computing, and courses in chemistry, engineering mathematics and fundamentals, and physics.

They also complete the curriculum designed for their major program, which covers four major stems: mathematics and basic sciences, engineering topics, an elective focus area, and the general education component. For information about the curriculum, see the Bachelor of Science in Engineering in the Catalog.

Big Data Analytics

Big data analytics is the process of examining big data in an effort to uncover hidden patterns, unknown correlations, and other useful information. Ninety-five percent of the data in the world today has been created in the last two years alone. This data comes from everywhere: sensors used to gather climate information, posts to social media sites, digital pictures and videos, purchase transaction records, and cell phone GPS signals to name a few.

Computer and Information Systems

Industrial engineers have a natural role to play in this field by using quantitative system analysis, manufacturing system knowledge, and human factors skills to help design and refine computer systems that are becoming ever more complex. The field offers substantial opportunities for technical skill development, travel, and interaction with a diverse range of professionals.
Design and Manufacturing
Many graduates find careers in manufacturing industries that include the use of computer-aided design and manufacturing, virtual and physical prototyping, 3-D design, design and simulation of manufacturing processes, and manufacturing systems. They find employment in diverse industries, including the supplier manufacturing industry (e.g., John Deere, Caterpillar, Rockwell Collins, Raytheon, Boeing), health care (e.g., Johnson & Johnson, Zimmer), and software and in the information industry (e.g., Pro/Engineer, Catia, SolidWorks, AutoCAD).

Entrepreneurship
Engineering students explore venture capital, marketability of products, and technology transfer. They gain exposure to understanding sound business practice, acquire team-building skills in both small and large companies, understand the entrepreneurial approach to acquiring and managing resources, learn how to create a business plan, and obtain valuable contacts and networking opportunities with businesses and industries.

Human Factors and Ergonomics
The human factors and ergonomics EFA represents an increasingly important engineering specialty. The dramatic increase in netcentric computer technology makes system performance increasingly dependent on the match between system characteristics and human capabilities. Graduates find employment in diverse industries that include health care (e.g., GE, Medtronics, Guidant), original equipment manufacturer (OEM) and supplier manufacturing industry (e.g., Rockwell Collins, Boeing, Deere, Caterpillar), computer systems (e.g., Microsoft, Intel, IBM), the government (e.g., NHTSA, NTSB, NASA, the Department of Defense), and consulting (e.g., Accenture, Battelle). Human factors considers cognitive characteristics, and ergonomics considers physical characteristics. The EFA provides advanced education in psychology, systems, statistics, and biomechanics.

Management
Industrial engineers are often assigned managerial tasks, project management, and financial assessments as they relate to project budgets, cost calculations, and optimization criteria. The EFA prepares students for a career in business management.

Wind Energy
Wind energy has become a major source of clean energy. Wind generation is expected to grow in the decades to come to and create new jobs. Professionals with diverse backgrounds and knowledge of wind energy fundamentals are needed to fill these careers.

Tailored
Students work with their advisor to tailor a program that is specific to their individual needs.

Combined Programs
B.S.E./M.S.
The College of Engineering offers a combined Bachelor of Science in Engineering/Master of Science program for industrial engineering undergraduate students who intend to earn a M.S. in industrial engineering.

Undergraduate students at the University of Iowa who have completed more than 80 s.h. and have a g.p.a. higher than 3.25 may apply for admission to the Undergrad to Grad (U2G) program designed to accelerate the attainment of an M.S. in industrial engineering degree. Students typically complete their M.S. degree within one year of their B.S.E. degree.

Students meet with their academic advisor, complete a plan, and submit an application for the M.S. program of study to the Graduate College. Graduate Record Examination (GRE) General Test scores are not required for University of Iowa students. Students continue to follow the industrial and systems engineering curriculum as planned with their advisor.

Students may take up to 15 s.h. of graduate coursework and count 12 s.h. toward both degrees, attend the program’s graduate seminar, and optionally work with a faculty member on a master’s thesis project while they are still undergraduates.

Interested students should consult the Department of Industrial and Systems Engineering.

Academic Plans
Sample Plan of Study
Sample plans represent one way to complete a program of study. Actual course selection and sequence will vary and should be discussed with an academic advisor. For additional sample plans, see MyUI.

Industrial Engineering, B.S.E.

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
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<tr>
<td><strong>First Year</strong></td>
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<tr>
<td><strong>Fall</strong></td>
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<tr>
<td>MATH:1550</td>
<td>Engineering Mathematics I: Single</td>
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<td>Variable Calculus</td>
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<td>ENGR:1100</td>
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<td>Solving</td>
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<td>CHEM:1110</td>
<td>Principles of Chemistry I</td>
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<td>RHET:1030</td>
<td>Rhetoric</td>
<td>4</td>
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<td>ENGR:1000</td>
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<td><strong>Spring</strong></td>
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<td>MATH:1560</td>
<td>Engineering Mathematics II: Multivariable</td>
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<td>ENGR:1300</td>
<td>Introduction to Engineering Computing</td>
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<td>PHYS:1611</td>
<td>Introductory Physics I</td>
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<td>MATH:2550</td>
<td>Engineering Mathematics III: Matrix</td>
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<td>Algebra</td>
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<td>GE:</td>
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<td><strong>Total Hours</strong></td>
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Second Year

Any Semester

Students must choose an Elective Focus Area (EFA). More information can be found on the Industrial and Systems Engineering website.
## Fall
- **MATH:2560** Engineering Mathematics IV: Differential Equations 3
- **PHYS:1612** Introductory Physics II 4
- **ENGR:2110** Engineering Fundamentals I: Statics 2
- **ENGR:2120** Engineering Fundamentals II: Electrical Circuits 3
- **ENGR:2130** Engineering Fundamentals III: Thermodynamics 3
- **PSY:1001** Elementary Psychology 3
- **ISE:2000** Industrial Engineering Sophomore Seminar 0

### Hours
18

## Spring
- **ISE:2500** Engineering Economy 3
- **STAT:2020** Probability and Statistics for the Engineering and Physical Sciences 3
- **ENGR:2720** Materials Science 3
- **ISE:3500** Information Systems Design 3
- **Elective Focus Area: #1** 3

### Hours
15

## Third Year
### Fall
- **ISE:3610** Stochastic Modeling 3
- **ENGR:2760** Design for Manufacturing 3
- **ISE:3400** Human Factors 3
- **ISE:3700** Operations Research 3
- **GE: Approved Course Subjects** 3

### Hours
15

### Spring
- **ISE:3300** Manufacturing Systems 3
- **ISE:3450** Ergonomics 3
- **ISE:3660** Data Analytics with R 3
- **ISE:3750** Digital Systems Simulation 3
- **Elective Focus Area: #2** 3
- **GE: Approved Course Subjects** 3
- **ISE:3000** Professional Seminar: Industrial Engineering 0

### Hours
18

## Fourth Year
### Fall
- **ISE:3350** Process Engineering 4
- **ISE:3600** Quality Control 3
- **Elective Focus Area: #3** 3
- **Elective Focus Area: #4** 3
- **GE: Approved Course Subjects** 3

### Hours
16

### Spring
- **ISE:4600** Industrial Engineering Design Project 4
- **Systems Elective** 3
- **Math/Science Elective Focus Area #5** 3
- **Elective Focus Area: #6** 3
- **Elective Focus Area: #7** 3
- **ISE:3000** Professional Seminar: Industrial Engineering 0

### Hours
16

### Total Hours
130

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### Degree Application
- apply on MyUI before deadline (typically in February for spring, September for fall)

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<tr>
<td>4</td>
<td>16</td>
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<tr>
<td></td>
<td>130</td>
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</tbody>
</table>

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### Notes
- **a** Enrollment in math courses requires completion of a placement exam.
- **b** Typically this course is offered in fall semesters only. Check MyUI for course availability since offerings are subject to change.
- **c** Enrollment in chemistry courses requires completion of a placement exam.
- **d** Typically this course is offered in fall and spring semesters. Check MyUI for course availability since offerings are subject to change.
- **e** Courses with prerequisites; students should complete a prerequisite waiver form.
- **f** Typically this course is offered in fall, spring, and summer semesters. Check MyUI for course availability since offerings are subject to change.
- **g** Typically this course is offered in spring semesters only. Check MyUI for course availability since offerings are subject to change.
- **h** A full list of approved course subjects can be found on the College of Engineering General Education Component website.
- **i** Systems Elective can include ISE:3149, ISE:4172, ISE:4175, ISE:4550, ISE:4900 or ENGR:2730. Alternatively, students can take a 5000 or above level Industrial Engineering course (3 sh), with the permission of the instructor, to fulfill this Systems Elective requirement.
- **j** At least 3 s.h. of courses must be mathematics or basic sciences courses (as defined by ABET) in a different area or at a more advanced level than those required in the regular curriculum.
- **k** Please see Academic Calendar, Office of the Registrar website for current degree application deadlines. Students should apply for a degree for the session in which all requirements will be met. For any questions on appropriate timing, contact your academic advisor. For more information visit [http://commencement.uiowa.edu/](http://commencement.uiowa.edu/)

### Career Advancement

Industrial and systems engineers have many opportunities for employment and service in industrial, government, research, and public service organizations. Employment opportunities are among the most varied in the engineering field. Industrial and systems engineers hold positions as advisers to management or may participate directly in management decisions. Representative job titles include industrial engineer, manufacturing engineer, systems analyst, quality specialist, operations research analyst, internal consultant, human factors specialist, supervisor, and manager. Industrial and systems engineers are employed by manufacturing and energy firms, wind turbine manufacturers, government agencies, and service organizations such as airlines, banks, hospitals, health care groups, and consulting companies.

People are often surprised to learn the impact and breadth of the industrial engineering profession, which is one of the three largest areas of engineering employment, according to the Bureau of Labor Statistics. Yet, less than five percent of all engineers are trained specifically for this specialty, according to the American Society of Engineering Educators. It is one of the more gender diverse engineering degrees: 31.3 percent of industrial engineering degrees are awarded to women, compared to 21.7 percent of all engineering degrees.

Engineering Career Services offers individual advising and class presentations on résumé and cover letter preparation, job and internship search strategies, interviewing skills, and job offer evaluation and negotiation. In addition to equipping students with the tools they need to navigate their internship, co-op, or full-time job search, Engineering Career Services...
also develops and promotes experiential education and professional opportunities for students in the College of Engineering. Professional staff coordinate the college's co-op and internship program, engage in employer outreach, and provide opportunities for students to network with employers in meaningful ways, including an engineering career fair each semester and other programming related to career development.