INDUSTRIAL ENGINEERING

Administered by the Department of Industrial and Manufacturing Systems Engineering

The undergraduate curriculum in Industrial Engineering leads to the degree Bachelor of Science.

The Industrial Engineering Program is accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org (https://www.abet.org/), under the commission’s General Criteria and Program Criteria for Industrial and Similarly Named Engineering Programs.*

Program Educational Objectives

The Industrial Engineering (IE) Program educates its future graduates to accomplish its program educational objectives (PEO’s) in their early careers.

Specifically, the IE Program prepares its majors so that, within a few years after graduation, graduates’ attainments are:

1. Industrial engineering solutions that are effectively created and communicated and consider relevant stakeholders and ramifications.
2. Team goal accomplishment through productive and inclusive interactions and leadership.
3. New capabilities, skills, and knowledge that advance professional practice and enable career advancement.

Student Learning Outcomes

The IE Program currently has the following student outcomes describing what IE majors are expected to know and be able to do by the time of graduation.

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.

The Industrial Engineering undergraduate curriculum provides students with fundamental knowledge in mathematics and science, engineering science, social science, and humanities as well as professional industrial engineering course work. In particular, the curriculum includes design, analysis, operation and improvement of integrated systems that produce or supply products or services in an effective, efficient, sustainable and socially responsible manner. Management electives provide students with an opportunity to become familiar with modern business practices that they will encounter in their career. A senior capstone design course provides students with an opportunity to solve open-ended industrial problems with an industrial partner. The cooperative education program provides students with real world experience in the profession and a good perspective on career choices. Students are encouraged to participate in international experiences through exchange programs and industrial internships.

Qualified juniors and seniors interested in graduate studies may apply to the Graduate College to concurrently pursue both B.S. and M.S. or M.Eng. degrees in Industrial Engineering, or B.S. and M.B.A. degrees. For further information please refer to Concurrent Undergraduate and Graduate Programs tab.

Curriculum in Industrial Engineering

Administered by the Department of Industrial and Manufacturing Systems Engineering.

Leading to the degree Bachelor of Science.

Total credits required: 122 cr.
See also Basic Program and Special Programs. Grades of C or better are required for any transfer credit course that is applied to the degree program but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA. Note: Department does not allow Pass/Not Pass credits to be used to meet graduation requirements.

International Perspectives: 3 cr. ¹
U.S. Cultures and Communities (formerly U.S. Diversity): 3 cr. ¹
Communication Proficiency/Library requirements:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL 1500</td>
<td>Critical Thinking and Communication (Must have a C or better in this course)</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 2500</td>
<td>Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)</td>
<td>3</td>
</tr>
<tr>
<td>LIB 1600</td>
<td>Introduction to College Level Research</td>
<td>1</td>
</tr>
</tbody>
</table>
### Remaining Communication courses: 9 cr.
- **ENGL 2500**  Written, Oral, Visual, and Electronic Composition  
  (Must have a C or Better in this course)  
  3 credits
- **SPCM 2120**  Fundamentals of Public Speaking  
  3 credits
- **ENGL 3140**  Technical Communication  
  3 credits

**Total Credits: 9**

### Social Sciences and Humanities Electives: 12 cr.  
Six of twelve credits must be from 2000-level or above courses. Six credits must be sequential or related courses.

### Basic Program: 24 cr.  
A minimum GPA of 2.00 required for this set of courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

- **CHEM 1670**  General Chemistry for Engineering Students  
  4 credits
- **ENGL 1500**  Critical Thinking and Communication (Must have a C or better in this course)  
  3 credits
- **ENGR 1010**  Engineering Orientation  
  3 credits
- **LIB 1600**  Introduction to College Level Research  
  1 credit
- **MATH 1650**  Calculus I  
  4 credits
- **MATH 1660**  Calculus II  
  4 credits
- **PHYS 2310**  Introduction to Classical Physics I  
  4 credits
- **PHYS 2310L**  Introduction to Classical Physics I Laboratory  
  1 credit

**Total Credits: 24**

### Math and Physical Science: 17 cr.
- **MATH 2650**  Calculus III  
  4 credits
- **MATH 2670**  Elementary Differential Equations and Laplace Transforms  
  4 credits
- **STAT 2310**  Probability and Statistical Inference for Engineers  
  4 credits
- **PHYS 2320**  Introduction to Classical Physics II  
  4 credits
- **PHYS 2320L**  Introduction to Classical Physics II Laboratory  
  1 credit

**Total Credits: 17**

### Industrial Engineering Core: 34 cr.
A minimum GPA of 2.00 required for this set of courses (please note that transfer course grades will not be calculated into the Core GPA):

- **IE 2220**  Design & Analysis Methods for System Improvements  
  3 credits
- **IE 2480**  Engineering System Design, Manufacturing Processes and Specifications  
  3 credits
- **IE 2710**  Applied Ergonomics and Work Design  
  3 credits
- **IE 3050**  Engineering Economic Analysis  
  3 credits
- **IE 3120**  Optimization  
  3 credits
- **IE 3410**  Production Systems  
  3 credits
- **IE 3480**  Solidification Processes  
  3 credits
- **IE 3610**  Statistical Quality Assurance  
  3 credits
- **IE 4130**  Stochastic Modeling, Analysis and Simulation  
  4 credits
- **IE 4410**  Industrial Engineering Design  
  3 credits
- **IE 4480**  Manufacturing Systems Engineering  
  3 credits

**Total Credits: 34**

### Other Remaining Courses: 26 cr.  
- **MATE 2730**  Principles of Materials Science and Engineering  
  3 credits
- **EE 4420**  Introduction to Circuits and Instruments  
  2 credits
- **CE 2740**  Engineering Statics  
  3 credits
- **ME 2310**  Engineering Thermodynamics I  
  3 credits
- **Focus Electives**  6 credits
- **Management Electives**  3 credits
- **Engineering Topic Electives**  6 credits

**Total Credits: 26**

### Seminar/Co-op/Internships:
- **IE 1010**  Industrial Engineering Profession  
  arr  
  †

Optional co-op/internship courses  
† Arranged with instructor.

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also allowed by the department to meet other course requirements within the degree program.
2. U.S. cultures and communities (formerly U.S. diversity) and international perspectives courses may not be taken Pass/Not Pass.

3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

See also the following grid showing course template by semester:

### 4-Year Plan of Study for Industrial Engineering

**Industrial Engineering, B.S.**

**First Year**

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring Elective</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>IE 1480</td>
<td>3</td>
<td>SSH Elective</td>
<td>3</td>
</tr>
<tr>
<td>IE 3050</td>
<td>3</td>
<td>MATH 1660</td>
<td>4</td>
</tr>
<tr>
<td>MATH 1650</td>
<td>4</td>
<td>ENGL 1500</td>
<td>3</td>
</tr>
</tbody>
</table>
Second Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 2650</td>
<td>Mathematics</td>
<td>4</td>
</tr>
<tr>
<td>IE 2480</td>
<td>Industrial Engineering</td>
<td>4</td>
</tr>
<tr>
<td>MATE 2730</td>
<td>MATE 2730</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 2320</td>
<td>PHYS 2320</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 2320L</td>
<td>PHYS 2320L</td>
<td>1</td>
</tr>
<tr>
<td>ENGL 2500</td>
<td>English</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits: 14

Third Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>IE 3050</td>
<td>Industrial Engineering</td>
<td>3</td>
</tr>
<tr>
<td>IE 3410</td>
<td>Industrial Engineering</td>
<td>3</td>
</tr>
<tr>
<td>IE 3120</td>
<td>Industrial Engineering</td>
<td>3</td>
</tr>
<tr>
<td>SPCM 2120</td>
<td>SPCM 2120</td>
<td>3</td>
</tr>
<tr>
<td>CE 2740</td>
<td>Chemical Engineering</td>
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</tr>
</tbody>
</table>

Total Credits: 18

Fourth Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus Elective</td>
<td>Focus Elective</td>
<td>3</td>
</tr>
<tr>
<td>SSH Elective</td>
<td>SSH Elective</td>
<td>3</td>
</tr>
<tr>
<td>IE 4130</td>
<td>Industrial Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 3140</td>
<td>English</td>
<td>3</td>
</tr>
<tr>
<td>ME 2310</td>
<td>Mechanical Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits: 16

Engineering Sales Minor

The Engineering Sales Minor is multidisciplinary and open to undergraduates in the College of Engineering. The minor requires 15 credits, including at least 6 credits in courses numbered 3000 or above taken at Iowa State University. The minor must include at least 9 credits that are not used to meet any other department, college, or university requirement.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>IE 4500</td>
<td>Technical Sales for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>IE 4300</td>
<td>Entrepreneurial Product Engineering</td>
<td>3</td>
</tr>
<tr>
<td>MKT 3400</td>
<td>Principles of Marketing</td>
<td>3</td>
</tr>
<tr>
<td>MKT 4500</td>
<td>Advanced Professional Selling</td>
<td>3</td>
</tr>
</tbody>
</table>

And one of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
</table>

Concurrent B.S./Master’s Industrial Engineering Degree

If you are considering going to graduate school, the concurrent B.S. IE/master’s program (either M.S. or M.Eng.) in industrial engineering is an excellent opportunity to obtain both degrees within 5 years. Up to 6 credits of graduate course work can be used to satisfy your program requirements for both degrees. After completing the B.S. program, you will be a full-time graduate student for the remainder of the master’s program.

Program Policies

1. Up to two semesters of concurrent enrollment are allowed.
2. Students can enroll in up to nine credits of coursework at the 5000-level in Industrial Engineering for both the B.S. and M.S./M.Eng. degrees. Six credits will be shared with your undergraduate degree. The remaining three credits will be applied to your M.S. or M.Eng. degree.
3. Students must take at least three credits of 5000-level courses each semester during concurrent enrollment and will be paying graduate tuition and fees.
4. Students participating in the concurrent program must adhere to the requirements for the graduate degree program in which they are enrolled.

Admission Requirements

Students must have a record of high academic achievement and should have a GPA of at least 3.40 on a 4.00 scale. Students must be within 30 credits of completing the requirements for the B.S. degree before applying to the concurrent program. Prospective students must speak with their undergraduate advisor prior to applying.

Concurrent B.S. in Industrial Engineering and MBA in the College of Business

Accelerate Your Career with an MBA

Today’s successful engineers often need strong business management skills to complement their degree in engineering. These skills are especially important for engineers who are interested in working for technical companies, launching their own business ventures, or pursuing nontraditional jobs such as consulting. The MBA provides an opportunity for competitive advantage for advancement into management positions.
The Colleges of Business and Engineering offer an integrated, concurrent program leading to Bachelor of Science and Master of Business Administration degrees.

The best part is that this program reduces by one year the normal time for completing both degrees separately.

The program is designed to be completed in a minimum of five academic years or ten semesters.

The actual time for completion may be longer depending upon semester course loads, internships, and course sequencing. Careful planning with an academic advisor is essential throughout the program. This program is slightly accelerated through the first six semesters to complete the general education requirements. The remaining four semesters integrate the B.S. in IE requirements and the MBA courses. Twelve credits will be shared in common and will fulfill the requirements for both the B.S. in IE and the MBA.

Summer study is possible, although students are strongly encouraged to complete at least two internships or co-ops in engineering and business for practical experience during their academic program.

Preparation for the B.S. IE/MBA

Students interested in pursuing the MBA need to demonstrate exemplary academic performance throughout their undergraduate program. Mastery of communications, economic theory, global and diversity perspectives, statistical data analysis, and the core professional curriculum is of particular importance.

The Selection Process

The program is demanding, and admission is selective. Students are expected to exhibit superior intellectual ability, strong leadership attributes, and must be highly motivated and career focused. Although not absolute minimums, admitted students typically will have earned a cumulative GPA of 3.00 or above and have scored 600 or higher on the Graduate Management Admissions Test (GMAT). All application materials, however, are taken into account collectively in the applicant review and student selection process.

GRADUATE STUDY

The department offers programs for the degrees Master of Engineering (M.Eng.), Master of Science (M.S.), and Doctor of Philosophy (Ph.D.) with a major in industrial engineering. A minor is available to graduate students having a major in another department. The M.Eng. degree consists of coursework designed to improve professional expertise in industrial engineering. The M.S. and Ph.D. degrees are designed to improve the student's capability to conduct research as well as advancing their professional expertise. In conjunction with the Department of Mechanical Engineering, the department offers a certificate in advanced manufacturing.

The prerequisite to major graduate work is the completion of a curriculum similar to that required of undergraduate students in engineering at this institution. Because of the diversity of industrial engineering topics, it is possible for a student to qualify for graduate study even though undergraduate or prior graduate training has been in a discipline other than engineering, e.g., mathematics or physics. However, completion of a math sequence of calculus through differential equations is expected.

The graduate program offers advanced study in advanced manufacturing, ergonomics/human factors, operations research/analytics, systems engineering and engineering management.

Well-qualified juniors and seniors in industrial engineering who are interested in graduate study may apply for concurrent enrollment to simultaneously pursue both the industrial engineering bachelor's degree and an M.Eng. or M.S. degree. Another attractive concurrent degree option is the industrial engineering bachelor's degree concurrent with a Master of Business Administration degree from the business college. For additional information about graduate degree programs, admission criteria, and procedures refer to https://www.imse.iastate.edu/graduate-program/.