Industrial Engineering, MS

Research and Study

The MS in industrial engineering program supports two major paths: one focusing on courses and one on research and a thesis. The first path is intended primarily for students who wish to advance their technical knowledge and move toward a career in industry. The second path also is a good choice for students interested in industry, but it is targeted more toward developing independent research skills and writing, and it also can support future graduate work.

Both paths expect some diversity of technical skills in three major areas which include systems, human factors, and analytics. The systems area emphasizes the design, construction, and analysis of complex systems with interdependent parts that include people and machines. The human factors area emphasizes the interaction of people with systems, and includes the study and analysis of people's cognitive and physical limitations. The analytics area emphasizes the application of mathematical formulas, including statistical approaches, as well as algorithmic and computational approaches to deriving knowledge from data. Each area is supported by several faculty members and many faculty members support multiple areas; see Facilities in the Department of Industrial and Systems Engineering section of the catalog to learn more about each research lab and its activities.

Learning Outcomes

Without Thesis

Students will:

- demonstrate a broad knowledge of the field of industrial and systems engineering and deep knowledge in their specific area of study;
- identify and analyze problems of value to industry and society;
- apply contemporary methodologies for solving problems valued by industry and society;
- demonstrate project and team management skills and initiative; and
- demonstrate ethical and professional behavior.

With Thesis

Students will:

- demonstrate a broad knowledge of the field of industrial and systems engineering and deep knowledge in their specific area of study;
- identify and analyze problems of value to industry and society;
- transform knowledge into applications valued by industry and society;
- demonstrate collaborative and communication skills;
- demonstrate project and team management skills; and
- demonstrate ethical and professional behavior.

Requirements

The Master of Science program in industrial engineering requires a minimum of 30 s.h. of graduate credit. Students must maintain a cumulative grade-point average higher than 3.25 to earn the degree.

In addition, students must enroll in ENGR:7270 Engineering Ethics, typically in the first or second semester of enrollment. ISE:5000 Graduate Seminar: Industrial Engineering must be taken in the first two consecutive semesters of enrollment, and one semester (fall or spring) in subsequent academic years. More information about graduate seminar requirements can be found in the Graduate Student Handbook on the Department of Industrial and Systems Engineering Graduate Program website. Credit in ISE:5000 and ENGR:7270 may not be applied toward the 30 s.h. of required coursework.

Breadth Requirement

All students must successfully complete at least one approved graduate-level course in each of three focus areas—analytics, human factors, and systems. Those with a relevant academic background in these areas may be excused from this requirement by the director of graduate studies.

For more detailed information about program requirements and focus area courses, see the Graduate Student Handbook on the Department of Industrial and Systems Engineering website.

Analytics

<table>
<thead>
<tr>
<th>Course #</th>
<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>ISE:3610</td>
<td>Stochastic Modeling</td>
<td>3</td>
</tr>
<tr>
<td>ISE:3660</td>
<td>Data Analytics with R</td>
<td>3</td>
</tr>
<tr>
<td>ISE:3700</td>
<td>Operations Research</td>
<td>3</td>
</tr>
<tr>
<td>ISE:4172</td>
<td>Big Data Analytics</td>
<td>3</td>
</tr>
<tr>
<td>ISE:5730</td>
<td>Digital Industry</td>
<td>3</td>
</tr>
<tr>
<td>ISE:5740</td>
<td>Design and Analysis of Computer Experiments</td>
<td>3</td>
</tr>
<tr>
<td>ISE:6300</td>
<td>Innovation Science and Studies</td>
<td>3</td>
</tr>
<tr>
<td>ISE:6380</td>
<td>Deep Learning</td>
<td>3</td>
</tr>
<tr>
<td>ISE:6650</td>
<td>Human Analytics and Behavioral Operations</td>
<td>3</td>
</tr>
<tr>
<td>ISE:6760</td>
<td>Pattern Recognition for Financial Data</td>
<td>3</td>
</tr>
<tr>
<td>ISE:6780</td>
<td>Financial Engineering and Optimization</td>
<td>3</td>
</tr>
<tr>
<td>ISE:6790</td>
<td>Advanced Data Analytics and Informatics</td>
<td>3</td>
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</tbody>
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Human Factors

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<tr>
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<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>ISE:3400</td>
<td>Human Factors</td>
<td>3</td>
</tr>
<tr>
<td>ISE:3450</td>
<td>Ergonomics</td>
<td>3</td>
</tr>
<tr>
<td>ISE:4175</td>
<td>Safety Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ISE:5420</td>
<td>Automated Vehicle Systems</td>
<td>3</td>
</tr>
<tr>
<td>ISE:5460</td>
<td>User Experience Design</td>
<td>3</td>
</tr>
<tr>
<td>ISE:6211</td>
<td>Human Factors in Healthcare Systems</td>
<td>3</td>
</tr>
</tbody>
</table>
must submit the Final Examination: Advanced Degree form, the graduate-level course requirement. In addition, students to enroll in research. Students pursuing the thesis option are permitted including the 9 s.h. breadth requirement, and up to 9 s.h. of thesis option consists of a minimum of 21 s.h. of coursework, and up to 9 s.h. in the thesis course may count toward their thesis to the Graduate Thesis. chair, who may authorize a change of status petition from the committee forwards approved requests to the department ready to serve as a student’s research advisor. The request is this request at the invitation of a faculty member who is status through the department. Typically, students make Nonthesis students may petition for entry into the MS thesis Master of Science with Thesis. Up to 9 s.h. in the thesis course may count toward their thesis to the Graduate College. The Design of Virtual the Design of Virtual Environments. The Design of Virtual Environments. One of these: ISE:6480 Unmanned Aircraft Systems 3

**Systems**

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<thead>
<tr>
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<th>Title</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>ISE:3300</td>
<td>Manufacturing Systems</td>
<td>3</td>
</tr>
<tr>
<td>ISE:3350</td>
<td>Process Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ISE:3500</td>
<td>Information Systems Design</td>
<td>3</td>
</tr>
<tr>
<td>ISE:3600</td>
<td>Quality Control</td>
<td>3</td>
</tr>
<tr>
<td>ISE:3750</td>
<td>Digital Systems Simulation</td>
<td>3</td>
</tr>
<tr>
<td>ISE:4620</td>
<td>Design of Experiments for Quality Improvement</td>
<td>3</td>
</tr>
<tr>
<td>ISE:4900</td>
<td>Introduction to Six Sigma</td>
<td>3</td>
</tr>
<tr>
<td>ISE:5310</td>
<td>Advanced Computational Design and Manufacturing</td>
<td>3</td>
</tr>
<tr>
<td>ISE:5520</td>
<td>Renewable Energy</td>
<td>3</td>
</tr>
<tr>
<td>ISE:5620</td>
<td>Design of Experiments</td>
<td>3</td>
</tr>
<tr>
<td>ISE:5650</td>
<td>Mechatronics Engineering for Device Design</td>
<td>3</td>
</tr>
<tr>
<td>ISE:6350</td>
<td>Computational Intelligence</td>
<td>3</td>
</tr>
<tr>
<td>ISE:6810</td>
<td>Advanced Topics on Additive Manufacturing</td>
<td>3</td>
</tr>
</tbody>
</table>

**Master of Science Degree Without Thesis**

The MS in industrial engineering without thesis requires at least 21 s.h. in Department of Industrial and Systems Engineering courses (prefix ISE), including the 9 s.h. breadth requirement and at least 12 s.h. of graduate-level courses at the 5000 level or above. Courses offered by other College of Engineering departments or courses from other colleges may be selected with the consent of the academic advisor to fulfill some or all of the remaining 9 s.h.

**Master of Science with Thesis**

Nonthesis students may petition for entry into the MS thesis program or the PhD program by requesting a change of status through the department. Typically, students make this request at the invitation of a faculty member who is ready to serve as a student’s research advisor. The request is then reviewed by the Graduate Admissions Committee. The committee forwards approved requests to the department chair, who may authorize a change of status petition from the department to the Graduate College.

Students are encouraged to write their thesis as a publishable journal article and submit the article for publication. The thesis option consists of a minimum of 21 s.h. of coursework, including the 9 s.h. breadth requirement, and up to 9 s.h. of research. Students pursuing the thesis option are permitted to enroll in ISE:5999 Research: Industrial Engineering MS Thesis. Up to 9 s.h. in the thesis course may count toward the graduate-level course requirement. In addition, students must submit the Final Examination: Advanced Degree form, complete a Report of Thesis Approval, and submit a copy of their thesis to the Graduate College by following the published guidelines and deadlines.

**Admission**

Applicants must meet the admission requirements of the Graduate College; for detailed information about Graduate College policies, see the Manual of Rules and Regulations on the Graduate College website.

Admission to the graduate program is competitive and based on an applicant’s previous coursework, research, and industrial experience. The general admission standards are intended to maintain the quality of the graduate program and to ensure sufficient preparation required for timely degree completion. Specific admission standards may be waived by the Graduate Admissions Committee when other evidence of competence is compelling. These standards are minimum standards, and meeting these standards does not ensure admission to the program; admitted students typically exceed these standards.

Applicants are expected to have a minimum cumulative grade-point average of 3.00 on a 4.00 scale, and have earned a BSE in industrial engineering degree or in a related science or engineering discipline. Applicants are not required to submit the results of their Graduate Record Examination (GRE) General Test.

International applicants whose first language is not English are required to submit the results of their Test of English as a Foreign Language (TOEFL), International English Language Testing System (IELTS), or Duolingo English Test (DET). Applicants who have completed a post-secondary degree at an English-speaking institution may request a waiver of this requirement. A minimum TOEFL score of 100, a minimum IELTS score of 7, or a minimum DET score of 105 is required for admission.

Applicants must arrange to have three letters of recommendation sent to the department online through the University of Iowa Office of Admissions website. The letters should be completed by persons who are well acquainted with the applicant and the ability of the applicant to undertake graduate work in industrial or systems engineering.

While the department considers applications at any time, first consideration is given to students who have their application materials, including their application, transcripts, English language test scores (DET, IELTS, or TOEFL), and the required letters of recommendation, submitted by the admission priority deadline as found on the Iowa Graduate Admissions website. The director of graduate admissions is responsible for overseeing the graduate recruiting activities and the admissions procedures in the department. The director serves as the point of initial contact between prospective graduate students and the department, and maintains a record of each qualified applicant in the departmental office. The director, in consultation with the Graduate Admissions Committee and the department chair, screens applicants and ultimately determines which applicants are extended offers of admission.

**Applicants with Degrees Not in Industrial or Systems Engineering**

The department encourages students with degrees in other scientific disciplines, such as computer science, mathematics,
Degree Program Selection

Unless otherwise specified, graduate students in the Department of Industrial and Systems Engineering are enrolled in the MS nonthesis program. If a student and faculty member have jointly agreed a student may pursue the MS with thesis option, the student may be admitted into the thesis track.

Financial Support

Many graduate students who are actively engaged in research receive financial support through a combination of research and teaching assistantships and fellowships. Decisions about research assistantships are made by the individual faculty members and the department. Support is available on a semester or academic year basis. Stipends are approximately $25,000 (half-time or 20 hours per week) for an academic year of graduate study. Other levels of support are possible. If an award is made, nonresident students usually qualify for tuition at the resident rate, at approximately $10,000 per academic year. Normally stipends are not immediately awarded to international applicants, but after admission and enrollment, an application can be made. Preference for graduate student support is given to PhD students.

Students should direct questions about the availability of financial support to faculty members in their primary area of study. Awards and reappointments are highly competitive and are based upon a student's academic record, prior performance, the ability to serve, and an assessment of the student's potential contribution to the research and teaching goals of the program.

For more information about departmental scholarships and funding opportunities, see Graduate Scholarships on the Department of Industrial and Systems Engineering website.

Career Advancement

Industrial and systems engineers have many opportunities for employment and service in industrial, government, research, and public service organizations such as airlines, banks, hospitals, health care groups, and consulting companies. Employment opportunities are among the most varied in the engineering field. Industrial and systems engineers hold positions as advisors 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.

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, MS

Course Title Hours
Academic Career
Any Semester
30 s.h. must be graduate level coursework; graduate transfer credits allowed upon approval. More information is included in the General Catalog and on department website.

Graduate College program GPA of at least 3.25 is required.

First Year
Fall
ENGR:7270 Engineering Ethics 1 1
ISE:5000 Graduate Seminar: Industrial Engineering 1 1
Analytics focus area course 1, 2 3
Human factors focus area course 1, 2 3
Elective course 1, 2 3
Elective course 1, 2 3

Spring
ISE:5000 Graduate Seminar: Industrial Engineering 1 1
Systems focus area course 1, 2 3
Elective course 1, 2 3
Elective course 1, 2 3

Second Year
Fall
ISE:5000 Graduate Seminar: Industrial Engineering 1 1
Elective course 1, 2 3
Elective course 1, 2 3

Total Hours 34

a Must include at least 12 s.h. of graduate-level courses at the 5000 level or above. All students must also select one graduate-level ISE course from each of three focus areas: analytics, human factors, and systems.

b Students must complete specific requirements in the University of Iowa Graduate College after program admission. Refer to the Graduate College website and the Manual of Rules and Regulations for more information.

c Graduate College program GPA is comprised of all courses taken, with the exception of courses transferred.

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For more information about departmental scholarships and funding opportunities, see Graduate Scholarships on the Department of Industrial and Systems Engineering website.
d Students must enroll in ENGR:7270, typically in the first or second semester of enrollment; does not count towards total semester hours for the degree.

e ISE:5000 must be taken in the first two consecutive semesters of enrollment, and one semester (fall or spring) in subsequent academic years; does not count towards total semester hours for the degree.

f See the General Catalog for list of approved courses.

g Work with faculty advisor to determine appropriate graduate elective coursework and sequence.