Industrial Engineering, M.S.

Research and Study

The M.S. 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 formula, 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.

Requirements

The Master of Science program in industrial engineering requires a minimum of 30 s.h. of graduate credit. Students must maintain a cumulative g.p.a. higher than 3.25 to earn the degree. Students must enroll in ENGR:7270 Engineering Ethics once and in ISE:5000 Graduate Seminar: Industrial Engineering every semester. Credit in these two courses does not count toward the 30 s.h. required to meet major requirements.

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 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>Code</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>
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<tr>
<td>ISE:4172</td>
<td>Big Data Analytics</td>
<td>3</td>
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<tr>
<td>ISE:6300</td>
<td>Innovation Science and Studies</td>
<td>3</td>
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<tr>
<td>ISE:6380</td>
<td>Deep Learning</td>
<td>3</td>
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<tr>
<td>ISE:6760</td>
<td>Pattern Recognition for Financial Data</td>
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<tr>
<td>ISE:6780</td>
<td>Financial Engineering and Optimization</td>
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Human Factors

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<td>ISE:3400</td>
<td>Human Factors</td>
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<tr>
<td>ISE:3450</td>
<td>Ergonomics</td>
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<tr>
<td>ISE:4175</td>
<td>Safety Engineering</td>
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<td>ISE:5420</td>
<td>Automated Vehicle Systems</td>
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<tr>
<td>ISE:6211</td>
<td>Human Factors in Healthcare Systems</td>
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<tr>
<td>ISE:6220</td>
<td>Cognitive Engineering</td>
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<tr>
<td>ISE:6410</td>
<td>Research Methods in Human Factors Engineering</td>
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<tr>
<td>ISE:6420</td>
<td>Human/Computer Interaction</td>
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<tr>
<td>ISE:6460</td>
<td>The Design of Virtual Environments</td>
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</tr>
<tr>
<td>ISE:6480</td>
<td>Unmanned Aircraft Systems</td>
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Systems

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<td>ISE:3300</td>
<td>Manufacturing Systems</td>
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<td>ISE:3350</td>
<td>Process Engineering</td>
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<td>ISE:3500</td>
<td>Information Systems Design</td>
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<tr>
<td>ISE:3600</td>
<td>Quality Control</td>
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<tr>
<td>ISE:3750</td>
<td>Digital Systems Simulation</td>
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<tr>
<td>ISE:4620</td>
<td>Design of Experiments for Quality Improvement</td>
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<tr>
<td>ISE:4900</td>
<td>Introduction to Six Sigma</td>
<td>3</td>
</tr>
<tr>
<td>ISE:5620</td>
<td>Design of Experiments</td>
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</tr>
<tr>
<td>ISE:5650</td>
<td>Mechatronics Engineering</td>
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</tr>
<tr>
<td>ISE:6350</td>
<td>Computational Intelligence</td>
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<tr>
<td>ISE:6810</td>
<td>Advanced Topics on Additive Manufacturing</td>
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Master of Science Degree Without Thesis

The M.S. in industrial engineering without thesis requires at least 21 s.h. in Department of Industrial and Systems Engineering courses (prefix ISE), including 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 consent of the academic advisor.

Master of Science with Thesis

Nonthesis students may petition for entry into the M.S. thesis program or the Ph.D. 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 and up to 9 s.h. of research. Students pursuing the thesis option are permitted to enroll in ISE:5999 Research: Industrial Engineering M.S. 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 g.p.a. of 3.00 on a 4.00 scale, and have earned a B.S.E. in industrial engineering degree or in a related science or engineering discipline. Applicants are required to submit the results of their Graduate Record Examination (GRE) General Test. The GRE Advanced Examination in Engineering is not required for admission to the program; however, these scores should be forwarded to the department if that examination is taken. The minimum GRE General Test requirement is a combined quantitative reasoning and analytical writing score of 300. There is no specified minimum requirement for the verbal reasoning portion of the 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 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, GRE scores, TOEFL scores, and the required letters of recommendation, completed by the admission priority deadline as found on the 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 in computer science, mathematics, physics, or other engineering disciplines, to apply for admission. Some students may have already completed M.S. degrees; however, these students are expected to attain a proficiency in specified core areas of industrial and systems engineering equivalent to entering graduate students who hold a B.S.E. degree in industrial engineering. The background of each student admitted to the program with a degree other than in industrial or systems engineering is reviewed by the faculty members. These proficiencies are intended to ensure that each admitted graduate student is able to fully participate in all industrial and systems engineering discipline areas at some level, even while advanced courses in certain areas may not be immediately accessible to all graduate students. The director of graduate studies specifies in writing any remedial courses that are required of a student.

**Degree Program Selection**

Unless otherwise specified, graduate students in the Department of Industrial and Systems Engineering are enrolled in the M.S. nonthesis program. If a student and faculty member have jointly agreed a student may pursue the M.S. 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 $20,000 (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 Ph.D. students.

Students should direct questions about 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 upon 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.

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.