Industrial Engineering, M.S.

Research and Study in Industrial Engineering

Graduate study in industrial engineering is tailored individually. Programs of study for all students are based on their background and career objectives and are designed according to sound academic practice. The curriculum is highly flexible; the goal is academic excellence.

The program offers six principal academic focus areas: design and manufacturing, human factors engineering and ergonomics, engineering management, reliability and production systems, operations research and applied statistics, and information systems. Graduate students participate in research in their academic concentration areas.

Engineering Management

Current research in engineering management consists of entrepreneurship, parametric cash flow analysis, strategic management, and economic risk analysis. Engineering management studies concentrate on engineering administration, engineering economics, and information systems. This area is covered by courses in the 50 series.

Human Factors and Ergonomics

Current research in human factors and ergonomics includes investigation of the effects of visual and auditory displays on human information processing and development of computer systems that ease the challenges of controlling complex medical and robotic systems. This work examines how engineers should shape information technology to enhance productivity, safety, and customer satisfaction. Industrial engineering faculty members and students work to improve the effectiveness of robot systems for exploration of Mars and the Moon, to improve driving safety, and to design new cockpit interfaces. The department has several medical, flight, and driving simulators. It also conducts research in other facilities, including the National Advanced Driving Simulator, the most advanced simulation facility in the world.

Human factors and ergonomics studies concentrate on designing systems compatible with human capabilities and limitations. Human factors engineering integrates components from the fields of psychology, cognitive sciences, physiology, statistics, and technical sciences to address issues of human-interface design and human-systems design. Specific considerations include human cognitive abilities and limitations, visual performance, error reduction, workload assessment and mitigation, design of jobs in the industrial environment, information acquisition and processing, choice of action, operator performance measurement, and economic concerns. This area is covered by courses in the 50 series.

Information Systems

Studies in information systems concentrate on system design. Design problems involve devising information systems that meet a diverse set of requirements. Contemporary topics include network-based systems, client/server systems, internet systems, and medical informatics.

Manufacturing

Ongoing manufacturing research consists of flexible manufacturing systems, optimum control of processes, and reliability assessment. Manufacturing courses, denoted by the 30 series, delve into selecting appropriate manufacturing methods, planning processing operations, devising control strategies, and designing products and manufacturing systems. Contemporary topics include computer-aided process planning, computer-aided design, computer-controlled manufacturing, concurrent engineering, and applications of artificial intelligence in manufacturing.

Operations Research and Applied Statistics

Ongoing research in operations research and applied statistics deals with the application of optimization techniques for informed decision making in the public and private sectors. The primary focus of this work is modeling, simulating, and optimizing the design and operation of systems such as logistics, communications, health care, and manufacturing. Studies in operations research and applied statistics concentrate on mathematical programming, statistical, and computer sciences for modeling, analyzing, and optimizing systems. Various methodologies in this area include mathematical programming, heuristic optimization, statistical analysis, and digital systems simulation. This area is covered by courses in the 70 series.

Quality Control and Production Systems

Current research in quality control and production systems focuses on measures for corporate quality and reliability, computer-aided layout and scheduling,Just-in-time production, inspection, and online expert systems in process control. Studies of quality control and production systems focus on reliability engineering, quality control, and production systems. This area is covered by courses in the 60 series.

Related Certificate: Informatics

The Graduate College offers the Certificate in Informatics with a health informatics subtrack. The subtrack emphasizes the organization, management, and use of health care information; health care research, education, and practice; and information technology developments in the socioeconomic context of health care. Industrial engineering students working toward the certificate complete IE:5860 Health Informatics I and approved electives. To learn more, see the Certificate in Informatics in the Graduate College section of the Catalog.

Requirements

The Master of Science program in industrial engineering requires a minimum of 30 s.h. of graduate credit with thesis, and a minimum of 36 s.h. of graduate credit without thesis. Students who intend to pursue a Ph.D. should select the thesis option; those who hold research or teaching assistantships may be required to select the thesis option. The M.S. concentration in wind power management is open to students in either option.

All M.S. students must earn 21 s.h. in graduate-level industrial engineering courses. They earn a minimum of 9 s.h. in 5000-level industrial engineering courses and complete at least one 3000- or 5000-level course from each of three focus areas.
areas: human factors, operations research, and reliability and systems design. Thesis students who plan to pursue a Ph.D. may choose to take two 5000-level courses in each of the three focus areas in order to complete their Ph.D. breadth requirement before entering the doctoral program. Students select other courses in consultation with their advisors; choices are documented in a student’s plan of study.

Thesis students may count a maximum of 6 s.h. of research credit toward the degree and may include that credit in the required 21 s.h. of graduate-level industrial engineering courses. The thesis option does not include research credit.

All graduate students must register for IE:5000 Graduate Seminar: Industrial Engineering (1 s.h.) each semester of enrollment. They may not substitute seminar credit for regular course work or research credit.

M.S. students must maintain a g.p.a. of at least 3.00 on all graduate work at the University of Iowa and must pass a final comprehensive examination as specified by their examining committees.

Entering students must have strong verbal and written skills in English and a background in computer programming (e.g., C++, C, VB), probability, statistics, and mathematics equivalent to that required by accredited undergraduate engineering programs. Students with insufficient academic background must remedy deficiencies by taking appropriate courses beyond those normally required for the study plan.

Entering students are advised by the department chair or by a designated faculty advisor. The department chair or the graduate program coordinator assigns an advisor to students during their first regular semester in residence.

During that semester, each student and the advisor prepare a study plan, which they submit to the department chair for approval. Once the plan is approved, it is filed with a student’s record. It is a student’s responsibility to assure that the study plan is submitted to the department chair.

M.S. students must pass a final comprehensive examination, as specified by their examination committees. Examination committees consist of at least three Graduate College faculty members and must be approved by the department chair.

The comprehensive examination may consist of both oral and written parts. Its purpose is to assess the adequacy of a student’s defense of thesis and/or course preparation. The final study plan, approved by the Graduate College dean, is prerequisite to the exam. A student should consult with the advisor on the composition of the advisory/examination committee and the time and place for the exam.

It is a student’s responsibility to submit a degree application by the college’s deadline.

For more detailed information about M.S. program requirements, including a list of focus area courses, see the Industrial Engineering Graduate Handbook or link to industrial engineering graduate programs on the Department of Mechanical and Industrial Engineering website.

**M.S. Concentration in Wind Power Management**

M.S. students in industrial engineering may elect to concentrate in wind power management. They must meet all regular requirements for the M.S. in industrial engineering. In addition, thesis option students must take three courses (9 s.h.) from the list of recommended courses. Nonthesis option students must take four courses (12 s.h.) from the list of recommended courses and one course (3 s.h.) from the list of electives. Students’ course selections must be approved by their advisors.

### Wind Power Management Recommended Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>IE:3350</td>
<td>Process Engineering</td>
<td>4</td>
</tr>
<tr>
<td>IE:3600</td>
<td>Quality Control</td>
<td>3</td>
</tr>
<tr>
<td>IE:3610</td>
<td>Stochastic Modeling</td>
<td>3</td>
</tr>
<tr>
<td>IE:3700</td>
<td>Operations Research</td>
<td>3</td>
</tr>
<tr>
<td>IE:3750</td>
<td>Digital Systems Simulation</td>
<td>3</td>
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<tr>
<td>CEE:4107</td>
<td>Sustainable Systems</td>
<td>3</td>
</tr>
<tr>
<td>CEE:4317</td>
<td>Remote Sensing</td>
<td>3</td>
</tr>
<tr>
<td>CEE:6151</td>
<td>Environmental Systems Modeling</td>
<td>3</td>
</tr>
<tr>
<td>ME:5143</td>
<td>Computational Fluid and Thermal Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ME:5195</td>
<td>Contemporary Topics in Mechanical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>ME:6255</td>
<td>Multiscale Modeling</td>
<td>3</td>
</tr>
<tr>
<td>ME:7268</td>
<td>Turbulent Flows</td>
<td>3</td>
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### Wind Power Management Electives

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<thead>
<tr>
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<tbody>
<tr>
<td>IE:3760</td>
<td>Applied Linear Regression</td>
<td>3</td>
</tr>
<tr>
<td>CS:4400</td>
<td>Database Systems</td>
<td>3</td>
</tr>
<tr>
<td>EES:1290</td>
<td>Energy and the Environment</td>
<td>3</td>
</tr>
<tr>
<td>GEOG:3750</td>
<td>Environmental Quality: Science, Technology, and Policy</td>
<td>3</td>
</tr>
<tr>
<td>GEOG:4930</td>
<td>Urban Geography</td>
<td>3</td>
</tr>
<tr>
<td>MSCI:9200</td>
<td>Business Programming</td>
<td>3</td>
</tr>
<tr>
<td>OEH:5410</td>
<td>Occupational Safety</td>
<td>3</td>
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### 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 of the Graduate College.

Reference letters, student research interests, grade-point average for previous graduate study, and factors such as faculty availability are considered in admission decisions.

M.S. applicants may be admitted from an ABET-accredited baccalaureate curriculum in any engineering discipline, or in the mathematical sciences, the physical sciences, or the computer sciences with a g.p.a. of at least 3.00 and an acceptable score on the Graduate Record Examination (GRE) General Test. Applicants from institutions outside the United States must meet equivalent conditions for regular admission. Students with lesser qualifications may be considered for conditional admission.

Students from business or social science programs who have mathematical preparation similar to that of engineering students are considered for regular or conditional admission. Students on conditional status must achieve regular status within two sessions of their first registration by attaining an acceptable grade-point average and gaining regular acceptance by the industrial engineering program faculty; otherwise, they are dismissed. Admissions may be limited by available resources.
Financial Support

A number of one-quarter-time and one-half-time teaching and research assistantships are available for graduate students. Awards are based on students' academic records and assessment of their potential contribution to the research and teaching goals of the program. Advanced graduate students also may qualify for appointments as graduate teaching fellows. Contact the chair of the Department of Mechanical and Industrial Engineering for details.

Career Advancement

The engineering profession is a foundation for a variety of careers in industry, medicine, law, government, and consulting. On average, 93-98 percent of graduates are employed in their field of study or pursuing advanced education within seven months of graduation.

Engineering Professional Development (EPD) 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, including an engineering career fair each semester and other programming related to career development.

EPD also offers individual advising and class presentations on résumé and cover letter preparation, job and internship search strategies, interviewing skills, and job offer evaluation.