Ph.D. in Industrial Engineering

Degree Requirements

Ph.D. in Industrial Engineering (students entering with appropriate master's degree)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core courses</td>
<td>12</td>
</tr>
<tr>
<td>Technical electives</td>
<td>12</td>
</tr>
<tr>
<td>IE 790 Doctoral Dissertation</td>
<td>36</td>
</tr>
<tr>
<td>IE 791 Graduate Seminar</td>
<td>0</td>
</tr>
</tbody>
</table>

Total Credits 60

1. A total of 12 credits must be at the 700 level. None of the 24 credits may be at the 500 level.
2. If the 36 credits of dissertation are completed before the dissertation is finished, students must register each semester for at least 3 credits of dissertation until the dissertation is accepted.
3. Required each semester.

Ph.D. in Industrial Engineering (students entering with bachelor's degree)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course work</td>
<td>42</td>
</tr>
<tr>
<td>IE 790 Doctoral Dissertation</td>
<td>36</td>
</tr>
</tbody>
</table>

Total Credits 78

Areas of Specialization

Manufacturing Systems and Assurance Sciences

Core Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>IE 704 Sequencing and Scheduling</td>
<td>3</td>
</tr>
<tr>
<td>IE 651 Industrial Simulation</td>
<td>3</td>
</tr>
<tr>
<td>IE 706 A Queueing Approach to Performance Analysis</td>
<td>3</td>
</tr>
<tr>
<td>IE 659 Supply Chain Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

Electives

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>700 level course</td>
<td>3</td>
</tr>
<tr>
<td>Three courses from IE, ME, MnE, CS, and Math</td>
<td>9</td>
</tr>
</tbody>
</table>

Total Credits 24

1. None at the 500 level

Human Factors and Occupational Safety

Core Courses

<table>
<thead>
<tr>
<th>Course</th>
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</tr>
</thead>
<tbody>
<tr>
<td>IE 604 Advanced Engineering Statistics</td>
<td>3</td>
</tr>
<tr>
<td>IE 760 Quantitative Methods in Human Factors</td>
<td>3</td>
</tr>
<tr>
<td>IE 761 Advanced Studies in Human Factors</td>
<td>3</td>
</tr>
<tr>
<td>IE 762 Psychophysical Methods in Human Factors</td>
<td>3</td>
</tr>
</tbody>
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</tbody>
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Total Credits 24

1. None at the 500 level

Specific degree requirements and dissertation topics are approved by the department on an individual basis. Before being permitted to register for dissertation, students must complete course requirements, pass qualifying examinations, both written and oral, and demonstrate that there are facilities and a faculty member available to supervise the research.
Qualifying Examinations

All doctoral students are expected to pass both a written and oral qualifying examination. Passing the written qualifying examination is a prerequisite for the oral examination. Students are urged to take these examinations as soon as possible after being admitted into the program.

Students must take a two-part written examination within the first year following admission to the program, and pass within two years. The examination is offered every October. A student will be allowed only two attempts to pass the examination. Both parts must be taken at the same time. It consists of two sections:

- **Section I** General competence in mathematics including calculus, probability and statistics, differential equations, and linear algebra.
- **Section II** Proficiency in fundamentals of industrial engineering including: operations research (deterministic and probabilistic), quality control, reliability, engineering economy, production planning and control, and human factors.

The oral examination should be taken and passed in the semester after the written examination is passed. The dissertation committee assigns a topic for the oral examination from the student's area of specialization. The examination is offered by the dissertation committee. Thorough study and understanding of theoretical, technical and practical aspects of the assigned topic should be demonstrated in the oral examination.

Formation of a Dissertation Committee

With the approval of the graduate advisor, within two months after passing the written examination, students must form a dissertation committee. The committee should consist of at least four faculty members from the department including the student's advisor. In addition, one member of the committee must be chosen from outside the department.

Dissertation Proposal

Within three months of passing the oral examination, students must submit, for the approval of their dissertation committee, both in writing and orally, a doctoral proposal on the scope of their proposed research.

The dissertation must represent original research leading to meaningful advances in the industrial engineering profession. The work must be worthy of publication in refereed journals on industrial engineering or related fields. Doctoral students must complete the dissertation in the five years subsequent to passing their written and oral qualifying examinations.

Dissertation Defense

Each doctoral student must submit to their committee a written dissertation for their approval. After the dissertation committee approves the document, the student must successfully defend the dissertation in front of the committee and other interested faculty and students.