

# Industrial Engineering, Ph.D.

## Requirements

The Doctor of Philosophy program in industrial engineering requires a minimum of 72 s.h. of graduate credit. Students must maintain a cumulative grade-point average of at least 3.50 to earn the degree. At least 36 s.h. must be taken in Department of Industrial and Systems Engineering courses (prefix ISE), including at least 24 s.h. in graduate-level courses numbered ISE:5000 and above.

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 be applied toward the 72 s.h. of required coursework.

Students must successfully complete coursework in each of three focus areas: see "Breadth Requirement" below. The academic advisor and/or examining committee may decide a student must complete other requirements such as additional coursework or the acquisition of specific skills. The actual amount of coursework required is determined with the advice and consent of the academic advisor. Students who earned an M.S. at the University of Iowa may have satisfied this requirement.

Students are typically expected to have completed three academic years of residence at the University of Iowa, or two years if they already hold a recognized M.S. degree. For students who earned their M.S. degree at the University of Iowa, no more than 36 s.h. from the M.S. degree may be counted toward the Ph.D. degree. For students who earned their M.S. from another institution, a maximum of 30 s.h. may be transferred toward the doctoral program. The director of graduate studies reviews the transcripts of new students to determine which requirements have been met from previous coursework.

Excellence in research is the principal requirement for the degree. It is expected that the Ph.D. dissertation research project represents an original and significant contribution to the body of knowledge in the field. At least one accepted research article in a peer-reviewed journal as first author with the research advisor as a co-author, in addition to the presentation of the research in a departmental seminar, are requirements. Submission of three, first-authored papers and at least one research presentation at a national conference is typical. In addition, students must fulfill the qualifying requirement, pass the comprehensive examination, 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.

## Breadth Requirement

Students must successfully complete at least 6 s.h. in approved courses numbered 5000 or above offered by the

Department of Industrial and Systems Engineering in each of the three focus areas—analytics, human factors, and systems. Students with a relevant academic background in these areas may be excused from the breadth requirement with the approval of the director of graduate studies. Approved courses are listed below.

## Analytics

Code	Title	Hours
Two of these:		
ISE:5730	Digital Industry	3
ISE:5740	Design and Analysis of Computer Experiments	3
ISE:6300	Innovation Science and Studies	3
ISE:6380	Deep Learning	3
ISE:6650	Human Analytics and Behavioral Operations	3
ISE:6760	Pattern Recognition for Financial Data	3
ISE:6780	Financial Engineering and Optimization	3
ISE:6790	Advanced Data Analytics and Informatics	3

## Human Factors

Code	Title	Hours
Two of these:		
ISE:5420	Automated Vehicle Systems	3
ISE:5460	User Experience Design	3
ISE:6211	Human Factors in Healthcare Systems	3
ISE:6220	Cognitive Engineering	3
ISE:6410	Research Methods in Human Factors Engineering	3
ISE:6420	Human/Computer Interaction	3
ISE:6450	Human Factors in Aviation	3
ISE:6460	The Design of Virtual Environments	3
ISE:6480	Unmanned Aircraft Systems	3

## Systems

Code	Title	Hours
Two of these:		
ISE:5310	Advanced Computational Design and Manufacturing	3
ISE:5520	Renewable Energy	3
ISE:5620	Design of Experiments	3
ISE:5650	Mechatronics Engineering for Smart Device Design	3
ISE:6350	Computational Intelligence	3
ISE:6810	Advanced Topics on Additive Manufacturing	3

## Qualifying Exam

Students interested in pursuing a Ph.D. are initially admitted as M.S. nonthesis students until they have completed the qualifying examination. This is typically achieved within their first three semesters if beginning the program without an M.S. degree, or within the first two semesters if beginning

the program with an M.S. degree. Once the exam is passed, students are formally admitted to the Ph.D. program. The purpose of this qualifier is to determine a student's proficiency in research and scholarship.

## **Comprehensive Examination**

The general rules for the administration of the Ph.D. comprehensive examination are contained in the policies and procedures of the Graduate College. The tradition in the department is for the comprehensive examination to consist of a written and oral component. Students write and submit a comprehensive examination document, usually called the dissertation research proposal, to each member of the examination committee two weeks before the examination date. During the examination, students make a roughly 30-minute presentation on the content of the research proposal. Committee members may ask questions regarding the proposal before, during, or after the oral presentation. Having satisfactorily completed the comprehensive examination, students are accepted as a candidate for the Ph.D. degree.

## **Final Examination (Dissertation Defense)**

Each student must defend the completed dissertation in the final examination, which is conducted by the examining committee.

## ***En Passant* Option**

Students admitted to the Ph.D. program may elect to earn their M.S. degree through the *en passant* option, with the permission of their Ph.D. committee. This option allows students to write an English-language manuscript as the first author and submit it to a peer-reviewed research journal in lieu of writing the M.S. thesis. With this option, students, in conjunction with their academic advisor, author a paper that serves as the foundation for the Ph.D. research. The decision to select this option must be made before the qualifying examination. The committee may determine, based on the published or submitted scholarship to peer-reviewed journals, that the presentation of a separate research thesis is not necessary. In this case, up to 9 s.h. in ISE:5999 Research: Industrial Engineering M.S. Thesis may be counted towards the nonthesis option. Students choosing the *en passant* option generally receive an M.S. degree without the thesis designation.

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