INDUSTRIAL ENGINEERING, PH.D.

REQUIREMENTS

MINIMUM GRADUATE SCHOOL REQUIREMENTS

Review the Graduate School minimum academic progress and degree requirements (http://guide.wisc.edu/graduate/#policiesandrequirementstext), in addition to the program requirements listed below.

MAJOR REQUIREMENTS

MODE OF INSTRUCTION

Face to Face	Evening/ Weekend	Online	Hybrid	Accelerated
Yes	No	No	No	No

Mode of Instruction Definitions

Accelerated: Accelerated programs are offered at a fast pace that condenses the time to completion. Students typically take enough credits aimed at completing the program in a year or two.

Evening/Weekend: Courses meet on the UW–Madison campus only in evenings and/or on weekends to accommodate typical business schedules. Students have the advantages of face-to-face courses with the flexibility to keep work and other life commitments.

Face-to-Face: Courses typically meet during weekdays on the UW-Madison Campus.

Hybrid: These programs combine face-to-face and online learning formats. Contact the program for more specific information.

Online: These programs are offered 100% online. Some programs may require an on-campus orientation or residency experience, but the courses will be facilitated in an online format.

CURRICULAR REQUIREMENTS

Requirement	Detail
Minimum Credit Requirement	51 credits
Minimum Residence Credit Requirement	32 credits
Minimum Graduate Coursework Requirement	26 credits must be graduate-level coursework. Details can be found in the Graduate School's Minimum Graduate Coursework (50%) policy (https://policy.wisc.edu/library/UW-1244 (https://policy.wisc.edu/library/UW-1244/)).
Overall Graduate GPA Requirement	3.00 GPA required. This program follows the Graduate School's GPA Requirement policy (https://policy.wisc.edu/library/UW-1203 (https://policy.wisc.edu/library/UW-1203/)).
Other Grade Requirements	Grades of C and D received by a candidate in any graduate course will not be counted as credit toward the degree. These grades will be counted in the graduate GPA. See additional grade requirement for HFE Ph.D. students below.
Assessments and Examinations	Qualifying exams, preliminary exams, and a final dissertation defense are required of all students. Details may be found in the program handbook.
Language Requirements	No language requirements.
Graduate School Breadth Requirement	All doctoral students are required to complete a doctoral minor or graduate/professional certificate. The program also has additional breadth requirements. See details below.

REQUIRED COURSES

Students choose one of the following research areas (https://engineering.wisc.edu/departments/industrial-systems-engineering/research/). Work with your faculty advisors to answer any questions and to form a plan of study.

Operations Research, Optimization, and Analytics [1]

Code	Title	Credits
Courses Recommended for DS/OR Qualifying Exam:		
I SY E/COMP SCI/ E C E 524	Introduction to Optimization	3
I SY E/COMP SCI/ MATH/STAT 525	Linear Optimization	3
I SY E 620	Simulation Modeling and Analysis	3
I SY E 624	Stochastic Modeling Techniques	3
I SY E/MATH/OTM/ STAT 632	Introduction to Stochastic Processes	3
I SY E/COMP SCI/ MATH 728	Integer Optimization	3
Courses Recommended for Optimization Qualifying Exam:		
I SY E/COMP SCI/ E C E 524	Introduction to Optimization	3
I SY E/COMP SCI/ MATH/STAT 525	Linear Optimization	3
I SY E/COMP SCI/ MATH/STAT 726	Nonlinear Optimization I	3
I SY E/COMP SCI/ MATH 728	Integer Optimization	3
I SY E/COMP SCI/ MATH 730	Nonlinear Optimization II	3
Other Suggested Courses:		
I SY E 412	Fundamentals of Industrial Data Analytics	3
I SY E/COMP SCI/ MATH 425	Introduction to Combinatorial Optimization	3
I SY E/M E 512	Inspection, Quality Control and Reliability	3
I SY E 516	Introduction to Decision Analysis	3
I SY E 517	Decision Making in Health Care	3
I SY E 575	Introduction to Quality Engineering	3

I SY E 603	Special Topics in Engineering Analytics and Operations Research	1-3
I SY E 604	Special Topics in Manufacturing and Supply Chain Management	1-3
I SY E 612	Information Sensing and Analysis for Manufacturing Processes	3
I SY E/MATH/OTM/ STAT 632	Introduction to Stochastic Processes	3
I SY E 645	Engineering Models for Supply Chains	3
I SY E 649	Interactive Data Analytics	3
I SY E/ COMP SCI 719	Stochastic Programming	3
I SY E/ COMP SCI 723	Dynamic Programming and Associated Topics	3
I SY E/ COMP SCI 727	Convex Analysis	3

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Health Systems Engineering [1]

Code	Title	Credits
Highly Recommended Courses:		
I SY E 417	Health Systems Engineering	3
I SY E 517	Decision Making in Health Care	3
I SY E 606	Special Topics in Healthcare Systems Engineering	1-3
I SY E/B M I 617	Health Information Systems	3
I SY E/ POP HLTH 703	Quality of Health Care: Evaluation and Assurance	1-3
Other Suggested Courses:		
I SY E 412	Fundamentals of Industrial Data Analytics	3
I SY E 415	Introduction to Manufacturing Systems, Design and Analysis	3
I SY E 521	Machine Learning in Action for Industrial Engineers	3
I SY E 555	Human Performance and Accident Causation	3
I SY E 575	Introduction to Quality Engineering	3
I SY E 601	Special Topics in Industrial Engineering [2]	1-3
I SY E/ PHARMACY 608	Safety and Quality in the Medication Use System	3
I SY E 615	Production Systems Control	3
I SY E 620	Simulation Modeling and Analysis	3
I SY E 624	Stochastic Modeling Techniques	3
I SY E/M E 643	Performance Analysis of Manufacturing Systems	3
I SY E/M H R 729	Behavioral Analysis of Management Decision Making	3
I SY E/ POP HLTH 875	Cost Effectiveness Analysis in Health and Healthcare	3
B M I/ COMP SCI 576	Introduction to Bioinformatics	3
B M I 773	Clinical Research Informatics	3
B M I/ COMP SCI 776	Advanced Bioinformatics	3

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2

Topics vary for this course. Obtain advance approval from your faculty advisor.

Advanced Manufacturing and Industrial AI [1]

Code	Title	Credits
Possible Courses:		
I SY E 412	Fundamentals of Industrial Data Analytics	3
I SY E 415	Introduction to Manufacturing Systems, Design and Analysis	3
I SY E/M E 510	Facilities Planning	3
I SY E/M E 512	Inspection, Quality Control and Reliability	3
I SY E 515	Engineering Management of Continuous Process Improvement	3
I SY E 575	Introduction to Quality Engineering	3
I SY E 601	Special Topics in Industrial Engineering [2]	1-3
I SY E 603	Special Topics in Engineering Analytics and Operations Research	1-3
I SY E 604	Special Topics in Manufacturing and Supply Chain Management	1-3
I SY E 605	Computer Integrated Manufacturing	3
I SY E 612	Information Sensing and Analysis for Manufacturing Processes	3
I SY E 615	Production Systems Control	3
I SY E/M E 641	Design and Analysis of Manufacturing Systems	3
I SY E/M E 643	Performance Analysis of Manufacturing Systems	3
I SY E 645	Engineering Models for Supply Chains	3
STAT/M E 424	Statistical Experimental Design	3
I SY E 823	Special Topics in Operations Research	1-3

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Human Factors and Ergonomics [1]

Code	Title	Credits
Possible Courses:		
I SY E/COMP SCI/ DS 518	Wearable Technology	3
I SY E 552	Human Factors Engineering Design and Evaluation	3
I SY E 555	Human Performance and Accident Causation	3
I SY E 562	Human Factors of Data Science and Machine Learning	3
I SY E/B M E 564	Occupational Ergonomics and Biomechanics	3
I SY E 601	Special Topics in Industrial Engineering [2]	1-3
I SY E 602	Special Topics in Human Factors	3
I SY E/B M E 662	Design and Human Disability and Aging	3
I SY E 699	Advanced Independent Study [2]	1-5
I SY E/PSYCH 854	Special Topics in Organization Design [2]	1-3
I SY E/PSYCH 859	Special Topics in Human Factors Engineering	1-3
I SY E 961	Graduate Seminar in Industrial Engineering [2]	1-3
CIV ENGR 679	Special Topics in Transportation and City Planning	3
Tools and Methods Courses [3]		
HFE Ph.D. students must complete an additional coursework and exam component.		

HFE Course Requirement

Code	Title	Credits
To take the qualifying exam, a student will have to have received a grade of AB or better in at least 3 credits in each of the three areas below. Courses taken during undergraduate studies can be used to satisfy this requirement:		
Cognitive Ergononics:		
I SY E 555	Human Performance and Accident Causation	3
I SY E/ MED PHYS 559	Patient Safety and Error Reduction in Healthcare	2
I SY E 601	Special Topics in Industrial Engineering [2]	1-3
I SY E 602	Special Topics in Human Factors [2]	3
I SY E 699	Advanced Independent Study [2]	1-5
I SY E/PSYCH 859	Special Topics in Human Factors Engineering [2]	1-3
Sociotechnical Systems / Macroergonomics:		
I SY E 555	Human Performance and Accident Causation	3
I SY E/ MED PHYS 559	Patient Safety and Error Reduction in Healthcare	2
I SY E/PSYCH 653	Organization and Job Design [2]	3
I SY E 601	Special Topics in Industrial Engineering [2]	1-3
I SY E 602	Special Topics in Human Factors [2]	3
I SY E 699	Advanced Independent Study [2]	1-5
I SY E/PSYCH 854	Special Topics in Organization Design [2]	1-3
Physical Ergonomics:		
I SY E 555	Human Performance and Accident Causation	3
I SY E/B M E 564	Occupational Ergonomics and Biomechanics	3
I SY E/B M E 662	Design and Human Disability and Aging	3
I SY E 601	Special Topics in Industrial Engineering [2]	1-3
I SY E 602	Special Topics in Human Factors [2]	3
I SY E 699	Advanced Independent Study [2]	1-5
I SY E/PSYCH 854	Special Topics in Organization Design [2]	1-3

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3

Various courses in the categories of Research Methods, Statistics, Qualitative Research, Biomechanics Methods, and Psychology count as "Tools and Methods." The Human Factors and Ergonomics faculty group updates the list of "Tools and Methods" courses, and advisors decide which set of courses are appropriate for each student. Work with your faculty advisor regarding non-I SY E course work.

Prior to defending their dissertation, HFE Ph.D. students must complete at least six seminar/special topics courses numbered 700 or above totaling a minimum of 12 credits; at least 6 credits of these must be in the Human Factors and Ergonomics area. Seminar credits outside the Human Factors and Ergonomics area may be used to satisfy the Industrial Engineering Breadth requirement. Other courses may qualify. Students may submit courses to the HFE Area group for consideration. Transfer students should submit a course syllabus or description and transcript for any courses from other institutions that they would like to have considered for satisfaction of this requirement. The HFE Area group will make this decision.

Additional Requirements for all ISyE PhD Students

- Industrial Engineering Breadth Requirement: The breadth requirement is to make sure the Ph.D. student achieves minimum competence in multiple areas of industrial and systems engineering. It consists of taking at least one 3-credit course in each of two different areas outside of the student's focus area, for a total of 6 credits. Students can choose from a select set of courses and must attain a grade of B or above in both courses. The courses selected by the student must be approved by the student's adviser. These courses must be completed before a Ph.D. student can request their Preliminary Warrant. Courses the student has taken before entering the Ph.D. program can be counted toward this breadth requirement, including

courses taken as an undergraduate. Students should submit the course title and syllabus to the student services coordinator who will then seek approval from the chair of graduate affairs.
    - PhD students must complete the Breadth requirement for their degree program by completing a cohesive group of courses outside the ISyE major in order to add breadth to their program.
- Recognizing the importance of instructional training to our PhD students, each student in the PhD program is required to serve as a teaching assistant for at least one semester during their program. Requests for a partial or full waiver of this requirement should be submitted in writing to the Associate Chair for Graduate Studies and will be reviewed by the Academic Affairs Cluster.
- Colloquium/Lecture Series: For at least two semesters, students must regularly attend a colloquium series. The appropriate colloquium series must be approved by the student's faculty adviser. It is not required to meet this requirement by registering for a course (indeed some colloquium series have no associate course). Instead, attendance at the approved colloquium series must be confirmed by the student's faculty adviser when the student submits their PhD Plan of Study prior to their preliminary examination. Example of colloquium series that can be used to meet this requirement include the ISyE Colloquia and the Systems, Information, Learning and Optimization (SILO) seminars.
- All ISyE PhD students must utilize the graduate student portal in MyUW to add, change, or discontinue any doctoral minor or graduate/professional certificate. To apply to this minor, log in to my.wisc.edu, click on Graduate Student Portal, and then click on Add/Change Programs. Select the information for the doctoral minor for which you are applying.
- For additional information, please contact iegradadmissions@engr.wisc.edu.