

# INDUSTRIAL ENGINEERING (PH.D.)

The Doctor of Philosophy degree is conferred upon individuals who have demonstrated the ability to make original contributions to the knowledge in this field. The Ph.D. program develops experts and professionals who will continue in academic work, industry, or government. It encourages the attainment of excellence in research and scholarship necessary to catalyze the advancement of industrial engineering.

## Traditional Ph.D. Program – Admission Requirements

Admission to this program is contingent upon admission to the Graduate School (<http://bulletins.wayne.edu/graduate/general-information/admission/>). In general, applicants are required to have a Graduate degree in engineering or a related discipline (e.g., operations research, MBA, information systems, or mathematics) with a 3.5 GPA or higher. Students with an undergraduate degree in one of these areas and a grade point average of 3.5 or above may apply for direct admission to the Ph.D. program. While such direct admissions will be rare, admission will be predicated on the specific courses and strength of the undergraduate curriculum as well as interests of faculty.

Applicants with an undergraduate major in mathematics, computer science, or the physical sciences, completed at an accredited institution, are also eligible for admission to this program, provided an evaluation concludes that the educational background includes sufficient background in analytically-oriented course work. Please visit the Doctor of Philosophy in Industrial & Systems Engineering (<https://engineering.wayne.edu/industrial-systems/academics/phd/>) website for more information.

## Global Executive Track Ph.D. Program – Admission Requirements

This is a unique track/curriculum designed to accommodate the busy schedule of working executives. Applicants for this cohort-based program are expected to bring ten years of experience with five years or more of significant managerial experience and management span of control, global experience, a technical B.S. Degree, and a relevant graduate degree. Admission to this program is contingent upon admission to the Graduate School (<http://bulletins.wayne.edu/graduate/general-information/admission/>). Upon completion of the program, the candidate earns a Ph.D. in Industrial Engineering. Every year, a limited number of highly qualified, full-time working professionals are admitted for the Winter term (limited admissions in Summer or Fall terms). Please visit the Global Executive Track Ph.D. (<https://engineering.wayne.edu/industrial-systems/academics/get-phd/>) website for more information.

## Industrial Engineering (Ph.D. Program)

The Doctor of Philosophy degree requires ninety credits beyond the baccalaureate degree, thirty of which must be earned as dissertation credits. All course work must be completed in accordance with the regulations of the Graduate School (<http://bulletins.wayne.edu/graduate/general-information/academic-regulations/>) and the College of Engineering (<http://bulletins.wayne.edu/graduate/college-engineering/academic-regulations/>).

The Industrial & Systems Engineering doctoral program is designed to be flexible, in order to meet the individual student's interests and to reflect the dynamic nature of the field. It is comprised of five major stages:

- 1. Advisor/Program Selection:** The first stage is devoted to the selection of a faculty advisor, taking course work, and the production of a Plan of Work in consultation with the student's faculty advisor. Students are encouraged to investigate the different areas of research available by talking with various graduate faculty members and attending research seminars held by the Department. Advisor selection should be done within the first semester of admission. The student will then begin course selection and outlining the Plan of Work. The approved Plan of Work must designate a primary area of research. The student is encouraged, in consultation with their advisor, to define his/her own primary and minor fields of interest by the selection of a cohesive grouping of available graduate courses. The Plan of Work must include at least thirty credits in course work at, or above, the 7000 level. Twenty-one of these credits must be in course work other than directed study (IE 7990).
- 2. Examination:** All Ph.D. students must pass the examinations outlined below. After successful completion of the written qualifying examination, a student may be admitted to the status of doctoral candidate.
  - a. Written Qualifying Examination (Preliminary Exams):** The exams are scheduled once each year in late May. The exam includes three separate tests: 1) probability, 2) statistics and 3) operations research. The material tested by the exams is generally covered in master's level or advanced undergraduate courses. Relevant courses include BE 2100, IE 6210, and IE 6560. The math course MAT 5700 is also good preparation for the probability exam. Students must take the preliminary examination before completing three academic year semesters of work after their masters degree. Doctoral students entering the program in Fall are expected to take the exam the following winter. Students who enter in winter would take the exam, a year later in their second winter semester. A student must take all three parts of the examination. If the student passes only two of the exams, the student will be required to retake only the third exam the next time it is offered. If a student fails at least two exams, the student will have to take all three exams the next time they are offered. Once a student has taken the preliminary exam once and failed all or part of the exam, the student MUST take the exam the next time it is offered; not doing so will count as a second failed attempt. Students will have two chances to pass the entire preliminary examination. If all or parts of the exam are not passed by the second attempt, the student will be asked to leave the doctoral program.
  - b. Oral Qualifying Examination (Proposal Defense):** This examination shall be a presentation of the student's proposal for dissertation research, and will be administered by the student's Doctoral Dissertation Committee. The Oral Examination must be satisfactorily completed at least twelve months prior to the Dissertation Defense. After completion of the written qualifying exam, the student will continue to develop the dissertation prospectus, a document that provides evidence that the prospective doctoral candidate has completed adequate preliminary research on the topic of the proposed doctoral dissertation. The principles for determining the scope of the prospectus are detailed in the Doctoral Dissertation Outline and Record of Approval form (<http://wayne.edu/gradschool/>).
- 3. Dissertation Committee Formation:** With the approval of the Department Doctoral Committee, the student establishes a Dissertation Committee that consists of four members. If there are co-chairs, the committee will consist of five members. At least two committee members are from the student's home department, Industrial & Systems Engineering. The Chairperson and one additional member must hold a Regular Graduate Faculty appointment in the Department of Industrial & Systems Engineering. The committee will

also include an external member from outside the department. This Committee is responsible for administering the prospectus and the dissertation defense of the candidate.

4. **Candidacy:** Candidacy is reached after the Plan of Work has been approved, the written qualifying examination has been passed, approximately fifty credits in course work have been completed, and the dissertation committee has been formed. Upon completion of these requirements, a Recommendation for Doctor of Philosophy Candidacy Status form is submitted to the Graduate School in order to advance the Ph.D. applicant to Candidate Status.
5. **Dissertation** requirements are satisfied by the successful completion of thirty credits of dissertation research. The thirty credit dissertation registration requirement is fulfilled by registering for the courses IE 9991, IE 9992, IE 9993, and IE 9994 (Doctoral Dissertation Research and Direction I, II, III, and IV, respectively), in consecutive academic year semesters. All Ph.D. students must pass the written qualifying examination and apply for doctoral candidacy before election of dissertation credits. All Ph.D. students must register for dissertation credits or candidacy maintenance status (IE 9995) for any semester in which they utilize campus facilities or consult with faculty, even though they may not be enrolled in a formal lecture course. The dissertation defense will be publicized by public notice to the academic community; at this session the candidate presents his/her doctoral research for final approval by the Doctoral Dissertation Committee. A minimum of one first author peer reviewed journal publication is required before defending the Doctoral Dissertation. All course work must be completed in accordance with the regulations of the Graduate School (<http://bulletins.wayne.edu/graduate/general-information/academic-regulations/>) and the College of Engineering (<http://bulletins.wayne.edu/graduate/college-engineering/academic-regulations/>). Students should consult the Graduate School's regulations (<http://bulletins.wayne.edu/graduate/general-information/degree-certificate-requirements/#doctoraldegreesphdtext>) governing doctoral study.

IE 8942	From Idea through Launch: Products and Services II	3
IE 8943	From Launch through Sustainability: Products and Services I	2
IE 8944	From Launch through Sustainability: Products and Services II	3
IE 8930	Global Perspectives and Networks	3
IE 8960	Literature Review & Research	3

#### Required Courses (must pass at least two)

Code	Title	Credits
IE 7220	Advanced Statistical Methods	3
IE 7511	Linear and Nonlinear Optimization	3
IE 7710	Stochastic Processes	3

## Global Executive Track PhD Program

The Global Executive Track (GET) PhD Program follows the same requirements as the traditional PhD Program as detailed above. The only differences between these two tracks is they have an alternative option for completing the Written Qualifying Examination and different core courses that are required.

### Written Qualifying Examination - Global Executive Track Program Option

To enhance writing skills and provide the learning partners with the opportunity to contribute to the body of teaching knowledge in industrial and systems engineering, each Executive Track cohort will draw on their years of relevant experience to develop and defend two (2) original Teaching Case Studies throughout the program. Successful development and defense of these two case studies will serve to satisfy the written qualifying examination requirement of the Global Executive Ph.D. track.

#### Required Courses

Code	Title	Credits
IE 8941	From Idea through Launch: Products and Services I	2