

PhD in Industrial Engineering

About the Doctoral Degree

Programs are individually tailored to meet students' objectives and to culminate in an original research dissertation. The PhD builds upon the graduate MS and fundamental BS programmatic areas. The current focus areas are Data Analytics and Operations Research, Manufacturing and Production Systems, Sustainable Systems Engineering, Service and Supply Chain Systems, and Healthcare and Human-centered Systems. Fundamental IE knowledge in each is expected. The basic goals of the PhD program are to provide students with a solid understanding of the theoretical bases for the latest tools and techniques of systems analysis and design, an extensive experience in applying these analyses and design tools and techniques, and research experience in the development of new tools or applications of existing techniques to design or analyze problems.

Degree Requirements

The PhD program is a 72 credit hour program beyond the bachelor's degree. A maximum of 27 hours (minimum of 12 hours) of research will count towards the 72 hours. A minimum of 15 hours of 8000-level work at MU, other than research hours, independent study hours, and problems hours is required. Students must earn a B+ or above for all core courses.

Transfer credits (up to a maximum of 30) may be accepted and will be determined by the student's doctoral committee. Once the committee has approved of the courses to be transferred, the Graduate School must make the final review of the transfer request to determine if the credit meets the minimum guidelines.

IMSE 8110	Design and Analysis of Engineering Experiments	3
IMSE 8000 level or higher		12
7000/8000 level	IMSE or other departments	30
IMSE 9990	Research-Doctoral Dissertation in Industrial Engineering	27
Total Credits		72

Graduation Requirements

The granting of a PhD requires completion of five major requirements:

1. A qualifying examination (D1 form).
2. A course of study (Study Plan, D2 form).
3. Comprehensive examination, and
4. Acceptance of dissertation proposal (D3 form)
5. Final defense and submission of completed dissertation (D4 form).

Admission to Candidacy

Admission to candidacy for the PhD degree requires three steps:

1. Passing the qualifying examination,
2. Selecting and advisory committee, and
3. Filing the Qualifying Examination Results and Doctoral Committee Approval Form (D-1).

Qualifying Process

Qualifying exam requirements:

A doctoral student must take and pass the Ph.D. qualifying examination in order to be a Ph.D. candidate in the department. The qualifying exam will be offered twice a year, in fall and spring semesters.

The qualifying exam can be taken only after completing IMSE 8110 and the other four IMSE 8000 level courses. The format is as follows:

In-class written exam: Doctoral faculty members from the IMSE department will develop the in-class exam. The written exam will focus on both methodology knowledge and its application. It will be an open-book, open-notes exam. In total, there will be five questions and the student can choose to answer three out of the five questions. Students will take the exam in-class and each faculty member will grade the student's answers. One of the following outcomes will be the result of this evaluation for each student:

- 1) If the student passes all three questions, they pass the test and can further work toward their research.
- 2) If the student passes two out of three questions, they conditionally pass and the student's doctoral committee will decide on what is to be done next.
- 3) If the student passes one or none of the questions, then they fail the written exam and the faculty will provide feedback on the student's performance. If the student fails the exam for a second time, then they must leave the program.

A student cannot take the qualifying exam unless an advisor has been identified. However, there is no need to re-take qualifying exam if the student's advisor is changed.

A student can take a maximum of two attempts to pass the qualifying exam.

Doctoral Committee

The Doctoral Committee is composed of a minimum of four members of the MU graduate faculty and will include at least three members from the student's doctoral degree program and an outside member from a different MU program. At least two of the doctoral committee members, including the student's adviser, must be MU doctoral faculty. Additional committee members with specialized expertise who do not meet the criteria for the MU graduate faculty or doctoral faculty may serve on a doctoral committee as a fifth or sixth member, with special permission of the Dean of the Graduate School.

Program of Study

After successfully completing the Qualifying Process, the doctoral candidate, in conjunction with their advisor and the Director of Graduate Studies, will design a program of study that meets the needs of their emphasis area and the requirements of the Graduate School. The student's doctoral committee must approve this program of study. The total program of study must constitute a definite educational plan for research and scholarly investigation in their emphasis area. The Plan of Study for the Doctoral Degree (D-2) form should be submitted to the Graduate School by the end of the third semester. The purpose of this form is to plan the program of study that the student will follow and certify that all committee members approve the program, including the recommended hours of transfer credit. MU requires a minimum of seventy-two semester hours beyond the baccalaureate degree for the PhD. No more than 27 research hours may be included in this seventy-

two hour requirement. At least 15 credit hours must be 8000-level regular courses (non-research or non-problems credits) from MU.

Comprehensive Examination

In the Department of Industrial and Manufacturing Systems Engineering the doctoral comprehensive exam is held in conjunction with the student's dissertation proposal defense. This defense is of the proposed research that will be completed by the candidate in order to prepare their dissertation and constitutes the written part of the test. During the oral defense of the proposal, the faculty will also conduct the oral part of the comprehensive examination. Students must provide the committee members with a copy of their research proposal two weeks prior to the proposal defense.

For the comprehensive examination to be successfully completed, the doctoral program committee must vote to pass the student on the entire examination, both written and oral sections, with no more than one dissenting or abstaining vote. The Doctoral Comprehensive Examination Results (D-3) form, carrying the signatures of all members of the committee, must be sent to the Graduate School not less than two weeks after the comprehensive examination is conducted. If failure is reported, the committee recommends remedial measures.

The student who fails may not take a second comprehensive examination for at least twelve weeks. Failure to pass two comprehensive examinations automatically prevents candidacy.

After successful completion of the comprehensive exam, doctoral candidates need only enroll in the minimum research hours necessary to meet the current continuous enrollment requirements; they will be still considered as full-time for reporting purposes.

Final Examination

During the process of developing and completing the research work, the student must submit at least **two articles, to advisor-approved refereed journals**. This requirement must be met prior to soliciting the Final Exam/ Dissertation Defense. The submission of the student's journal article must be reported to the director of graduate studies and must include a copy of the paper and a letter from the journal confirming the review process. In addition, copies of the paper should be submitted to the members of the doctoral committee.

After the PhD dissertation is completed, the candidate should submit a copy to each member of the Committee.

All students completing graduate degrees will be required to submit final dissertations to the Graduate School in the required electronic format. Hard copy dissertations will no longer be accepted. Please consult The Graduate School's Electronic Theses and Dissertation Guidelines.

At this time, the candidate is eligible to take the Final Examination. The PhD candidate is responsible for arranging the time and place of the Final Examination. An announcement must be sent to each member of the department faculty and publicly posted at least two weeks prior to the examination. Committee members should also be provided with a copy of the dissertation at this time.

Also, the candidate must make arrangements to present his/her dissertation at a departmental seminar, either in the IMSE 8087 seminar or a special seminar, during the month prior to the formal defense of the dissertation. It is the policy of the Department of Industrial and Manufacturing Systems Engineering to require the Final Examination be

an oral defense of the work included in the dissertation and open to all members of the University graduate faculty.

The candidate must be enrolled at the time of this examination and the examination cannot be taken when MU is not officially in session. It is recommended that the Report of the Dissertation Defense (D-4) form be taken to the defense, along with the dissertation approval page so that committee members can sign both forms for students who successfully defend their dissertation. The purpose of this form is to record the official results of the dissertation defense.

Admissions

Admission Contact Information

Luis G. Occeña, Interim Director of Graduate Studies
E3437 Thomas and Nell Lafferre Hall
Columbia, MO 65211
(573) 882-2691

Application Deadlines

Applications accepted throughout the year.
Fall application deadlines: March 1 (Priority deadline: January 1)
Spring application deadline: September 15

Minimum Criteria to be Considered for Admission

- Minimum GPA: 3.5/4.0
- Demonstrated research experience
- Compatible research interests or capabilities with a member of the faculty
- Minimum OVERALL IELTS scores: 6.5; or Minimum TOEFL scores:

Internet-based test (iBT)	Paper-based test (PBT)
80	550

- Minimum GRE scores

When did you take the GRE?	Verbal	Quantitative
Prior to August 1, 2011	350	700
On or After August 1, 2011	143	155

Note: Only highly qualified students are accepted for advisement in the PhD program. The faculty looks for excellence in undergraduate and graduate work, high GRE scores, research experience, and strong indications of research potential.

Admission Cycle

This department does not use "rolling admission." Applicants will be notified within a month after the application deadline.

Required Application Materials

To the Graduate School (<https://applygrad.missouri.edu/apply/>):

- All required Graduate School documents

To the IMSE Graduate Program:

- 3 letters of recommendation
- Writing sample demonstrating research experience
- Statement of Purpose

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- Curriculum Vitae (CV)
 - GRE scores

TA/RA Hiring

This academic department does **not** have any function of financial Aid. Rather, IMSE hires TA/RA automatically based on the department needs. No separate application or contacts are necessary; all top ranked applicants will be considered.