USC UNIVERSITY OF SOUTHERN CALIFORNIA
Daniel J. Epstein Department of Industrial and Systems Engineering

www.usc.edu/dept/ise

Ph.D. Handbook
2017-2018

DISCLAIMER

This handbook is produced by the Daniel J. Epstein Department of Industrial and Systems Engineering as an unofficial guide to graduate studies in the department. The source for much of the information in this booklet is the *USC Catalogue*, the document of authority for all students of the University of Southern California. Degree requirements listed in the *USC Catalogue* supersede any information which may be contained in any bulletin of any school or department. The *USC Catalogue* is updated and published annually by the University of Southern California. Other sources for information contained in this booklet are the *School of Engineering Bulletin*, the *Schedule of Classes*, and the *SCampus*. The student is referred to these publications for the definitive answers to any questions whether or not they are covered in this booklet. Matters of department policy not covered in the above publications may be referred to the ISE Educational Services Coordinator or to the ISE Faculty.

Although the University of Southern California, the School of Engineering, and the Daniel J. Epstein Department of Industrial and Systems Engineering have many resources to help each student achieve his/her desired education and training goals, it is ultimately the student's responsibility to see that all requirements for graduation are satisfied.

"Students are expected to be familiar with university policies and to monitor their own academic progress. They should keep all records of official grades earned, degree requirements met, transfer credits accepted and actions taken on requests for substitutions or exceptions to university policies and regulations."

--USC Catalogue

For additional information on USC or the Daniel J. Epstein Department of

Industrial and Systems Engineering,

go to www.usc.edu/dept/ise

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Admission

Minimum admission requirements for the Ph.D. in Industrial and Systems Engineering are:

- GPA: UGrad - ≥ 3.5, Grad ≥ 3.7 (Domestic), 3.2 (International)
- GRE Verbal: 153 (Domestic),
- GRE Quantitative: 151
- Preference is given to students who have already earned a Master of Science degree in industrial engineering or a related field.

Applicants must supply transcripts, GRE score reports, three recommendation letters, and a personal statement with the application form. An application fee is required, but is waived for USC alumni.

Faculty Advisor

Upon admission to the program, the student will be assigned a Faculty Advisor, a research active member of the ISE Faculty. The Faculty Advisor will help the student select courses and develop the study plan.

Study Plan

At least two weeks prior to the screening exam, the student must submit a *proposed* study plan[1] that has been approved by the Faculty Advisor. This plan will identify all courses that are intended to satisfy the various requirements of the degree, and the semesters in which they will be taken. The study plan should form a coherent body of coursework fulfilling the student's academic and professional objectives. The study plan will be reviewed as part of the screening process, and the Faculty will have the opportunity to suggest changes in the study plan. Subsequent to screening, the Graduate Committee will be responsible for approving the study plan and any changes to the study plan. Until approval is granted, the study plan will be considered tentative.

The study plan will include all courses that satisfy prerequisite deficiencies, which are not counted toward the degree. In addition, the study plan will include courses taken in preparation for the screening examination, as well as courses taken in preparation for dissertation research.

[1] The PhD Study Plan Form can be found at the end of this handbook.

The ISE Ph.D. requires 60 units of coursework, which meet the following requirements:

PhD Seminar: ISE 651, 1 unit each for three semesters	3 units
Major Concentration: Doctoral students are required to complete at least 18 units of regular coursework which form a coherent line of study within the broad field of Industrial and Systems Engineering. Credit hours earned in ISE 790, Directed Research, may not be counted toward this requirement.	18 units
Minor Courses (Outside ISE Department): Doctoral students are required to complete at least 9 units of courses outside the ISE Department that form a methodological or application-oriented theme to expand their breath of knowledge. The courses selected should be decided upon between the student and the Faculty Advisor, and may not overlap with the courses taken to satisfy the major concentration requirement	9 units
Industrial and Systems Engineering Courses Doctoral students must complete a minimum of 24* units of coursework from the ISE Department. The courses may include those taken to satisfy the major concentration requirement, and ISE 790 Directed Research. At least one unit of ISE 790 Directed Research must be completed during the first year in preparation for screening exam. Requirements for this 1-unit directed research is listed under Screening Examination.	24* units
Other Courses Approved by Advisor Doctoral students should seek advice and approval from their Faculty Advisor for other course work.	
Dissertation (ISE 794 abcdz) The doctoral students must take a minimum of 4 units of ISE 794 for their dissertation. Additional units can be taken as needed. However, only up to 6 units may be counted towards the 60 units of coursework requirement.	4-6 units

*Students with an advanced degree from another discipline must take a minimum of 18 units of courses from the ISE Department.

A maximum of 30 units of previously earned graduate coursework earned at USC or elsewhere, may be applied toward the Ph.D. These units may be applied toward the Major, Minor, and ISE Course requirements, and are subject to the approval of the Faculty Advisor and the Graduate Committee.

Satisfactory Academic Progress

Students pursuing a Ph.D. must maintain an overall cumulative grade point average of at least 3.5[2]. If a student's cumulative GPA falls below 3.5 at the end of any semester, the overall average must be raised to at least 3.5 by the end of the following semester; otherwise the student will be dismissed from the program.

[2] This is calculated based on grade points earned in all post-baccalaureate courses taken at USC that are number 400 or higher.

Screening Examination

The Ph.D. screening examination must be taken within three semesters of admission to the PhD program, and prior to the completion of 24 units. The examination is intended to provide an opportunity for the faculty to assess the student's intellectual and creative capabilities, knowledge of industrial and systems engineering, and likelihood of completing the Ph.D. program.

The core courses associated with the screening exam involve one specific course in each of the following four topical areas[3]:

Foundations of Optimization (ISE630)	Advanced Topics in Applied Stochastic Models (ISE620)
Advance Design of Experiments (ISE610)	Mechatronic Systems Engineering (ISE511)

All PhD students are required to complete at least 3 of the specified courses. A student who has achieved a GPA of at least 3.3 in the core courses is eligible for screening. A student who has not achieved at least a 3.3 in the core courses may petition the Graduate Committee for permission to be screened. Students who can document that they have completed similar courses elsewhere may petition the graduate committee regarding the substitution of these courses for screening purposes. As part of the screening process, written examinations will be offered in each of the four topical areas. Students are required to take two of these examinations, and are free to choose the exams that they take.

In addition to the core courses, students are required to complete at least 1 unit of ISE 790 (Directed Research). This research experience is intended to examine the student's capacity for independent and creative inquiry, and must be completed prior to the date on which the written exams are offered. The output from this research experience will include a written document (three to five pages) which serves as a report of their findings, and a 20-30 minute oral presentation to the faculty. The Faculty intends for the research component of the screening process to be highly individualized, and recognize that it may vary greatly among student-advisor pairings. The DR may involve activities such as:

Design and verification by experimentation (hardware and/or software based)
Critical review and/or analysis of a small number of paper (e.g., 1-3)
Survey or review of a body of literature.

Students who pursue an alternate form of the directed research are advised to seek feedback from the Graduate Committee regarding the suitability of the project for screening purposes.

The screening exam will be offered at the start of each fall semester, and may be offered during the spring semester as well if there is a sufficiently large group of students who request screening at that time. The sequence of events associated with the screening process is as follows:

1. Students complete at least three core courses and the directed research requirement within the first year of their PhD studies.
2. Thirty days prior to the examination date, the student submits to the ISE Graduate Committee a formal request to be screened. This request must include a statement from the student's Faculty Advisor stating that (a) the student has met all the requirements to take the screening

[3] Specific courses will be specified, and students will be notified accordingly.

examination and (b) he/she is willing to continue guiding the student through the completion of the degree program.

If the request to be screened is denied by the Graduate Committee, an explanation of the basis for the denial will be provided.

3. The written exams will be open book / open note / open course materials. The exams will be constructed such that they can be completed by a well-prepared student within one hour. The student will be required to complete the two exams that he/she selects within a three hour block of time; the student will receive both exams simultaneously and will allocate his/her time as necessary.

   The exams will not be released to any student, either before or after the exam takes place, although a student may review his/her exams after the screening process has been completed.

4. The written exams will be graded by a faculty team. The results of the Directed Research component of the screening process (i.e., the written and oral portions) will be determined by the faculty member who guides the Directed Research.

5. The result of the screening examination is determined by the faculty present at a faculty meeting following the completion of the doctoral screening examination. The faculty will take into account the student's performance on the examination, compatibility of research interests with the faculty, the summary of each student's academic performance to date, and any additional relevant information. The result of the examination will be one of the following: (a) pass, (b) fail, or (c) repeat screening. A pass or repeat requires majority approval of the faculty present.

   - A passing grade signifies that the student has successfully completed the screening examination and is invited to continue the doctoral program on a full-time basis.

   - A failing grade signifies that the student has not passed the screening examination and is not eligible to continue in the doctoral program.

   - A repeat grade indicates that the student, although not having passed the examination, is invited to undertake a second attempt at screening. Students given a repeat grade will be expected to take the examination a second time in the following semester. In this case, students must successfully complete the screening process the next time it is offered. The student will not be eligible for screening beyond that time.

Guidance Committee

After successful completion of the screening process, the student should begin to identify faculty members to serve on his or her Guidance Committee. The student is referred to the *Catalogue* for university regulations on the formation of the Guidance Committee. The Guidance Committee is not considered official until the Request for Qualifying Examination is filed with The Graduate School.

Qualifying Examination

The qualifying examination is taken after passing the screening examination and completion of at least 24 units within the Ph.D. program. It is usually taken during the last semester of the second year of Ph.D. study, and by the end of the fifth semester. The Request to Take Qualifying Examination form must be filed during the semester prior to taking the examination and at least 30 days before beginning the written portion of the examination. The examination is intended to determine the student's ability for original and scholarly research and the student's ability to successfully complete a Ph.D. dissertation.

The examination can be scheduled at any time during the semester provided that all members of the Guidance Committee are available. All portions of the examination must be passed within 60 days of the start of the written examination. After passing the qualifying examination the Ph.D. student is admitted to candidacy by the Dean of Graduate Studies and the Dissertation Committee is established. After qualifying, students will normally engage in at least one year of full-time graduate study and research on campus.

Students who fail the qualifying examination may be allowed, at the discretion of the Guidance Committee, to retake the examination. In such cases, the second attempt will be made no sooner than 6 months and no later than 12 months after the failed attempt. Students who are not allowed to retake the qualifying examination, fail to qualify on the second attempt, or fail to retake the qualifying examination within the allotted timeframe will not be eligible to continue the Ph.D. program.

Structure of the Examination

The examination will consist of two parts, written and oral. At least 28 days prior to the oral examination, the student must submit a written proposal for his or her dissertation research to the chair of the Guidance Committee. Failure to submit on time will cause the oral examination to be postponed.

The proposal should include a statement of the research topic and intended research contribution, a review of relevant literature from archival journals, the proposed methodology for addressing the research topic, and a research plan. The chair of the Guidance Committee must then distribute the proposal to all committee members at least 25 days in advance of the oral examination.

Guidance Committee members will then have the opportunity to submit written questions in advance of the examination. The questions must be pertinent to the research proposal. They should be written with the intention of testing the student's ability to complete a Ph.D. level dissertation within the proposed topic. Questions must be submitted to the chair of the Guidance Committee at least 18 days in advance of the oral examination.

The Guidance Committee chair is responsible for editing the submitted questions, with the objectives of ensuring consistency, relevance and clarity, and ensuring that the examination can reasonably be completed within one week's time. In cases where the Guidance Committee consists of more than five members, the chair should ensure that the total workload does not exceed normal expectations by limiting the number or length of questions.

The written portion of the examination is given to the student 14 days in advance of the oral examination, and returned within 7 days (168 hours). The qualification examination officially starts on the day that the student receives the written questions. The answers are submitted in writing, and the entire set of answers is distributed to the entire Guidance Committee. The chair should ensure that committee members receive the answers within one day of their submission to the chair. Each committee member is responsible for reviewing all answers, as well as the proposal, in advance of the examination. Each member should also carefully assess the acceptability of the answer to his or her own question. Members will not discuss the student's performance with the student in advance of the oral examination.

The oral examination consists of two parts. In the first part, lasting up to 45 minutes, the student will give a presentation on his or her proposed research. Committee members will have the opportunity to ask questions for the purpose of clarification during the presentation. These questions are not intended to test the student. The second part of the oral examination may last up to 60 minutes. During this time, committee members will ask questions pertaining to the presentation, the written proposal, or responses to the written examination. The objective of the questions is to assess the student's abilities within the proposed area of research and abilities for dissertation research.

After the student completes the second part of the oral examination, the committee will meet in private to discuss the student's performance in the examination. The outcome of the exam is based on the student's total performance in the examination, combined with the student's academic record. A student who is retaking the exam and fails to qualify will not be offered any additional opportunities to qualify. In the case of a retake, both the written and oral portions of the examination must be repeated. In the case of either a retake or a fail, the committee chair will be responsible for explaining the basis for the decision to the student and for summarizing the performance that is expected to pass a retake (if applicable).

Qualifying Examination Timeline

Deadline	**Action**
30 days prior to written examination	Student files "Request to Take Qualifying Examination Student's proposal should be complete or nearly complete
28 days prior to oral examination	Student submits written proposal to chair of committee*
25 days prior to oral	Committee chair distributes proposal to Guidance Committee
18 days prior to oral	Guidance Committee submits written questions to chair
14 days prior to oral	Committee chair provides written exam to student
7 days prior to oral	Student submits answers to exam Chair distributes answers to committee
Prior to oral	Committee reviews answers and proposal
Oral examination day	Student presents proposal, responds to questions Committee meets in private to make decision
60 days after start of written examination	Qualification examination must be completed no later than this day

* Failure to meet deadline will cause the oral examination to be postponed.

Dissertation

Upon passing the qualifying examination, the student may form the Dissertation Committee. Please see the *Catalogue* for regulations pertaining to the Dissertation Committee. To obtain the Appointment of Committee form, go to The Graduate School website at https://www.usc.edu/schools/GraduateSchool/current_guidelines_forms_03.html

Students must register for ISE 794a in the first semester after passing the qualifying examination, and may register for ISE 794a in the summer if qualifying occurs in the spring.

Dissertation guidelines are available from The Graduate School at https://www.usc.edu/schools/GraduateSchool/current_thesis_dissert_02.html

The student is advised to keep all members of the Dissertation Committee apprised of his or her progress toward completing the research and the dissertation. This can be accomplished by periodically providing the committee members with drafts of the dissertation, or by other means agreeable to the student and to the committee.

A draft of the dissertation that is sufficiently complete to be used as a basis for the defense is due to the Dissertation Committee at least 60 days prior to the defense.

It is highly recommended that the student obtain all the necessary forms from The Graduate School for completing and submitting the dissertation. The Appointment of Dissertation Committee form MUST be submitted to the department at least 30 days before the defense date. DO NOT wait until the last minute as this could delay your defense date. The form must be signed by all committee members, department chair, and the Dean before the defense can take place.

Time Limit for Degree Completion

Most Epstein ISE doctoral students are admitted to the doctoral program only after completing an applicable master's degree, normally an MS degree. For students who earned an applicable master's degree within five years prior to admission to the Epstein ISE doctoral program, the time limit for completing the doctoral degree is six years from the date of admission to the doctoral program.

The Epstein ISE faculty expects that most students will be able to fully complete their doctoral program within five years from the date of admission to the program. The Department tracks student progress in this dimension. At the end of a student's fifth year in the program, he or she will be notified that one year remains for him or her to complete the requirements for his or her degree, and the student will be required to submit a progress plan for the remaining year to the Department Chair and his or her advisor.

If the student expects to require more than one year to complete his or her program, and the student's advisor attests to the student's progress and likely success, the student will be instructed to petition for a one-year extension in the time permitted to complete the degree. The Department will normally permit a single one year extension beyond the standard six-year time limit. The Department will not normally grant requests for a second, one-year extension.

Leave of Absence

All graduate students must be continuously enrolled at USC, except for summers. Registration at other institutions without prior department approval is prohibited. See the *Catalogue* for specific residence requirements.

Students who cannot comply with the continuous enrollment requirement may petition to The Graduate School of a leave of absence of up to one year. The student must report the reason for the petition and obtain endorsements from both the Guidance Committee chair and the ISE Department Chair.

The period during which a leave of absence is in effect does not count against the time limit for degree completion.

Ph.D. Study Plan

Name: _____ SS/ID#: _____ Date: _____

BS Major	GRE V	Date Entered Graduate Studies
BS School	GRE Q	Date Entered PhD Program
BS GPA	GRE A	Date Passed Screening Exam
MS Major	TOEFL	Date Passed Qualifying Exam
MS School		Date at which Candidacy Expires
MS GPA		Date Candidacy Extended to
		Date Passed Dissertation Defense

Major Concentration: _____

Course	Title	Units	Semester	Grade	Advisor
Choose 3 of following 4 core courses for screening exam (to be completed by third semester in the program)					
ISE 511	Mechatronic Systems Engineering				
ISE 630	Foundations of Optimization				
ISE 610	Design of Experiments				
ISE 620	Advanced Topics in Applied Stochastic Models				
	Subtotal ≥ 9 units				
	Total ≥ 18 units				

Minor:_____

Course	Title	Units	Semester	Grade	Advisor
	Total Units (≥ 9)				

Other ISE Courses

Course	Title	Units	Semester	Grade	Advisor
	Total Units (≥ 6)				

Other Courses

Course	Title	Units	Semester	Grade	Advisor
ISE 651	Seminar in Industrial Engineering	1			
ISE 651	Seminar in Industrial Engineering	1			
ISE 651	Seminar in Industrial Engineering	1			
ISE 790	Directed Research (required for screening exam)	1			
ISE 794a	Doctoral Dissertation	2			
ISE 794b	Doctoral Dissertation	2			
	Total Other Units				
	Total All Units (≥ 60)				

Note: Only 2 semesters of GRSC 800 (Preparing for the Qualifying Examination) is permitted.

Advisor Signature:_____ Date:_____ (11/2012 Revision)