



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

www.usc.edu/dept/ise

Ph.D. Handbook

2009-2010

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

Industrial and Systems Engineering Ph.D. Handbook 2007

Admission

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

- GRE Verbal: 500
- GRE Quantitative: 700
- 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 shall identify a Faculty Advisor, a full-time, tenure-track ISE faculty member. The Faculty Advisor will help the student select courses and develop the study plan.

Study Plan

The student must submit a *proposed* study plan listing all courses to be taken toward the degree and when the courses will be taken. The form for the PhD study plan is available at the end of the handbook. The study plan is due two weeks prior to the screening examination.

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 procedure, 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 consists of courses to satisfy prerequisite deficiencies (not counted toward the degree), to prepare for the screening examination, and to prepare for research leading to the dissertation.

The ISE Ph.D. requires 60 units of courses. The coursework must meet the following requirement:

Required Course

Ph.D. Seminar (ISE 650 abc)

3 units

Major Concentration:

The doctoral students are required to take a minimum of 18 units of courses, decided upon between the student and the academic advisor, to form a coherent line of study within the broad field of Industrial and Systems Engineering. The courses may be taken from the ISE department or closely related departments. However, the course work may not include ISE 790 Directed Research.

18 units

Approved Minor Courses (Outside ISE Department):

The doctoral students must also select a minimum of 9 units of courses outside the ISE Department that form a methodological or application theme to expand their breath of knowledge. Choice of the courses should be decided upon between the student and the academic advisor. The courses may not overlap with the courses taken to satisfy the major concentration requirement.

9 units

Industrial and Systems Engineering Courses

The doctoral students must take a minimum of 24* units of courses from the ISE Department. The courses may include those taken to satisfy the major concentration requirement, and the ISE 790 Directed Research.

24* units

Other Courses Approved by Advisor

The doctoral students should seek advice and approval from their academic 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

A maximum of 30 units of previously earned graduate coursework, earned at USC or elsewhere, may be applied toward the Ph.D. with the approval of the faculty. The transferred units may be applied towards the Major, Minor, and ISE Courses requirements upon the approval of the academic advisor.

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

Satisfactory Academic Progress

Ph.D. students must maintain an overall cumulative 3.5 GPA on all 400-level and above work at USC beyond the bachelor's degree. 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 dropped from the program.

Screening Examination

The Ph.D. screening examination is administered to students enrolled in the Ph.D. program prior to beginning a dissertation proposal. The objective of the examination is to assess the intellectual abilities of students, their knowledge of industrial and systems engineering and the likelihood of completing the Ph.D. program.

The screening examination is composed of exams on three courses taken before an audience of faculty members and the student's academic record at USC. The outcome of the examination is decided by a vote at the next faculty meeting based on the performance on the course exams, research promise, and academic record.

The examination must be taken before completing 24 units (counting only those units earned after admission to the Ph.D.) and within three semesters of being admitted to the Ph.D. program. Except under unusual circumstances, the examination should not be taken before satisfying the prerequisites of the MSISE degree program. (These prerequisites are summarized in the ISE Department's *Graduate Handbook*.)

1. Sixty days prior to the examination date, the student must make a formal request to the ISE Graduate Committee about his or her intent to take the examination. The formal request must include (a) a statement from the student's Faculty Advisor stating that the student has met all the requirements to take the screening examination, and (b) a selected list of courses upon which to be examined.

If the request to take the examination is denied by the Graduate Committee, a study plan to meet the necessary requirements will be provided to the student.

If the student's request is approved, then tenure-track faculty as a whole will serve as the examination committee.

2. The student is responsible for selecting the courses on which he/she will be examined from a list of approved graduate ISE courses. The list of approved courses is divided into five categories: (1) production, (2) quantitative methods, (3) engineering and technology management, (4) manufacturing and mechatronics, and (5) systems architecture and engineering. See Table 1. No more than two courses may be selected from any one category.
3. An exam is held for every course selected for screening by a student. The Graduate Committee appoints at least two faculty members per course to conduct the exam to all students screening on that course.

The exam may be a written test, an oral exam, or a combination of these to be decided by the faculty conducting the exam. The Graduate Committee must ensure that there is an oral component to at least one of the exams completed by each student.

4. At least two faculty members adjudicate student performance in each exam. The faculty members shall provide separate grades for each student. The grade options are "high pass," "pass," "low pass," and "fail." All tenure-track and engineering practice faculty (including full time teaching faculty, i.e. Senior Lecturers) present in the exam may submit a grade, however faculty submitting a grade must evaluate all students being examined on that course.
5. The screening examination will be offered once each semester on an announced date. Two of the department's regular (tenure-track or engineering practice) faculty must be present in the exam of every course.

The result of the screening examination shall be made 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 decision may be: (a) pass, (b) fail, or (c) repeat. 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 accepted into the doctoral program on a full-time basis.
- A failing grade signifies that the student has not passed the screening examination and will be dropped from the doctoral program.
- A repeat grade indicates that the student, although not having passed the examination, will be given a second opportunity to take the screening examination. Students given a repeat grade will be expected to take the examination a second time in the following semester. Only one opportunity will be allowed to repeat the examination.

Table 1. Courses Approved for Screening Examination

| Screening Areas and Courses (Effective Fall 2009) | |
|--|---|
| PRODUCTION AND OPERATIONS RESEARCH | |
| 513 | Inventory Systems |
| 514 | Advanced Production Planning and Scheduling |
| 536 | Linear Programming and Extensions |
| 538 | Elements of Stochastic Processes |
| MANAGEMENT AND QUALITY ENGINEERING | |
| 525 | Design of Experiments |
| 562 | Value and Decision Theory |
| 564 | Performance Analysis |
| 570 | Human Factors Engineering |
| MANUFACTURING & TECHNOLOGY INNOVATIONS | |
| 510 | Advanced Computational Design and Manufacturing |
| 511 | Computer Aided Manufacturing |
| 545 | Technology Development and Implementation |
| 555 | Invention and Technology Development |
| SYSTEMS ARCHITECTURE & ENGINEERING | |
| 541 | Systems Engineering Theory and Practice |
| 542 | Advanced Topics in Systems Engineering |
| 549 | Systems Architecting |

Requirements : Three courses may be chosen from the list for screening and they should be from at least two different areas.

Guidance Committee

Upon passing screening, 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 no sooner than completing 24 units within the Ph.D. program. It is usually taken during the last semester of the second year of Ph.D. study or, at the latest, in the fifth semester or equivalent. The Request to Take Qualifying Examination form must be filed in 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 no sooner than 6 months after the failed exam. Students who fail to pass qualifying on the second attempt will be asked to leave 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, at a minimum, 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, then the chair should ensure that the total workload does not exceed normal 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 examination. The answers should be submitted in writing and typewritten (when feasible). The entire set of answers is then distributed to the entire Guidance Committee. The chair should ensure that committee members receive the answers within one day of the day received. 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. However, questions during the first part are not intended to test the student. In the second part, lasting up to 60 minutes, 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 decision of whether to pass, fail or retake is based on the student's total performance in the examination, combined with the student's academic record. 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

| <u>Deadline</u> | <u>Action</u> |
|--|--|
| 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 <http://www.usc.edu/dept/GRADSCHL/downloadstudents.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 http://www.usc.edu/dept/GRADSCHL/thesis_diss.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. Signatures for the Final Typing Card, the Dissertation Cover Sheet, etc. are easily obtained when your entire Dissertation Committee is present at the defense.

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.

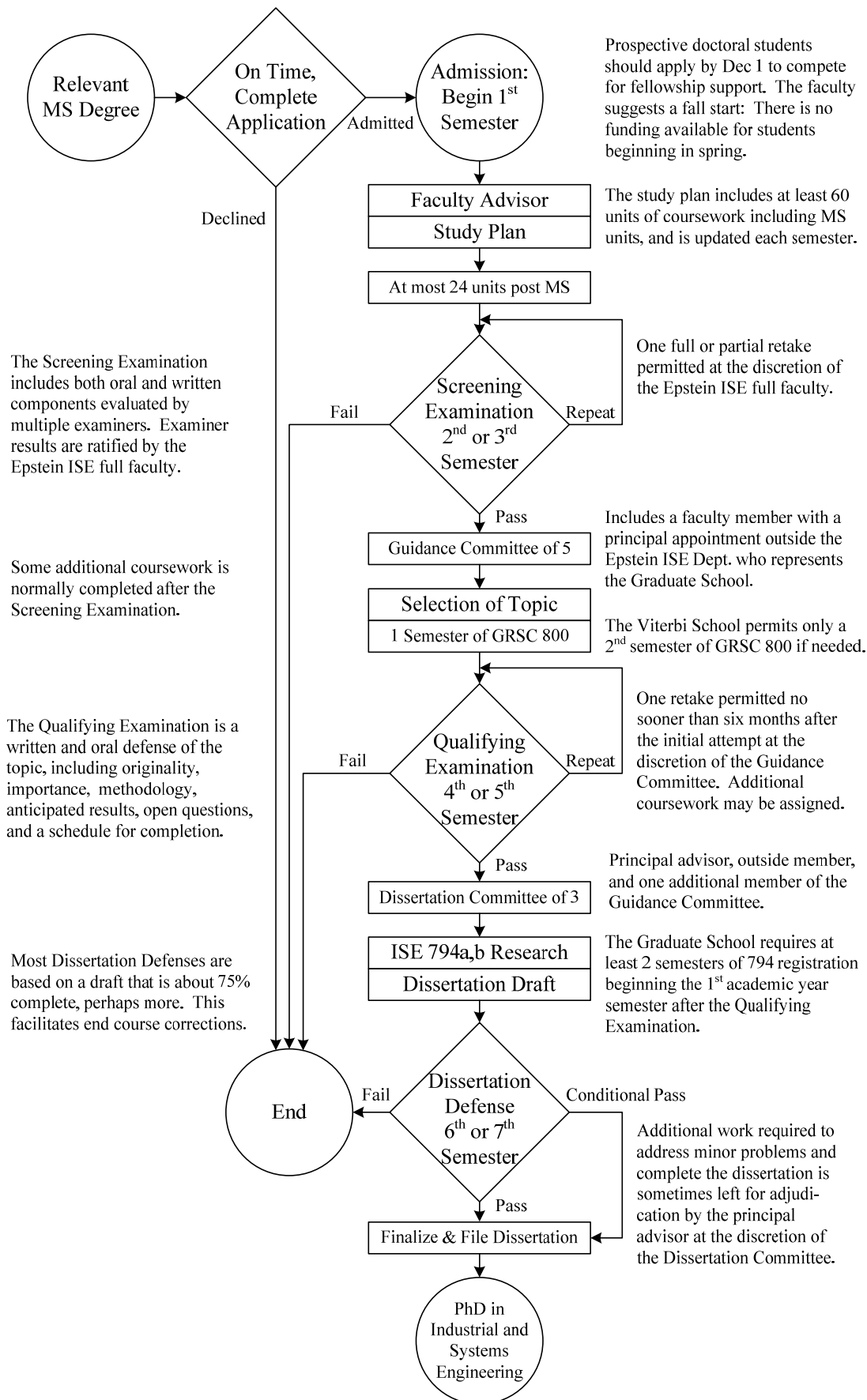
Leave of Absence

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.

Figure 1. Flow Chart through the Ph.D. Program



ISE FACULTY

Barry Boehm, Professor

Ph.D., 1964, Mathematics, University of California, Los Angeles
Joint with Computer Science

Yong Chen, Assistant Professor

Ph.D., 2001, Computer Aided Engineering & Design, Georgia Institute of Technology

Elaine Chew, Assistant Professor

Ph.D., 2000, Operations Research, MIT

Maged M. Dessouky, Associate Professor

Ph.D., 1992, Industrial Engineering and Operations Research, University of California at Berkeley

Randolph W. Hall, Professor

Ph.D., 1982, Civil Engineering, University of California at Berkeley

Qiang Huang, Assistant Professor

Ph.D., 2003, Industrial & Operations Engineering, University of Michigan

Behrokh Khoshnevis, Professor

Ph.D., 1979, Industrial Engineering and Management, Oklahoma State University

Stephen C-Y. Lu, Professor

Ph.D., 1984, Carnegie-Mellon University
Joint with Aerospace and Mechanical Engineering

Najmedin Meshkati, Associate Professor

Ph.D., 1983, Industrial and Systems Engineering and Management, University of Southern California
Joint with Civil Engineering

James Moore, II, Professor and Chairman

Ph.D., 1986, Civil Engineering (Infrastructure Planning and Management), Stanford University
Joint with Civil Engineering, and School of Policy, Planning and Development

Gerald Nadler, Professor Emeritus

Ph.D., 1949, Industrial Engineering, Purdue University

Fernando Ordóñez, Associate Professor

Ph.D., 2002, Operations Research, MIT

Kurt Palmer, Associate Professor of Engineering Practice

Ph.D., 1998, Industrial and Systems Engineering, Georgia Institute of Technology

Mansour Rahimi, Associate Professor

Ph.D., 1982, Industrial and Systems Engineering, Virginia Polytechnic Institute and State University

Sheldon Ross, Professor

Ph.D., 1968, Statistics, Stanford University

F. Stan Settles, Professor

Ph.D., 1969, Industrial Engineering, Arizona State University

Detlof von Winterfeldt, Professor

Ph.D., 1976, Mathematical Psychology, University of Michigan, Ann Arbor

Shinyi Wu, Assistant Professor

Ph.D., 2000, Industrial Engineering, University of Wisconsin, Madison

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 |
|--------------------|-------|-------|----------|-------|---------|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| Total Units (≥ 18) | | | | | |

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 650a | Seminar in Industrial Engineering | 1 | | | |
| ISE 650b | Seminar in Industrial Engineering | 1 | | | |
| ISE 650c | Seminar in Industrial Engineering | 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: _____