
INDUSTRIAL AND SYSTEMS ENGINEERING



LEHIGH UNIVERSITY

PH.D. PROGRAM

RULES AND PROCEDURES

effective Fall 2023

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■ Glossary

The following is a glossary of terms, abbreviations, and acronyms found throughout this document.

400-level course	course with number greater than or equal to 400
advisor	doctoral research advisor
credits	credit hours
DGS	Director of Graduate Studies
ISE	Department of Industrial and Systems Engineering
Lehigh	Lehigh University
Ph.D.	Doctor of Philosophy
Ph.D.-level course	400-level course that is intended for Ph.D. students
program	Lehigh ISE Ph.D. Program
RCEAS	P.C. Rossin College of Engineering and Applied Science

■ Quick Guide for Students

This guide summarizes the requirements for each student seeking a Ph.D. degree from the program. For further details about these requirements, please see the subsequent sections. The expected times of completion of requirements in this guide are presented with full-time students in mind. The expected times of completion by part-time students are determined based on a customized program of study developed in consultation with the ISE DGS.

Courses: Each student is required to complete the **three** Ph.D.-level core courses listed in the table below.

Course Number	Course Name (# of Credits)
ISE 403	Research Methods (3)
ISE 406	Fundamentals of Optimization (3)
ISE 429	Probability and Stochastic Processes (3)

Each student is required to complete at least **six** other Ph.D.-level courses, at least **five** of which must be taken within ISE. The table below lists ISE non-core Ph.D.-level courses that are offered typically every year. Other ISE non-core Ph.D.-level courses also count toward this requirement, but are typically offered on a less regular basis.¹

Course Number	Course Name (# of Credits)
ISE 402	Operations Research Models and Applications (3)
ISE 407	Numerical Methods and Scientific Computing (3)
ISE 415	Optimization Under Uncertainty (3)
ISE 417	Continuous Optimization (3)
ISE 418	Discrete Optimization (3)
ISE 444	Optimization Methods for Machine Learning (3)
ISE 456	Conic Optimization (3)

Qualifying Examination: Each student must pass a Qualifying Examination that is conducted by a committee of **three** program faculty members. This exam is expected to be attempted for the first time after the student's first spring semester in the program. Two failures of the exam will lead to dismissal from the program.

Performance Review: Each student must pass a Performance Review that assesses the student's performance in coursework, performance on the Qualifying Examination, and progress in developing a research agenda. The first review is conducted typically in the student's third semester in the program. The result of the review is either pass, incomplete, or fail. Failure leads to dismissal from the program.

Program Review: Each student must pass a Program Review that assesses whether all program requirements that are distinct from those overseen by the student's doctoral committee have been completed.

Dissertation Proposal Defense: Each student must pass a Dissertation Proposal Defense that is conducted by the student's doctoral committee, which is formed in consultation with the student's doctoral research advisor. The defense consists of the student submitting a written proposal document and being examined by oral presentation on the contents of the written proposal. It is completed typically in the student's second or third year in the program. After passing the Dissertation Proposal Defense, a student must apply for **Admission to Candidacy for the Doctorate** from the RCEAS and submit confirmation that the student has passed the **General Examination**, both of which are required to acquire a Ph.D. degree from Lehigh University.

Credits: Each student entering the program with a master's degree requires a minimum of 48 credits. Each student entering the program without a master's degree requires a minimum of 72 credits. In each semester, each full-time student must register for a number of credits to maintain full-time status. Prior to Admission to Candidacy, all credits not obtained through courses are obtained by registering for ISE 499 (Dissertation) credits.

Dissertation Defense: Each student must pass a Dissertation Defense that is conducted by the student's doctoral committee, which is chaired typically by the student's advisor. The defense consists of the student submitting a completed dissertation and being examined by oral presentation on the contents of the dissertation by the committee. It is completed typically in the student's fourth or fifth year in the program.

¹See Appendix of Ph.D. Program Rules and Procedures.

■ Overview

Disclaimer: The program is subject to the rules and procedures of Lehigh and the RCEAS. All readers of this document should refer to the RCEAS Graduate Student Handbook, especially the section on *Doctor of Philosophy Degree Requirements*. This document focuses on rules and procedures that are particular to the Lehigh ISE Ph.D. Program. It reiterates some of the rules and procedures mentioned in the RCEAS Graduate Student Handbook, but not all of them. Therefore, all readers of this document should refer to the RCEAS Graduate Student Handbook for a comprehensive treatment of all other rules and procedures not stated explicitly in this document.

A summary of the requirements to obtain the Ph.D. degree offered by Lehigh ISE is the following. Further details, along with rules and procedures particular to the program, can be found in the subsequent sections.

- Program Requirements
 - Complete a set of core and elective (i.e., non-core) Ph.D.-level courses.
 - Acquire an advisor from among the program faculty members.
 - Pass a Qualifying Examination conducted by a committee of program faculty members.
 - Pass a Performance Review conducted by the program faculty members.
 - Pass a Program Review conducted by the ISE DGS (or, conditionally, the program faculty members).

These requirements remain incomplete until a student passes the Program Review, which in turn cannot be passed until all other Program Requirements have been completed.

- Doctoral Research Requirements
 - Form a doctoral committee satisfying the RCEAS requirements.
 - Pass a Dissertation Proposal Defense conducted by the doctoral committee.
 - Receive Admission to Candidacy for the Doctorate by the RCEAS.
 - Complete paperwork to indicate passage of the General Examination required by the RCEAS.
 - Accumulate a number of credits as required by the RCEAS.
 - Pass a Dissertation Defense conducted by the doctoral committee.

These requirements remain incomplete until a student passes the Dissertation Defense, which in turn cannot be passed until all other Doctoral Research Requirements have been completed and the student submits a dissertation approved by all of the student's doctoral committee members to the RCEAS.

- Additional Requirements
 - Submit annual progress reports to the ISE DGS.
 - Any additional Ph.D. degree requirements specified by the RCEAS and Lehigh.

The expected times of completion of requirements written throughout this document are presented with full-time students in mind. The expected times of completion by part-time students are determined based on a customized program of study developed in consultation with the ISE DGS.

■ Program Requirements

The program requires that a student completes a set of core and elective Ph.D.-level courses, acquires an advisor, passes a Qualifying Examination, passes a Performance Review, and passes a Program Review. These requirements remain incomplete until a student passes the Program Review, which in turn cannot be passed until all other Program Requirements have been completed.

□ Course Requirements

Each student in the program is required to complete a set of core Ph.D.-level courses and a minimum number of Ph.D.-level elective courses. The **three** required core courses are stated in the following table. These courses are expected to be taken in the student's first semester in the program, unless a student has taken the course at Lehigh prior to starting the program or has obtained prior approval from the ISE DGS to take the course at another time.

Course Number	Course Name (# of Credits)
ISE 403	Research Methods (3)
ISE 406	Fundamentals of Optimization (3)
ISE 429	Probability and Stochastic Processes (3)

In addition to these required core courses, each student is required to take at least **six** Ph.D.-level elective courses, at least **five** of which must be offered by ISE. Ph.D.-level courses that are pre-approved for satisfying these elective requirements and are offered typically every year are stated in the following table. Other ISE elective Ph.D.-level courses may also count toward this requirement, but these are typically offered on a less regular basis.²

Course Number	Course Name (# of Credits)
ISE 402	Operations Research Models and Applications (3)
ISE 407	Numerical Methods and Scientific Computing (3)
ISE 415	Optimization Under Uncertainty (3)
ISE 417	Continuous Optimization (3)
ISE 418	Discrete Optimization (3)
ISE 444	Optimization Methods for Machine Learning (3)
ISE 456	Conic Optimization (3)

The following paragraphs describe additional rules, procedures, and restrictions in terms of the course requirements.

Ph.D.-level courses: These are 400-level courses that have been determined to be intended for Ph.D. students. In terms of 400-level ISE courses, unless a course is included in the pre-approved list above, a student should consult with the ISE DGS prior to the student registering for the course about whether the course is considered to be a Ph.D.-level course. (The determination is made by the instructor of the course, who informs the ISE DGS.) An elective course can be taken in another department at Lehigh. In the case when a student wishes to use a course outside of ISE to cover an elective course requirement, the student must obtain approval from the ISE DGS and their research advisor prior to registering for the course.

Readings courses: A "Readings" course (i.e., ISE 461) cannot be used to cover any of the course requirements without prior approval from the ISE DGS. Approval must be obtained before the student registers for the course.

Preparatory courses: In case a student lacks the background necessary to pass a core or elective course, the student may seek approval from the ISE DGS to take a preparatory course that is below Ph.D.-level. Such a course may be used to fulfill a Ph.D. course requirement with prior approval from the ISE DGS. Students must seek such approval prior to registering for the preparatory course.

Non-Lehigh courses: If a student has completed a course at another institution that the student believes is equivalent to a core course, then the student may fulfill the core course requirement by successfully passing an examination by an instructor of the Lehigh core course. (The instructor must have taught the course within the prior two calendar years and/or be scheduled to teach the course in an upcoming semester.) Note, however, that in this case the student will not receive credits for the course and this does not reduce the total number of credits required for the degree. Any such examination(s) should be scheduled in consultation with the ISE DGS.

²See [Appendix](#).

Lehigh courses: If a student has passed any of the core courses or other Ph.D.-level courses at Lehigh prior to starting the program, then these can be used to fulfill Ph.D. course requirements if approval is granted by the student's research advisor and the ISE DGS. Note, however, that by obtaining this approval, the student does not receive credits for the course and this does not reduce the total number of credits required for the degree.

Grade requirements: Grades in all courses are expected to be at the level of B- or higher. If a student receives a grade lower than B-, then this will likely result in remedial action as a consequence of the subsequent Performance Review or Program Review of the student. The grades expected in particular courses and the overall level of performance in courses are subject to the discretion of the program faculty.

□ Research Advisor

Each student requires an advisor who will advise the student's research and, typically, act as chair of the student's doctoral committee. Each student is matched with an advisor on a trial basis around the end of the student's first semester in the program, or at least by the time that funding decisions need to be made about the student's second semester in the program. By the end of the student's second semester in the program, it is expected that the student will have acquired an advisor who is intended to remain in that role on a permanent basis. This advisor, who might or might not be the same one with whom the student was matched previously, is expected to be the one who will advise the student's research and become the chair of the student's doctoral committee.

A student can transition from one advisor to another even after the student's second semester in the program. That said, if, at any point in time after the student's second semester in the program, the student is without a research advisor, then oversight of the student's progress in the program is the responsibility of the ISE DGS. In such cases, the ISE DGS will advise the student in acquiring a research advisor. If the student is unable to acquire a research advisor who is willing to advise the student, then the student will be dismissed from the program, at which time the student may petition to transfer to a master's degree program.

□ Qualifying Examination

Following the final exam period at the end of a student's first spring semester in the program, the ISE DGS assigns the student a Qualifying Examination committee consisting of **three** program faculty members. This committee cannot include the student's doctoral research advisor. The committee conducts the exam of the student, which is to be completed by the end of the second week of the fall semester of the same calendar year. The exam may be postponed (typically to the subsequent year) with prior approval from the ISE DGS. In such a case, approval of the postponement should be sought at least two weeks prior to the start of the fall semester.

The purpose of the exam is to assess the student's

- knowledge of program-related topics,
- potential to conduct original research, and
- ability to communicate both orally and in writing.

The committee selects a research article to be the subject of the student's exam. The article is not revealed to the student until the start of the student's exam period (see next paragraph). The committee is expected to consult with the student's advisor about an article that may be relevant for the student's potential future research agenda, but the final decision about which article to use for the exam is made by the committee.

Once the research article has been selected, the student and committee members coordinate about the time period in which the exam will take place. The committee is expected to follow the student's preferences in terms of the timing of the exam, but the final decision about the timing of the exam is made by the committee. The exam period is expected to be a continuous three-week period, although in special circumstances the committee may allow the exam to be scheduled over a longer time period. In any case, the exam period must start after the final exam period at the end of the student's first spring semester in the program, the student must be given at least 120 working hours to complete the exam, and the exam must conclude by the aforementioned deadline, namely, the end of the second week of the fall semester of the same calendar year.

At the beginning of the exam period, the student is told which is the article that is the subject of the exam. During the exam period, the student is expected to study the article and research an "extension" to the topic of the article. It is highly recommended that the student proposes the extension to the committee members *during*

the exam period to ensure that the committee deems it to be sufficient for the purposes of the exam. By the end of the exam period, the student prepares materials for an oral presentation—which is expected to be at most 2 hours in length, including time to answer questions posed by the committee members—and a written report about the article and the extension. The committee members assess the student’s performance in the oral presentation, ability to answer questions during the oral presentation, and written report. The evaluation form to be used by the committee members will be made available to the student prior to the start of the exam period.

The result of the exam is either pass or fail. Passage of the exam is necessary for passage of the Performance Review. A single failure of the exam will not necessarily lead to failure of the subsequent Performance Review. However, two failures of the exam will lead to failure of the subsequent Performance Review.

□ Performance Review

Each student is subject to a Performance Review, which must be passed before the student can pass the Program Review. In the typical scenario in which a student starts the program in the beginning of a fall semester, the first Performance Review of the student is conducted after the end of the second week of the student’s second fall semester in the program. If a student starts the program at any other time, then the timing of the first Performance Review of the student is determined by the ISE DGS. The student’s performance is assessed based on

- evaluation of courses completed and grades received,
- evaluation of Qualifying Examination results (if applicable),
- evaluation of progress toward developing a research agenda, and
- any other factor as deemed relevant by the program faculty members.

The result of the review is determined by a vote of the program faculty and may be either pass, incomplete, or fail. A pass indicates that the Performance Review has been passed. An incomplete indicates that the student may continue in the program subject to certain conditions being fulfilled within a specified time frame. These conditions may include, but are not limited to, (re)taking the Qualifying Examination, writing a research report, completing specific coursework, or achieving a minimum GPA during subsequent semesters. All of the conditions that must be fulfilled and the specified time frame in which they must be fulfilled are written out explicitly for the student at the time the incomplete is granted. Failure of the Performance Review results in the student’s dismissal from the program, after which the student may petition to transfer to a master’s degree program.

If a student receives an incomplete on a Performance Review, then the student should request that a subsequent review take place directly following completion of all required conditional actions. When a student feels that the conditional actions have been completed, the student should notify the ISE DGS and request the review. The ISE DGS may also call for a review to take place at any time that the DGS deems appropriate.

□ Program Review

Each student is subject to a Program Review, which must be passed before the student is said to have completed all Program Requirements toward the degree. Once a student has completed the core and elective courses and passed the Qualifying Examination and Performance Review, the student should request a review by the ISE DGS. The ISE DGS may also call for a review to take place at any time that the DGS deems appropriate.

If the ISE DGS determines that course grade requirements have been met since the student passed the Performance Review and is informed by the student’s advisor that progress toward the development of a research agenda has been sufficient, then the ISE DGS can deem that the student has passed the Program Review. Otherwise, the ISE DGS calls for a review of the student by all program faculty. In such a review, the student’s performance is assessed based on all of the same factors as an initial Performance Review. The result of such a review is pass, incomplete, or fail. The consequences of each of these results is the same as for the Performance Review.

■ Doctoral Research Requirements

The program requires that a student forms and maintains a doctoral committee, passes a Dissertation Proposal Defense, obtains Admission to Candidacy for the Doctorate by the RCEAS, completes the paperwork to indicate passage of the General Examination as required by the RCEAS, accumulates a number of credits as required by the RCEAS, and passes a Dissertation Defense. These requirements remain incomplete until a student passes the Dissertation Defense, which in turn cannot be passed until all other Doctoral Research Requirements have been completed and the student submits a dissertation approved by all doctoral committee members to the RCEAS.

□ Doctoral Committee

In consultation with the student's research advisor, a student is required to identify a dissertation topic and form a doctoral committee. (Each student should consult the RCEAS Graduate Student Handbook for information about guidelines and restrictions about the formation of this committee.) It is expected that the committee will meet at least annually to assess the student's performance and progress. Such meetings may be in concert with the required milestones described in the following sections and/or may be conducted separately.

□ Dissertation Proposal Defense

The dissertation proposal is a written document that must be submitted to the student's doctoral committee and defended during an oral examination. The written proposal should be submitted to the student's doctoral committee at least two weeks prior to the oral presentation date. The subjects of the proposal and presentation during the defense are the research that the student has conducted so far and the research that the student proposes to complete for the student's dissertation. The result of the defense, which is determined by the student's doctoral committee, is either pass or fail. If a student fails the Dissertation Proposal Defense, then the defense may be rescheduled as many times as offered by the student's doctoral committee.

Each student is required to pass the Dissertation Proposal Defense prior to Admission to Candidacy for the Doctorate, which is a required milestone for all doctoral students in the RCEAS at Lehigh. Since passage of the Dissertation Proposal Defense constitutes passage of the General Examination (see the next subsection), the rules of which are dictated by the RCEAS at Lehigh, the Dissertation Proposal Defense must be passed no later than 7 months prior to the time when the degree is to be conferred.

□ General Examination

Passage of the Dissertation Proposal Defense constitutes passage of the General Examination, which is a required milestone for all doctoral students in the RCEAS at Lehigh. The General Examination must be passed no later than 7 months prior to the time when the degree is to be conferred.

□ Admission to Candidacy

A student must be admitted to candidacy in order to obtain a Ph.D. degree. This requires applying for and receiving Admission to Candidacy for the Doctorate by the RCEAS. Each student in the program should apply for admission to candidacy promptly after (i) completion of a master's degree or an equivalent number of credits and (ii) after passing the Dissertation Proposal Defense. If a student has obtained a master's degree prior to joining the Lehigh ISE Ph.D. program, then (i) has been completed; otherwise, (i) is completed after a student has received at least 30 credits toward the Ph.D. degree. Applying for admission to candidacy involves submitting the student's written dissertation proposal, signed by the student's doctoral committee, as well as an Application to Candidacy form to the Office of Graduate Studies and Research. For candidacy to be applicable for a given semester (which may influence the number of credits for which the student must enroll, as explained in the Credits Requirements below), the student should apply for admission to candidacy at least two weeks prior to the start of the semester.

□ Credit Requirements

The credit requirements for the program are those established by the RCEAS at Lehigh. The program does not have any credit requirements beyond those stipulated by the RCEAS. The following is a brief overview of the credit requirements stipulated by the RCEAS. For a complete list of requirements and discussion of related topics, the RCEAS Graduate Student Handbook should be consulted.

Each student in the program must accumulate a minimum number of credits to obtain a Ph.D. degree. Each student who enters the program without a master's degree must accumulate at least 72 credits. Each student who enters the program with a master's degree from another institution must accumulate at least 48 credits. Each student who aims to receive both a master's and Ph.D. degree from Lehigh must accumulate at least 72 credits in addition to satisfying the other requirements of both the master's degree and Lehigh ISE Ph.D. program.

Full-time students who have not yet received Admission to Candidacy for the Doctorate typically must register for at least 9 credits per semester in order to maintain full-time status. Exceptions may be granted when the remaining number of credits that a student needs to accumulate in order to reach the minimum credit requirement is fewer than 9. Once the remaining number of credits that a student needs to accumulate is fewer than 9, the number of credits for which a student needs to register depends on whether the student has yet received Admission to Candidacy. If the minimum credit requirement (of 72 or 48 credits) is attained prior to Admission to Candidacy, then continued registration of at least three credits per semester is necessary. On the other hand, if a student has received Admission to Candidacy, then the student must register for at least 3 credits per semester until 1 or 2 credits remain, after which the student can apply for Maintenance of Candidacy for 1 credit per semester.

Prior to Admission to Candidacy for the Doctorate, all credits not obtained by a student through courses are obtained by registering for ISE 499 (Dissertation) credits.

A student must be registered (e.g., for Maintenance of Candidacy) in the semester in which the degree is conferred.

□ Dissertation Defense

The Dissertation Defense requires a written dissertation and an oral presentation. The required dissertation should be submitted to the student's doctoral committee at least two weeks prior to the oral presentation date. The subject of the oral presentation is the content of the student's dissertation. The result of the defense is determined by the student's doctoral committee and is either pass or fail. If a student fails the defense, then it may be rescheduled as many times as offered by the student's doctoral committee. A student is required to pass the Dissertation Defense in order to obtain a Ph.D. degree; see the RCEAS Graduate Student Handbook for further guidelines and restrictions related to the defense.

■ Additional Requirements

Annual Surveys

Toward the end of every spring semester, each student in the program is required to submit a progress report to the ISE DGS. In this report, the student provides a summary of progress over the prior calendar year, which may include: a list of courses taken and corresponding grades received; papers submitted, accepted, and/or published; and milestones (i.e., Qualifying Examination, Performance Review, Program Review, Dissertation Proposal Defense, and/or Dissertation Defense) passed. A student must also submit a final report to the ISE DGS prior to any non-Spring graduation date.

■ Useful Information

Course Registration

A great source of information is Lehigh's [Registration FAQ](#) page.

Registration

- Registration (of an expected set of course and/or other credits) should be completed as soon as possible once the registration period begins. Registration can be modified easily in advance of the start of a semester, so an initial registration should be completed as soon as possible and modified later (ideally before the start of a semester), as needed.
- A hold on a student's account will prevent registration; see [here](#) for further information.
- Registration requires a PIN, which can be obtained from the department's graduate coordinator.
- If an override is needed to register for a course, then an override request form needs to be completed, which can be obtained from the department's graduate coordinator.

Adding/Dropping Classes

- A great source of information is available [here](#).
- Until the 5th day of a semester, students can add or drop a course through Banner Self-Service.
- From the 6th through the 10th day of a semester, students need instructor permission to add or drop a course. In this case, an override is needed, which can be obtained from the department's graduate coordinator.
- After the 10th day of the semester, students may drop a course (and receive a "W" for the course) by completing a Course Withdrawal Form. Students can add a course by requesting an override, but a late fee will apply. That said, if there is a valid reason for a late addition, then a student can petition for the late fee to be waived/reimbursed by completing a Petition Form.

For the specific dates for a given academic semester, check the deadlines [here](#).

Full-Time Status

Full-time students must maintain full-time status at Lehigh. Prior to a student accumulating the minimum credit requirement and prior to receiving Admission to Candidacy for the Doctorate, a student maintains full-time status automatically by registering for at least 9 credits. After accumulating the minimum credit requirement and after receiving Admission to Candidacy, a student maintains full-time status by registering (for 1 credit) for Maintenance of Candidacy. In all other cases, a student typically needs to submit a Full-Time Certification form and satisfy one of the relevant requirements indicated on the form in order to maintain full-time status.

Administrative Forms

Most of the administrative forms that are needed are available [here](#).

IMPORTANT: When filling out any form through DocuSign, un-aliased Lehigh addresses must be used; e.g., fec309@lehigh.edu rather than the alias frank.e.curtis@lehigh.edu.

CPT and OPT

Please start by directing questions to Lehigh's [Office of International Students and Scholars](#).

■ Appendix

The table below lists ISE core Ph.D.-level courses.

Course Number	Course Name (# of Credits)
ISE 403	Research Methods (3)
ISE 406	Fundamentals of Optimization (3)
ISE 429	Probability and Stochastic Processes (3)

The table below lists ISE non-core Ph.D.-level courses that are offered typically every year.

Course Number	Course Name (# of Credits)
ISE 402	Operations Research Models and Applications (3)
ISE 407	Numerical Methods and Scientific Computing (3)
ISE 415	Optimization Under Uncertainty (3)
ISE 417	Continuous Optimization (3)
ISE 418	Discrete Optimization (3)
ISE 444	Optimization Methods for Machine Learning (3)
ISE 456	Conic Optimization (3)

The table below lists other ISE non-core Ph.D.-level courses.³

Course Number	Course Name (# of Credits)
ISE 4XX	Quantum Computing Optimization (3)
ISE 4XX	Uncertainty Quantification (3)

³The course number “4XX” indicates that a permanent course number has not yet been determined.