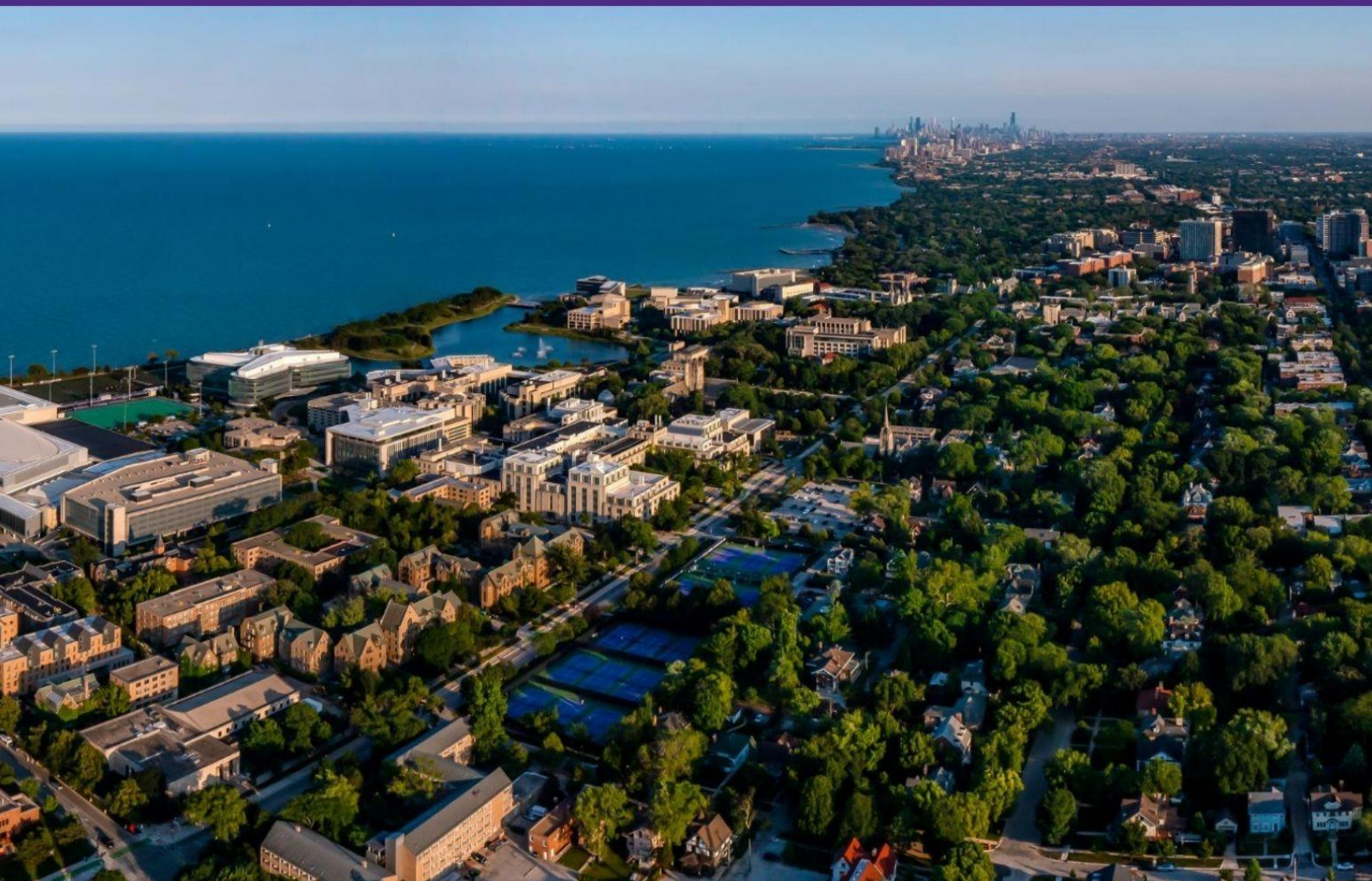
Northwestern | McCORMICK SCHOOL OF ENGINEERING

Industrial Engineering and Management Sciences

PhD Student Graduate Student Handbook

Revised June 2026



Letter from the Department Chair:

Simge Küçükyavuz
Chair, David A. and Karen Richards Sachs Professor

Dear PhD Students,

Welcome to the PhD program in Industrial Engineering and Management Sciences (IEMS) at Northwestern University. We are proud to be a consistently top-ranked graduate program, recognized for our rigorous academic standards, world-class faculty, innovative research, and impactful contributions to science and society.

Our program offers a strong foundation in optimization, statistical machine learning, and stochastic and risk analysis. You will also find a rich spectrum of applications—from healthcare, operations, and logistics to computational social science, artificial intelligence, and energy systems. This combination of theoretical depth and real-world relevance prepares our students to become leaders in academia, industry, and beyond.

We set high expectations and admit top students from around the world who are motivated to excel. At the same time, we value building a supportive and inclusive community. We offer a variety of social events and informal gatherings to foster connections among students, faculty, and staff—because we believe that meaningful engagement and collaboration are essential to a rewarding graduate experience.

This handbook outlines the rules, milestones, and expectations that will guide your journey toward your PhD. If you have questions or need support, please don't hesitate to reach out to your advisor, the Director of Graduate Studies, or me.

Wishing you a creative, productive, and fulfilling time in IEMS.

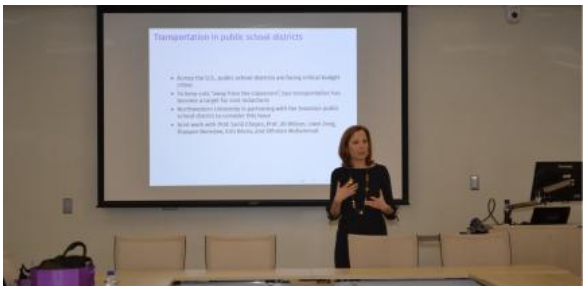
Warm regards,

Simge Küçükyavuz
Chair, David A. and Karen Richards Sachs Professor

Introduction

This handbook guides students through the requirements, procedures, and opportunities of study associated with the PhD program in Industrial Engineering & Management Sciences at Northwestern University. For the most part, the handbook deals with procedures of the IEMS Department and its PhD program. On matters concerning Graduate School or University policy, the Graduate School's Academic Policies and Procedures or the Northwestern Student Handbook should be consulted.

While the handbook provides the basic information necessary for successfully negotiating the requirements of the Program, it is not meant to serve as a substitute for our advisory system. Students are encouraged to schedule frequent meetings with their advisors to discuss their goals, options and plans, as well as progress in the Program.



Students are admitted to The Graduate School of Northwestern University in order to study in the Program. Students must follow all the procedures and guidelines established by The Graduate School for such matters as registration, receiving payment of stipends, ensuring full-time status in terms of graduate study, and meeting graduation deadlines. Staff within The Graduate School do their best to assist students in meeting requirements and deadlines. Do not ignore notices, requests or memos issued by The Graduate School (e.g., TGS E-News) to insure compliance with Graduate School procedures.

It is the students' responsibility to consult this handbook and seek out additional information so that they adhere to all required procedures, including those of the Program, Department, McCormick School of Engineering, Graduate School, and University. If there are questions or confusion, consult the Graduate Program Coordinator for IEMS.

Degree Requirements

To receive the PhD in Industrial Engineering and Management Sciences, students must successfully complete the required coursework, candidacy, prospectus, and dissertation defense exams, teaching requirements of The Graduate School, and McCormick Responsible Conduct of Research (RCR) training. Students also must complete all degree requirements within the IEMS Departmental timeline and submit all required forms prior to graduation. (For details on the candidacy, prospectus, and dissertation defense exams, please see Degree Milestones.)

Required Coursework

To fulfill the course requirements, 15 one-credit courses must be taken for a letter grade (not taken P/NP).

Three Core Courses

- IEMS 401 Applied Mathematical Statistics
- IEMS 460-1 Stochastic Processes I
- IEMS 450-1 Mathematical Optimization I

Two Advanced Core Courses

Two from the following four courses:

- IEMS 402 Statistical Learning
- IEMS 450-2 Mathematical Optimization II
- IEMS 460-2 Stochastic Processes II
- IEMS 435 Introduction to Stochastic Simulation

Three Application Courses

- IEMS 488 Economics of Decision Analysis

and two courses must be chosen from the following list:

- IEMS 441 Social Networks
- IEMS 473 Financial Engineering
- IEMS 481 Logistics
- IEMS 482 Operations
- IEMS 485 Healthcare Engineering
- IEMS 486 Smart Grid
- IEMS 490 Computational Social Science

Independent Research (2 Courses)

- IEMS 499 Independent Study

Electives (5 Courses)

PhD students must complete five courses from the list of approved electives (see Appendix B for the list). These courses can be chosen from different subject areas as shown below:

- Analytics
- Stochastic Analysis and Simulation
- Optimization
- Financial Engineering
- Logistics and Operations
- Healthcare Engineering
- Applied Statistics and Statistical Learning
- Management Science

In addition to the above courses, all students are required to take Real Analysis course as pre-requisite for core and advanced core courses. Students' advisors must approve the five elective courses. Thus, it is essential that students get approval of their advisors before registering for a course. See the Major Approval Form in Appendix A.

Students may petition the Director of Graduate Studies to add a new course to the list (see Appendix C). Petitions must be submitted before students take the course. After receiving the petition, the IEMS Graduate Committee will evaluate it and decide whether to add the new course to the list of approved electives or reject the petition.

Students enrolled in the PhD program prior to Summer Quarter 2025 are considered to operate under the earlier coursework requirements but retain the option to opt into the new system as desired. Please email the Graduate Program Coordinator if you wish to do so.

Waiving Required Courses

Students may request a waiver of the course requirement for their Ph.D. in IEMS if they can justify it with graduate-level coursework completed at another institution. Waiving a required course does not reduce the total number of courses required for the degree. If a core course is waived, a substitute course must be taken in its place. This substitution must be approved by the IEMS Graduate Committee. The substitute course must be in the same subject area. Interested students should submit the Required Course Waiver Request Form (Appendix D), along with supporting documentation of previous graduate-level coursework (such as transcripts, syllabi, course descriptions, and reading lists), to the Director of Graduate Studies immediately after entering the program.

Teaching Requirements

TGS requires that all PhD students serve in some instructional capacity for at least one academic quarter during their graduate education at Northwestern University. This requirement is usually fulfilled by IEMS PhD students through service as a teaching assistant in an IEMS course**.** For details on IEMS expectations of teaching assistants, please review the IEMS Department responsibilities and expectations for teaching assistants (Appendix E), and see details under Year Two (page 11).

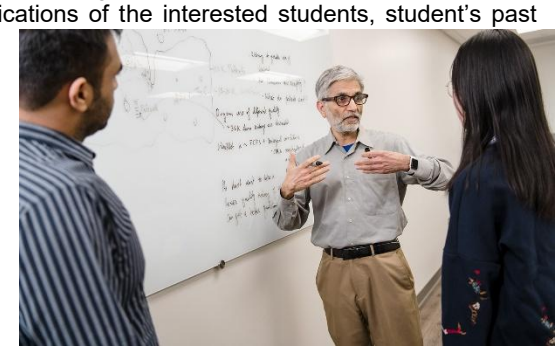
English Proficiency: Please see Graduate and Teaching Assistantships on The Graduate School's requirement regarding spoken English proficiency. International students should be sure to satisfy this requirement by the end of the first year in the program. Because spoken English proficiency is a TGS requirement to receive financial aid as a teaching assistant, the IEMS Department's guarantee of financial aid to an international PhD student is valid after the first year only if this spoken English proficiency requirement is satisfied.

Serving as the instructor for an IEMS course is another way to satisfy the TGS teaching requirement. Opportunities for PhD students to be instructors of an IEMS course are limited because the Department aims to appoint only students with proper talent and training as instructors. Students interested in the possibility of becoming instructors are encouraged to communicate their interest to the Director of Graduate Studies and to use the following procedure for demonstrating their qualifications to be instructors.

An interested PhD student asks for the opportunity to deliver a lecture in an IEMS course. Often, this is a course in which the student is currently serving as a teaching assistant, but it does not have to be. When such an arrangement is made, the instructor should provide teaching notes for the lecturing student, or review the lecturing student's notes in advance. The instructor, or another faculty member, attends the lecture or reviews a video of the lecture, and then writes an evaluation. The evaluation goes to the student, to the Director of Graduate Studies, and to the Graduate Program Coordinator for inclusion in the student's file. The evaluation should summarize the strengths, weaknesses, and areas of potential improvement in the lecture, and include a rating on the following scale:

A. Excellent job – teaching at this level would be very acceptable from regular IEMS faculty.
B. Good job – some aspects were done very well, but there is room for improvement; teaching at this level would probably result in average student evaluations.
C. Adequate job – there were some significant shortcomings; teaching at this level would probably result in relatively poor student evaluations.
D. Poor job – there were serious problems; teaching at this level is unacceptable in IEMS classes and would probably result in very poor student evaluations.

Students are encouraged to discuss the evaluation with the Director of Graduate Studies, who can provide an assessment of the likelihood of an instructorship. The evaluation process can be repeated, which provides an opportunity to learn from the initial evaluation. The decision about appointing a PhD student as an instructor is made by the Department Chair, considering factors including the qualifications of the interested students, student's past performance as Teaching Assistant (TA), and the Department's need for instructors.



Registration Requirements

PhD students who have not completed the Dissertation must maintain continuous registration during Fall, Winter, and Spring quarters (or else take a leave of absence). The Crown Internship satisfies the requirement of continuous registration. For more details, see TGS' Continuous Registration Policy (TGS section 4.10).

PhD students past their 20th quarter* who are not doing research or Teaching Assistantships can enroll in TGS 512, an unfunded registration. Students must receive Dean's Office approval to alternate TGS 512 registration with another full-time, funded registration. PhD students can only enroll in TGS 512 for 2 quarters**.

*PhD students in their first 20 quarters can request an exception from their advisor and the Dean's office by emailing mccormick-gradprograms@northwestern.edu

**To enroll in a third (or more) quarters, the student and their advisor must agree on an academic performance plan and set goals at the end of the second (or higher, N) quarter and meet at the end of the third (or higher, N+1) to discuss progress and determine if the student remains in good academic standing.

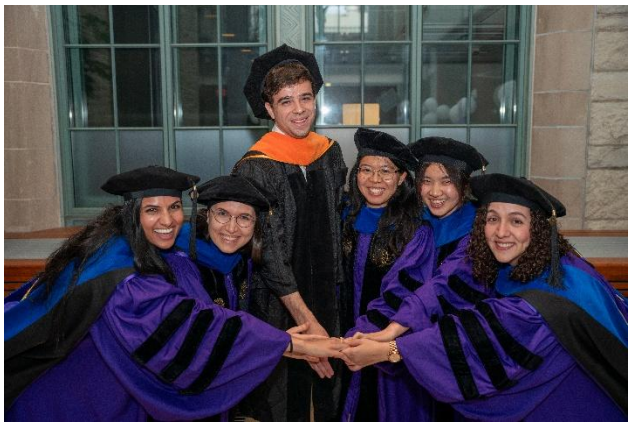
Time Requirements

Students are expected to devote their full efforts to graduate study and complete the requirements for the PhD within 4-5 years. Students must be registered full-time except during a Summer quarter in which no funding is received. Full-time registration means at least 3 credits per quarter (including credits of IEMS 499 or IEMS 590 research) or

registration in TGS 500, 512. Therefore, a student who is funded as an RA for Summer quarter should register for research. A first-year student who has not yet attained candidacy should enroll in credits of IEMS 499, while those students who have passed their candidacy exams should enroll in individual units of IEMS 590 or a quarter of TGS 500.

The Graduate School's deadlines for completion of degree requirements extend beyond those of the IEMS Program. According to Graduate School rules, students must complete all requirements for the PhD within 9 years. Because the IEMS Program accepts only full-time students, we expect students to complete the PhD within the guidelines outlined by our Program (see Degree Milestones for more information).

Graduation



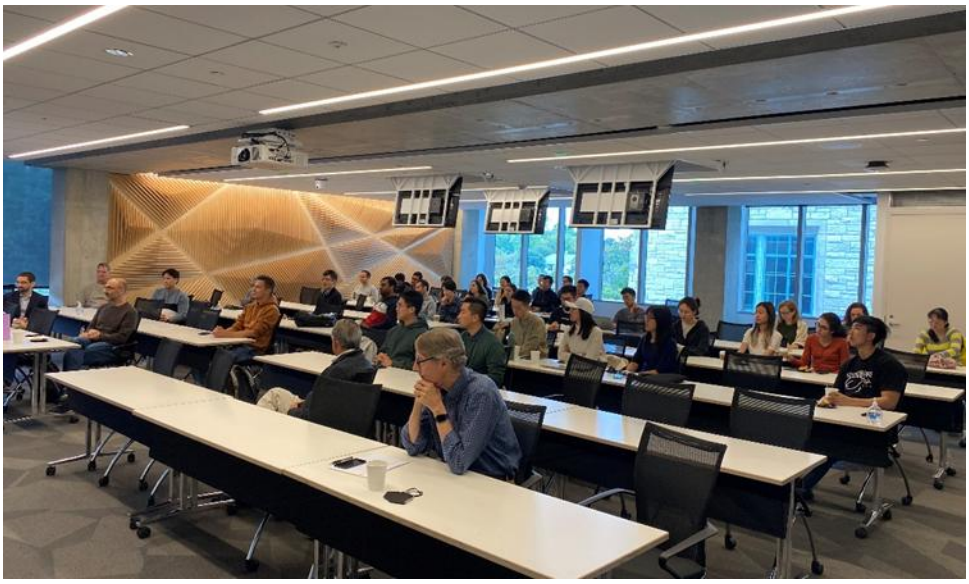
When a student is ready to graduate at the end of a particular quarter, they should file an Application for Degree with The Graduate School online via the Graduate Student Tracking System (GSTS.) Graduation is held in June and December, each year. As long as all the requirements for the PhD have been completed, students may participate in either the June or December ceremony. (Students should consult with their advisor as well as the Graduate Program Coordinator before making their final decision.) The application deadline is usually about two months prior to graduation. (Consult the TGS Academic Calendar for exact dates.)

International Students should be aware of visa requirements if they intend to seek employment in the United States after graduation. Students with F-1 visas should consult information provided by the Office of International Student Scholars (OISS) about optional practical training (OPT; see International Office website). It is important to plan ahead because it can take months for work authorization to be processed.

Other Activities & Events

Brown Bags and Seminar Speakers

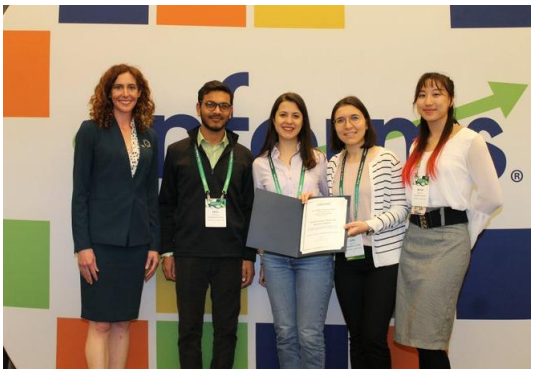
The Department hosts a weekly research seminar. The brown-bag seminar series is designed for first-year students of the PhD program in the IEMS Department. It provides an opportunity for students to meet IEMS faculty members and learn about their research interests and current projects. This provides an opportunity to identify potential advisors and an orientation to the field of IEMS. Attendance is required for all first-year IEMS PhD students, even in the case that the speaker is not a potential advisor for the student.



INFORMS Student Chapter

Northwestern University has a student chapter of the nationally recognized INFORMS organization. The INFORMS student chapter arranges professional development and social events for students. Some of these events are as follows:

- **Graduate Student Research Mixer:** The Graduate Student Research Mixer is an opportunity for IEMS PhD students to present to their peers, in an informal setting, their current research to nurture collaboration between research groups.
- **Panels:** 3-4 panel events throughout the year provide students the opportunity hear from IEMS Alumni, Industry Professionals, Academic Professors, and a Candidacy Panel for 1st years to ask general questions to IEMS 2nd years and above about the Qualifying exam process.
- **Peer mentorship:** Incoming IEMS first-year students are partnered with a current IEMS Student during their first quarter in the fall.
- **Chicago Activities:** Organized tickets to Chicago Cubs games, Chicago Bulls Games, and more.
- **Cultural Snack Hours:** quarterly events where IEMS Students can socialize and share snacks from around the world.
- **Game Nights**: Quarterly Game nights organized for IEMS Students to socialize overboard games and pizza.



Internships

After their first year in the program, students may take on internships with outside organizations. Interning students do not receive funding from IEMS but are supported by the internship instead. It is especially common

to do internships during Summer quarter if other funding is not available. Internships in a quarter other than Summer quarter may be possible, but are rarely appropriate. Students should consult their advisors before making internship arrangements. Students can find internships on their own, get advice from their advisors, or peers in the INFORMS student chapter, or visit the Career Advancement Office in McCormick.

The Crown Family Internship Registration: Students who are on full-time internships and not taking classes, should apply and register for the The Crown Family Internship. This is a non-credit course which allows students on internship to maintain their student status within the University. International students should be aware of visa requirements if they intend to seek employment in the United States **including internships**. Students with F-1 visas should consult information provided by the International Office about Curricular Practical Training (CPT). **It is important to allow adequate time for processing.**

Degree Milestones

Year One

1. Completion of Core Courses

First-year PhD students must take a total of 12 courses, consisting of three core courses, two advanced core courses, two research-based courses, and five other courses chosen from the lists of advanced core, application, or elective courses. Elective courses are relevant; graduate-level courses offered throughout the university. Students must choose electives from the approved list. Their advisor (or the Director of Graduate Studies) should approve the selection prior to student registering for the course (see Appendices A and B).

The course work for the first year includes the following:

(i) Three Core Courses:

- IEMS 401 Applied Mathematical Statistics
- IEMS 450-1 Mathematical Optimization I
- IEMS 460-1 Stochastic Processes I

(ii) Two Advanced Core Courses:

Two from the following four courses:

- IEMS 402 Statistical Learning
- IEMS 450-2 Mathematical Optimization II
- IEMS 460-2 Stochastic Processes II
- IEMS 435 Introduction to Stochastic Simulation

(iii) Two Research Courses:

Students must complete two research-based courses, IEMS 499 Independent Study, in their first year. Only one IEMS 499 course may be taken per quarter. Students must first receive approval from the faculty member with whom they wish to take the course to register for these courses. At the end of each quarter, students must submit their reports to their advisors to receive a grade. Students should also send a copy of the report to the IEMS Graduate Program Coordinator.

(iv) Five Other Courses:

The remaining five courses can be taken from the lists of advanced core courses, application courses, and approved elective courses (see Appendix B).

In addition to the above courses, all students are required to take Real Analysis course in fall quarter as pre-requisite for core and advanced core courses.

2. Completion of RCR Course and Online Training

As part of the McCormick policy for Responsible Conduct of Research (RCR) Training, students must fulfill two requirements:

1. **Online Course:** Complete 9 modules of the online CITI course before the beginning of Fall quarter of the first year and obtain a passing grade of at least 80% on each module. To begin, see https://www.citiprogram.org/. Return certificate of completion to the Graduate Program Coordinator before the last day of Fall quarter.
2. **Complete McCormick Course GEN_ENG 519 before the end of the first year.**

3. Candidacy Exam and Continuation in the PhD Program.

Candidacy exam consists of two components: (i) performance in core courses, and (ii) performance in the oral exam.

1. **Performance in Core Courses:**
   During their first year, students must maintain a Core GPA of 3.3 or higher in five courses: three core courses and two advanced core courses. If a student takes more than two advanced core courses during the first year, the two highest grades from those courses will be used to calculate the Core GPA. Failure to achieve a Core GPA of at least 3.3 will result in dismissal from the program.
2. **Performance in the Oral Exam:**
   The oral exam is offered in June of each year. Students must take the exam during the first offering after completing the five core and advanced core courses. For students who begin in the fall quarter, the candidacy exam must be taken in June of their first year in the program.

The oral exam is a two-hour exam administered to individual students by committees of at least three IEMS faculty members. The exam is based on the student's review and presentation of one of a selection of papers provided by IEMS faculty. A student is also required to submit to their committee a short-written report on the paper prior to the oral examination. Guidelines for the oral presentation and written report are communicated in advance. In the above, the phrase "IEMS faculty member" means any graduate faculty member with at least a 20% appointment in IEMS.

Evaluation at the End of the First Year

After the oral exam, the IEMS faculty evaluates the overall performance of each student. This includes performance on the two components of the candidacy exam, as well as the student's research potential evaluated through the two IEMS 499 course reports, among others. There are four possible outcomes of the evaluation after the candidacy exam:

- **Invitation to continue in the PhD program:** This is the normal outcome.
- **Invitation to continue in the PhD program, with conditions:** The student can continue temporarily in the PhD program but will be dismissed from the program unless specified conditions are met. The conditions are determined as warranted by the individual student's unique record. Possible conditions include earning adequate grades in additional courses, performing satisfactorily on another candidacy exam, finding an advisor, and completing English requirements.
- **Dismissal from the PhD program, eligible for MS degree:** The student is dismissed from the PhD program effectively immediately. However, the performance on the candidacy exam was sufficient to grant an MS degree once the other requirements for the MS degree are satisfied.
- **Dismissal from the PhD program, ineligible for MS degree:** The student is dismissed from the PhD program effectively immediately and cannot receive the MS degree.

MS Degree Conferral

The requirements for the Master of Science in IEMS are: (i) Twelve credits of graduate coursework taken for a letter grade (not P/No P), including the five core and advanced core courses; (ii) A GPA of at least 3.0; and (iii) Satisfactory performance on the oral exam. If a student's overall performance is not sufficient to continue in the PhD program, then the candidacy exam performance will be evaluated according to the standard criteria for awarding a Master's degree. An IEMS PhD student who has satisfied these requirements and wants to be awarded the MS degree must log into the Graduate Student Tracking System and fill out the Master's in Primary PhD form. Following approval of this form,

applicants will subsequently submit the Application for Degree and Master's Degree Completion forms via GSTS. All three forms must be submitted to be awarded the degree.

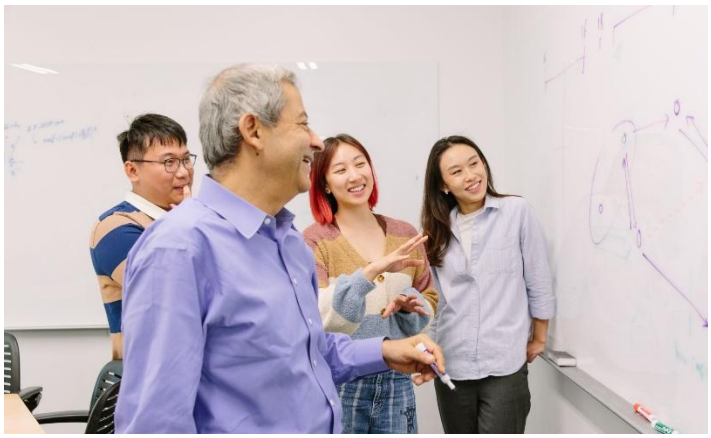
Year Two

Research, Advisor, and Committee

By the end of June of the first year, at latest, each student should have an advisor and begin research leading towards a dissertation. Students are free to change advisors but must consult the Director of Graduate Studies (DGS) before doing so. Students who fear that their current advising relationship is not helping them achieve satisfactory progress towards the dissertation should discuss their goals and progress with their advisors and consult the DGS if problems persist. Students are encouraged to form the prospectus committee by the end of the second year. They should seek guidance from all committee members and learn their expectations while research is in progress.

Teaching Requirements

TGS requires that all PhD students serve in some instructional capacity for at least one academic quarter during their graduate education at Northwestern University. This requirement is usually fulfilled by IEMS PhD students through service as a teaching assistant in an IEMS course. For details on IEMS expectations of teaching assistants, please review the IEMS Department responsibilities and expectations for teaching assistants (Appendix E).



FERPA Online Training: (Required)
The Family Educational Rights and Privacy Act (FERPA) defines student educational records and directory information, outlines students' rights, and governs who may access the information and under what circumstances. FERPA Training is required to be completed before working as a Teaching Assistant or Grader and can be completed here: https://www.northwestern.edu/ses/staff/ferpa-policy.html

English Proficiency: Please see http://www.tgs.northwestern.edu/funding/assistantships/graduate-and-teaching.html on The Graduate School's requirement regarding spoken English proficiency. International students should be sure to satisfy this requirement by the end of the first year in the program. Because spoken English proficiency is a TGS requirement to receive financial aid as a teaching assistant, the IEMS Department's guarantee of financial aid to an international PhD student is valid after the first year only if this spoken English proficiency requirement is satisfied.

Year Three

Prospectus

Students present a prospectus once they have finished an initial part of their dissertation research and can present their ideas about the next steps. This must happen by the end of the third year. The prospectus exam requires a research document, an oral presentation, and approval by a committee chosen by student and advisor. The research document must be submitted to all members of the prospectus committee at least two weeks before the prospectus exam. The exam should include at least one completed paper (preferably submitted) and ideas for future research. The exam is open to all IEMS faculty and PhD students who wish to attend.

Prospectus Committee: A student's Prospectus committee is chaired or co-chaired by the student's advisor. Two or more additional committee members are chosen by the advisor in consultation with the student. At least two committee members, including the chair or a co-chair, must be full or joint IEMS faculty. The committee must include at least one member whose primary affiliation is outside the IEMS department. Often, this member is also from outside the university. The prospectus exam must be conducted in person, and both the student and all committee members are expected to attend in person. If an external committee member is unable to be physically present and must participate virtually, the student must obtain prior approval from the Director of Graduate Studies.

Preparation Prior to Prospectus: The student must complete the following steps at least one week before the prospectus exam:

1. Log into the Graduate Student Tracking System (GSTS) fill out the PhD Prospectus form in the TGS Forms tab and notify the Graduate Program Coordinator. The Graduate Program Coordinator will verify that the committee meets the requirements stated above; if not, the committee will need to be changed before the exam can take place.
2. Notify all IEMS faculty and PhD students by email about the date, time, and location, title, and short abstract, two weeks in advance.
3. Send the written report to all committee members two weeks before the exam.
4. The student must complete the Course Verification form (Appendix F) and sign it, along with their advisor, and submit it to the Graduate Program Coordinator. The purpose of this is to ensure that the student is on track to fulfill coursework requirements before graduation.

Prospectus Exam: There are three possible outcomes when the prospectus exam takes place:

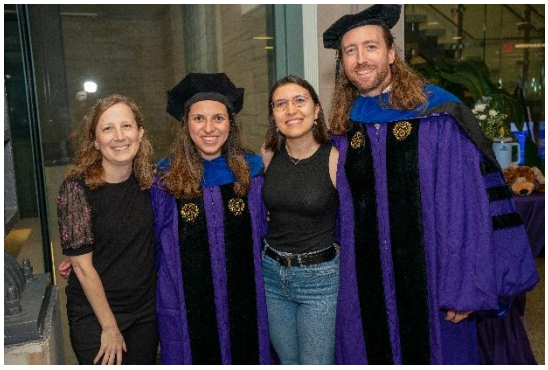
1. **Pass**: With the unanimous agreement of the committee members, the student has satisfied the prospectus exam requirement.
2. **Pass with conditions:** The committee members unanimously agree that the oral component of the prospectus exam was satisfactory. However, some or all of them require changes to the prospectus document before giving final approval. Once changes are made to the satisfaction of a committee member, they will notify the Graduate Program Coordinator that all requirements have been met. Once unanimous support has been achieved, the student has satisfied the prospectus exam requirement.
3. **Fail**: At least one committee member declines to endorse the passage of the exam on the grounds that the student's performance was unsatisfactory. The student must do another prospectus exam to satisfy the prospectus exam requirement.

The Graduate Program Coordinator will reach out to each of the committee members after the exam has been completed to assess the student's performance.

A student who did not pass the prospectus exam can schedule another prospectus exam, in consultation with the advisor. There is no penalty for failing a prospectus exam. There is only the requirement to pass a prospectus exam by the end of the third year. If this is not done, the student will be placed on academic probation, as described here, which will result in eventual dismissal if the prospectus exam is not passed. So as to leave time for changes to the prospectus document or a second prospectus exam, the prospectus exam should be scheduled well before the end of the third year.

In case of failing the prospectus exam if the student and advisor disagree with the judgment of a committee member, if need be, they can change the composition of the committee for the next prospectus exam. If the student disagrees with the advisor's judgment that the student failed the exam, and cannot resolve the situation through mutual discussion, the student should discuss the situation and a possible change of advisor with the DGS.

Electronic Participation and Approval: The prospectus exam should be in person, with all committee members physically present. If an outside committee member cannot participate in person, the student must receive approval from the DGS to participate electronically.



Year Four and Beyond

Dissertation Defense

The dissertation is normally completed and defended during the fourth or fifth year. It must be defended at least 3 quarters after the prospectus exam. The procedures and rules governing the dissertation defense are the same as those for the prospectus exam, with the following differences:

1. Instead of the research document for the prospectus exam, there is the dissertation.
2. The IEMS deadline for passing the prospectus exam is not relevant; instead, the TGS deadline of 9 years for completing the PhD applies.

Steps to complete Defense:

1. Log into the Graduate Student Tracking System (GSTS) fill out the Application for Degree (AFD), and notify the Graduate Program Coordinator.
2. Work with your committee and Advisor to schedule a date for the defense. (steps continued on next page)
3. Log into GSTS to complete the PhD Final Exam Form (PFE). This form is submitted after the defense is completed and dissertation is formatted correctly and uploaded into ProQuest.

4. Notify all IEMS faculty and PhD students by email about the defense exam, with a title, abstract, time, date, and location of the exam. The exam is open to any of them who wish to attend.

Final Copy of the Dissertation: Once the committee approves the Dissertation (including any necessary edits and changes) and the Oral Defense, the Final Copy of the Thesis/Dissertation is submitted on-line via the ProQuest system. Once the dissertation has been approved by its committee and all edits and revisions are complete, the student must submit an electronic version of the paper online via UMI/ProQuest. See this page for information on formatting guidelines and copyright laws and regulations.

Notification of Academic Progress

Review

Satisfactory academic progress is assessed in two ways: completion of milestones by deadlines, and satisfactory research progress based on advisor's evaluation. The milestones of candidacy, prospectus, and defense exams were described above. The advisor's evaluation of research progress takes two forms: annual review and timely notification of unsatisfactory progress.

Requirement to Have an Advisor

Beyond year one, every PhD student must have an advisor. If a student's advisor chooses to stop advising the student, the advisor should notify the Director of Graduate Studies (DGS). A PhD candidate should see the DGS for help if they have trouble finding an advisor, lose an advisor, or believe that their advisor is not doing enough to help the student achieve satisfactory academic progress. A PhD candidate who does not have an advisor must find an advisor within three months of learning of the need to find a new advisor. The new advisor should notify the DGS of the new advising relationship. After three months have elapsed without having an advisor, a PhD candidate will be excluded (dismissed) from the program immediately.

Review by Advisor of Research Progress

By the end of the week after finals week each Spring quarter, each student must fill out an annual report on their progress in the Graduate Student Tracking System. The advisor will review the report and provide written comments. The DGS will review the report and comments. By the end of Summer quarter, the DGS will notify students as to whether their progress is satisfactory or unsatisfactory.

If, at any time, the advisor judges that the student's research progress is persistently unsatisfactory, the advisor will notify the DGS and provide a written description of the problem. The judgment as to whether research progress is satisfactory must take into account the student's academic progress towards degree requirements not involving research, e.g., in fulfillment of coursework or teaching requirements.

The DGS will review the information provided in the annual review and its comments, or in a notification of unsatisfactory progress, and consult with the advisor and student about the situation. Then the DGS will decide whether to put the student on probation. If so, then the DGS, in consultation with the advisor, will give the student written information as to what future progress, within what timeline, would be considered satisfactory. The advisor should provide supporting documentation of the existence of the problem, if any. Such supporting documentation could include notes from meetings of the advisor and student, emails, and the student's written research notes or products. Documentation is best able to demonstrate that progress was unsatisfactory if it states expectations for progress and demonstrates that they were not met. Advisors are urged to document expectations clearly, for each week, each quarter, or both.

The progress of a student who is on probation will be reviewed quarterly by their advisor. If the advisor judges the progress to be satisfactory, they will notify the DGS, who will remove the student from probation. If the advisor judges the progress to be unsatisfactory, they will provide the DGS with documentation of the unsatisfactory progress. The DGS, after consultation with advisor and student, will decide whether to remove the student from probation. If the student is not removed from probation within the timeline specified by TGS, the student will be excluded (dismissed) from the program.

Appeals

An appeal of the decision to put a student on probation would go to IEMS Graduate Committee. The petitioner must submit their appeal to the Graduate Committee members, including the DGS, within 10 days of receiving the notification from the DGS of the finding of unsatisfactory progress. The Graduate Committee, including the DGS, will deliberate on the appeal. The appeal is decided by a vote of the Graduate Committee members, excluding the DGS and the student's advisor (if the student's advisor is on the Graduate Committee). If the number of votes to rescind the decision to put the student on probation is strictly greater than the number of votes to sustain the decision to put the student on probation, then the decision is rescinded. Otherwise, the decision is sustained and the student will be put on probation.

An appeal of the final decision to exclude a student who has been on probation goes to TGS. TGS policies on satisfactory academic progress, described here, govern this appeals process. They also impose other criteria for satisfactory academic progress, including standards for minimum GPA, maximum number of incomplete grades, and maximum length of time to complete the PhD program.

Student Affairs

Academic Integrity

Academic Integrity Policy

The following academic integrity policy applies to all PhD courses in the IEMS Department, unless the instructor specifies an alternative policy in writing.

No sharing of course materials: Students may not receive course materials of any kind, except from the instructor. Students who have previously taken a course may not give course materials to students who have not yet taken the course. Course materials include, but are not limited to: homework assignments, homework solutions, examinations, examination solutions, and lecture notes.

Submitting One's Own Work: Unless the instructor's alternative policy forbids it, it is permitted to collaborate on homework problems with other students who are enrolled in the course at the same time. Unless the instructor's alternative policy allows it, it is forbidden to collaborate on any other submissions that affect the course grade, or use any Generative AI such as ChatGPT or similar tools. It is also permitted for students to receive assistance in learning the subject matter from others. However, students may not receive assistance on their assignments from anyone who is not involved in the course currently, including students who took the course previously. Students may not show written solutions or computer programs to other students, nor may they look at others' written solutions or computer programs. Mere similarity of the homework submissions of students currently enrolled in the course is not evidence of a violation of this policy, because it can arise from legitimate collaboration.

Examinations: During examinations, students may not discuss anything in the examinations with anyone other than instructor. This includes take-home examinations. "During the examination" means between the time the examination has been distributed and the time the examination is due, including any extension of time to complete the exam.

Plagiarism: Northwestern University's Principles Regarding Academic Integrity define plagiarism as "submitting material that in part or whole is not entirely one's own work without attributing those same portions to their correct source." Plagiarism is forbidden in any work that students submit for courses, as well as in research. Students may submit work that relies on published sources, but they must cite these sources correctly. The Office of the Provost and The Writing Place have provided guidelines for avoiding plagiarism.

Do Not Suggest Violating the Rules: It is a violation of this policy to ask others to violate the rules in this policy or to offer to violate them.

Clarification: A violation of this policy is not excused if a student misinterpreted the policy.

Adjunction: Allegations of academic dishonesty are referred to The Graduate School, whose process for handling them is found here. This applies to those who provide help to others in violation of the policy as well as those who receive help in violation of the policy.

Reasons for the rules:

- Sharing course materials may interfere with accurate assessment by the instructor; an example in the lecture notes one year may become a homework problem another year. Sharing course materials among students may create unfair disadvantages for students who do not have access to materials that some of their peers have. Instructors should provide students with adequate study materials, including practice exam problems. Students who want more course materials to assist in their studies should ask the instructor directly.
- Voluntary collaboration on homework among students enrolled in a course is encouraged because it often helps learning. However, it is not collaboration when a student uses written solutions or computer programs prepared by someone else. It is also not collaboration when a student gets help from someone who is not involved in the course. It is beneficial when others in the University help a student learn, but receiving help on any graded submissions

from someone who is not involved in the course can too easily undermine the learning that takes place when working on them. Students who need help that they cannot get from voluntary collaboration with other students in the course should get help from the instructor in office hours. Instructors usually want to evaluate students' submissions other than homework (e.g., projects, reports) on the assumption that they represent independent effort, but instructors may sometimes choose to allow collaboration on such submissions.

- Examinations are a very important part of the instructor's evaluation of the student's learning. Any communication with others during the exam calls into question the integrity of the evaluation.
- The ability to cite others' work appropriately is an important professional skill, and plagiarism is a serious form of professional misconduct. Students must practice appropriate citation consistently, in coursework as well as in research.
- Behavior such as asking to see another student's homework solutions or offering to help another student on a take-home examination damages the Department's culture of academic integrity. It makes honest students fear that their honesty puts them at a disadvantage, and it tempts students to break the rules by making them suspect that others are breaking the rules.
- A student who is uncertain about whether something is permitted under this policy should not do it until they have learned that it is permitted by consulting with the course instructor or with the Director of Graduate Studies.
- It is the policy of The Graduate School to investigate and adjudicate alleged violations of academic honesty involving its students.

Leave of Absence

General Information

Leaves of absence are defined as a temporary separation from the University for a minimum of one quarter and a maximum of one year. For more information, please review the TGS Leave of Absence Policy.

Students who need time away extending beyond reasonable sick or vacation time should connect with TGS Student Services and Student Assistance and Support Services (SASS) to explore leave options. If a student has an accommodation request, they should work with AccessibleNU or the Office of Civil Rights and Title IX Compliance.

Parental Leave

General Information

The Graduate School's childbirth accommodation policy applies to enrolled (active) graduate students prior to or following the birth or adoption of a child. Graduate students who meet this requirement and wish to use the Parental Leave should refer here for more details on TGS's policy.

Nondiscrimination Statement

General Information

Northwestern University does not discriminate or permit discrimination by any member of its community against any individual on the basis of race, color, religion, national origin, sex, pregnancy, sexual orientation, gender identity, gender expression, parental status, marital status, age, disability, citizenship status, veteran status, genetic information, reproductive health decision making, or any other classification protected by law in matters of admissions, employment, housing, or services or in the educational programs or activities it operates. Harassment, whether verbal, physical, or visual, that is based on any of these characteristics is a form of discrimination. Further prohibited by law is discrimination against any employee and/or job applicant who chooses to inquire about, discuss, or disclose their own compensation or the compensation of another employee or applicant.

Northwestern University complies with federal and state laws that prohibit discrimination based on the protected categories listed above, including Title IX of the Education Amendments of 1972. Title IX requires educational institutions, such as Northwestern, to prohibit discrimination based on sex (including sexual

harassment) in the University's educational programs and activities, including in matters of employment and admissions. In addition, Northwestern provides reasonable accommodations to qualified applicants, students, and employees with disabilities and to individuals who are pregnant.

Any alleged violations of this policy or questions with respect to nondiscrimination or reasonable accommodations should be directed to Northwestern's Office of Equity, 1800 Sherman Avenue, Suite 4-500, Evanston, Illinois 60208, 847-467-6165, equity@northwestern.edu.

Questions specific to sex discrimination (including sexual misconduct and sexual harassment) should be directed to Northwestern's Title IX Coordinator in the Office of Equity, 1800 Sherman Avenue, Suite 4-500, Evanston, Illinois 60208, 847-467-6165, TitleIXCoordinator@northwestern.edu.

A person may also file a complaint with the Department of Education's Office for Civil Rights regarding an alleged violation of Title IX by visiting https://www.ed.gov/laws-and-policy/civil-rights-laws/file-complaint/discrimination-form-us-department-of-education or calling 800-421-3481. Inquiries about the application of Title IX to Northwestern may be referred to Northwestern's Title IX Coordinator, the United States Department of Education's Assistant Secretary for Civil Rights, or both.

Probation and Exclusion

General Information

The Department of Industrial Engineering and Management Sciences (IEMS), McCormick School of Engineering and Applied Science, and The Graduate School (TGS) may place students on academic probation or exclude students from the program.

Probation

A student placed on probation will work with the Director of Graduate Studies (DGS) and their advisor to receive written requirements and a specific timeline detailing what future progress is required to return to good academic standing. Students who violate the University's Code of Conduct are subject to the University's formal conduct process administered by the Office of Community Standards.

IEMS PhD students may be placed on probation for a designated timeframe (a minimum of one academic quarter) based on concerns related to academic performance or degree progress. The exact length of the probationary period and the specific deadline for remediation will be determined by the DGS, in consultation with the student's advisor, and will depend on the nature and severity of the concern. Progress will be reviewed on a quarterly basis. Academic progress concerns include, but are not limited to:

- **Failure to Pass Milestones:** Failure to pass the Prospectus Exam by the end of the third year.
- **Unsatisfactory Progress:** Failure to make satisfactory degree progress, as identified through annual or quarterly academic progress reviews.
- **Training Non-Compliance:** Failure to complete mandatory Responsible Conduct of Research (RCR) training by the end of the fourth quarter.

Failure to return to good academic standing by the specified deadline will result in eventual exclusion (dismissal) from the program.

Exclusion

In addition to failure to satisfy probation requirements, certain situations will result in immediate exclusion from the program without a prior probationary period:

- **Failure to Secure an Advisor:** Failure to secure a primary research advisor by the end of June of the first year.

- **Loss of Advisor:** Failure to secure a new primary research advisor within three months of an advising relationship ending.
- **Candidacy Exam Performance:** Academic dismissal resulting from first-year candidacy evaluation or failure to satisfy the specified conditions of a conditional invitation.
- **Failure in Prospectus Exam Retake.**

Students who are excluded from the IEMS PhD program following program-level probation can file an academic appeal to TGS. The exclusion decision is final and cannot be appealed if TGS excludes a student for failure to meet TGS' own criteria for satisfactory academic progress (such as minimum GPA standards, maximum incomplete grades, or the 9-year degree completion deadline) and the student has failed to remediate within the TGS probationary period. In such cases, exclusion takes effect immediately.

Financial Support

Financial Aid

The IEMS Department's commitment to provide funding for each student is contained in offer letters sent to each student individually upon acceptance to the program. The most common funding package covers tuition and stipend for Fall, Winter, and Spring quarters for up to five years of PhD study. The Department's goal is to enable students to devote their full efforts and attention to completing the PhD without being concerned about securing funding. All funding is conditional on satisfactory progress in the program and the availability of funds.

Students who need funding after the Department's commitment has expired are encouraged to inform their advisors about their needs as soon as possible and attempt to secure research assistantships through their advisors. The decision about providing Department funding that does not come from the advisor depends on funding availability, the student's progress, and the student's suitability for the available graduate assistantships or instructorships. For this reason, the Department may not always provide support in the form most preferred by the student and advisor. For example, even if the advisor is willing to provide a research assistantship, it may be necessary for the Department to offer a student a less-preferred form of support for purposes of managing the total supply of funding, providing teaching assistants for all classes and research assistants for all projects that need them, etc.

Fellowships

Students are encouraged to seek out other funding opportunities for themselves. These include Terminal Year Fellowships available from McCormick or fellowships from centers at Northwestern such as the Transportation Center. There are external fellowships such as those offered by Fulbright and Microsoft. Other fellowships are for students from particular countries, such as the National Science Foundation Graduate Research Fellowship in the United States. Benefits of earning such fellowships can include prestige, summer funding, and the assurance of being able to devote full time to one's own research when supported by a fellowship and not needing to rely on a graduate assistantship provided by the Department, which may entail duties not related to one's research.

Instructors

For students interested in teaching, the Department may be able to offer an instructorship. Instructor positions are awarded on an as-needed basis. To become eligible for an instructorship, students should arrange to be evaluated as guest lecturers in a class (see Teaching Requirements on page 11 for details).

Outside Employment

University funding is provided to enable students to devote full-time effort to graduate study. As such, students agree not to hold outside employment when receiving financial aid. International students are subject to visa restrictions on employment outside of Northwestern.

In instances where the University is unable to provide financial assistance (e.g., advanced students completing the dissertation), it is recognized that students may need to secure part-time employment. Completion of degree requirements, however, should remain the top priority and a full-time pursuit. Holding full-time employment while trying to complete dissertation research is strongly discouraged, because it tends to lead to low productivity, excessive delays, or even failure to complete the program.

IEMS Department Professional Membership Policy

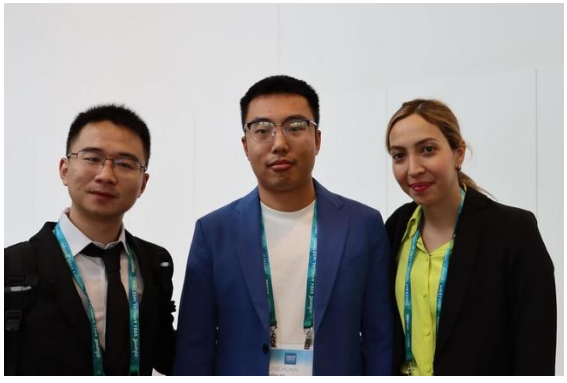
The Department of Industrial Engineering and Management Sciences encourages its PhD students to pursue membership in a relevant professional society as a means of expanding their research knowledge and contacts. Depending on funding availability, the Department may support student membership in a professional society as stipulated in the student's offer letter. Any additional expenditures must be funded by a PI or by the student. Please note that students are only eligible for this program in their first five years as a PhD student in the IEMS Department, and students in their sixth year of study and beyond will need to secure an alternate source of funds.

IEMS Computer Policy

The IEMS Department recognizes that many of its students require specialized computing resources in order to carry out their research. PhD students entering the program are provided the use of a personal desktop computer during their first year, and the specifications of this computer are designed to meet the requirements of all IEMS core courses. Depending on funding availability, the Department may provide computing equipment support as stipulated in the student's offer letter. If available, this funding can be used to purchase computers and related supplies directly applicable to the student's research, with applicability reviewed by the Senior I.T. Consultant prior to purchase. Students who wish to exceed the budget allocated for them are welcome to do so, and must present a personal check for the overage directly to the Graduate Program Coordinator prior to the completion of the order. Students who leave the program without a PhD degree must return all materials purchased with the computer funding allocation to the Senior I.T. Consultant prior to leaving campus. Please feel free to contact the Graduate Program Coordinator with any questions regarding this policy.

Conferences and Workshops

Depending on the availability of funds, IEMS department allocates travel funds to each student for use throughout their graduate career, as stipulated in the student's offer letter. These funds, along with the TGS Travel Grant, can be used to fund travel to domestic and international conferences. Please check with the Graduate Program Coordinator for exact details and restrictions. Ph.D. students may also receive funding from their dissertation advisors for conference travel.



TGS Travel Grant: The TGS Conference Travel Grant provides funds to assist PhD students traveling to conferences and/or seminars on behalf of the University. The award is not intended to support attending courses at other schools, research or general educational travel. TGS permits students to make use of this program twice during their careers at Northwestern

The TGS Conference Travel Grant application and deadlines can be found here: https://www.tgs.northwestern.edu/funding/fellowships-and-grants/internal-fellowships-grants/conference-travel-grant.html

IEMS Travel Funds: The IEMS Department provides travel funds to IEMS PhD students under the following rules.

1. A student must apply for approval prior to travel to each conference. The application must be approved by the student's advisor and the IEMS Graduate Program Coordinator and the IEMS Financial Administrator.
2. A first-year PhD student has a budget stipulated in their offer letter for use over their career in IEMS. The number of conferences is unlimited, and the money may be combined with funds from TGS, the student's advisor, or other sources.
3. A per conference limit of $1500 applies to reimbursable expenses for combined funds from IEMS and TGS.
4. A student cannot exhaust their IEMS travel fund allocation prior to exhausting their funds from TGS. (Simultaneous exhaustion is okay.)

Dependent Care Grant: The TGS Dependent Care Grant provides funds to assist PhD students, with dependents, so that they may participate in professional development opportunities. Please refer to the TGS website for application deadlines and eligibility requirements.

The Department

Department Chair

Professor Simge Küçükyavuz

Director of Graduate Studies

Professor Seyed Iravani

Staff

Business Administrator
Kendall Minta
Budget Oversight
Staff Management
Planning and Analysis

Financial Administrator
Colleen Sweeney Walker
Payroll
Purchasing

Graduate Program Coordinator
Charlotte Dezen
Admissions and Recruitment
Graduate Student Support

Senior Research Administrator
Rebecca Kell
Sponsored Funding Proposal Preparation
Post-Award Management

Program Assistant
Nathan Keiller
Event Planning
Seminar Coordination
Assistant to the Chair

Information Technology Consultant
McCormick IT
Information Technology Support
Computer Purchasing
Department Computer Lab Management

Graduate Faculty

Bruce Ankenman
Daniel Apley
Minshuo Chen
Noshir Contractor
Izzy Grosof
Seyed Iravani
Diego Klabjan
Simge Küçükyavuz
Yiping Liu
Sanjay Mehrotra
David Morton
Jorge Nocedal
Chang-Han Rhee
Naichen Shi
Sean Sinclair
Karen Smilowitz
Dashun Wang
Zhaoran Wang
Ermin Wei

INFORMS Student Board

The NU INFORMS Student Chapter is a student-run organization, which serves the students of the Industrial Engineering and Management Sciences Department at Northwestern University. The INFORMS Student Chapter provides opportunities for academic, professional and personal development. The chapter organizes brown bags, career panels and social events throughout the year and assists the Department to build a friendly environment. https://informs.iems.northwestern.edu/

Appendices

Appendix A
Elective Course Approval Form
(This form must be completed and submitted before the Prospectus exam)

Student Name: _____ **Student ID**: _____

Advisor(s) Name(s): _____

Entrance to PhD Program: Fall 20_____ DATE: _____ /_____ /_____

Dring their first three years, PhD students must complete five elective courses from the list of approved electives (see Appendix B). These courses can be chosen from one or more of the following areas: Analytics, Stochastic Analysis and Simulation, Optimization, Financial Engineering, Logistics and Operations, Healthcare Engineering, Applied Statistics and Statistical Learning, and Management Science. Students must consult with their advisors and receive their approval before registering for a course. Students and their advisors must complete this form.

Title of Major (Optional)

Students must select five elective courses that align with their research. These courses may constitute a student's PhD major. Although optional, advisors and students are encouraged to choose a title for the major. The title may be one of the above areas (e.g., "Optimization"), a combination of these areas (e.g., "Operations Models of Healthcare Engineering"), or a title reflecting the theme of the five courses. Having a titled major on a student's resume provides a clearer picture of their education and expertise.

Major Title: _____

Five Courses of the Major:

List the courses you took or are planning to take to fulfill the elective (major) requirement. For each course, explain how it relates to your dissertation goals.

COURSE 1:_____Instructor: _____ __**Year (quarter) Taken**:_____ **Grade:**:_____
Full Course Title

Reason for taking the course:
……

……
……

COURSE 2:_____Instructor: _____ __**Year (quarter) Taken**:_____ **Grade:**:_____
Full Course Title

Reason for taking the course:
……

……
……

COURSE 3:_____Instructor: _____ __**Year (quarter) Taken**:_____ **Grade:**:_____
Full Course Title

Reason for taking the course:
……

……
……

COURSE 4:_____Instructor: _____ __**Year (quarter) Taken**:_____ **Grade:**:_____
Full Course Title

Reason for taking the course:
……

……
……

(form continued on next page)

COURSE 5:_____Instructor: _____ __**Year (quarter) Taken**:_____ **Grade:**:_____
Full Course Title

Reason for taking the course:
……

……
……

Student Signature:_____ Date:_____

Approval of the Advisor (Advisor must complete below):

I acknowledge that the student consulted with me before enrolling these courses. These courses are beneficial to the student's dissertation and research. Thus, I approve these courses to satisfy the elective (major) requirement.

Advisor Signature: _____ Date:_____

Do not mark below this line – DGS use only

Date Presented to Director of Graduate Studies (DGS): _____

_____ I approve the designed area as listed

_____ I approve the designed area with the following modifications (See below)

Modifications:

_____

_____

_____

Graduate Director Signature:_____ Date: _____

Do not mark below this line – Office use only

Date Processed:_____ Graduate Program Coordinator Signature_____

Appendix B
List of Approved Elective Courses

Five courses in the following areas can be chosen to fulfil the Major in the IEMS PhD course requirements.

- Analytics
- Stochastic Analysis and Simulation
- Optimization
- Financial Engineering
- Logistics and Operations
- Healthcare Engineering
- Applied Statistics and Statistical Learning
- Management Science

Some courses may not appear here, even if they were approved to count towards an area in the past, if they have not been taught in recent years. They may appear in gray if future offerings are in doubt.

Analytics

Major should not include more than two courses from this area:

IEMS Department:

- IEMS 455 Machine Learning
- IEMS 404-1 Predictive Analytics I
- IEMS 404-2 Predictive Analytics II

Machine Learning and Data Science Program

- MLDS 420 Predictive Analytics
- MLDS 421 Data Mining
- MLDS 490-23 Health Analytics and Decision Making
- MLDS 490-21 Predictive Models for Credit Risk Management
- MLDS 490-20 Text Analytics
- MLDS 490 Reinforcement Learning for Artificial Intelligence

Electrical Engineering Department

- ELEC_ENG 435 Neural Networks

Computer Science Department

- COMP_SCI 496: Advanced Topics in Deep Learning

Applied Statistics & Statistical Learning

IEMS Department

- IEMS 404-1 Predictive Analytics I
- IEMS 404-2 Predictive Analytics II
- IEMS 463 Statistical Analysis of Designed Experiments
- IEMS 465 Simulation Experiment Design and Analysis
- IEMS 490 Statistical Learning
- IEMS 490 Uncertainty Quantification

Department of Economics

- ECON 480-1,2,3 Introduction to Econometrics
- ECON 481-1,2,3 Econometrics
- ECON 482 Applied Econometrics: Time-Series Methods
- ECON 483 Applied Econometrics: Cross-Section Methods

Electrical Engineering Department

- ELEC_ENG 433 Statistical Pattern Recognition

Computer Science Department

- COMP_SCI 574 Probabilistic Graphical Models

Kellogg Finance Department

- FINC 520 Time Series Analysis

Kellogg Managerial Economics and Strategy Department

- MECS 577 Introduction to Applied Econometrics 2
- MECS 578 Introduction to Applied Econometrics 3

Statistics Departments

- STAT 325 Survey Sampling
- STAT 348 Applied Multivariate Analysis
- STAT 350 Regression Analysis
- STAT 351 Design and Analysis of Experiments
- STAT 352 Nonparametric Statistical Methods
- STAT 355 Analysis of Qualitative Data
- STAT 356 Hierarchical Linear Models
- STAT 359 (Topics) Data Mining
- STAT 420-1,2,3 Statistical Theory & Methodology
- STAT 448 Multivariate Statistical Methods
- STAT 453 Survival Analysis
- STAT 454 Time-Series Analysis
- STAT 455 Advanced Analysis of Qualitative Data
- STAT 457 Applied Bayesian Inference
- STAT 461 (Topics) Theory of Statistical Data Mining
- STAT 461 (Topics) Advanced Survey Sampling
- STAT 465 Statistical Methods for Bioinformatics and Computational Biology

University of Chicago Statistics Department

- *University of Chicago: STAT 31150 Inverse Problems and Data Assimilation

Financial Engineering

IEMS Department

- IEMS 461 Advanced Stochastic Models
- IEMS 473 Financial Engineering
- IEMS 475 Simulation in Financial Engineering

Electrical Engineering Department

- ELEC_ENG 495 Game Theory and Networked Systems

Kellogg Finance Department

- FINC 585 Introduction to Financial Theory / 485-1 Asset Pricing I
- FINC 587 Dynamic Asset Pricing Theory / 485-2 Asset Pricing II
- FINC 588 Econometrics of Financial Markets

Healthcare Engineering

IEMS Department

- IEMS 443 Health Policy Modeling
- IEMS 444 Health Management Science
- IEMS 445 Decision and Risk Analysis
- IEMS 490 (Selected Topics) Humanitarian and Non-profit Logistics
- IEMS 441 Social Network Analysis

Civil and Environmental Engineering Department

- CEE 377-0: Choice Modeling in Engineering

Machine Learning and Data Science Program

- MLDS 490 (Selected Topics) Healthcare Analytics

Statistics Department

- STAT 453 Survival Analysis
- STAT 465 Statistical Methods for Bioinformatics and Computational Biology

Masters in Public Health Department (Feinberg)

- PUB HLTH 444 Advanced Decision Analysis

Optimization

IEMS Department

- IEMS 451 Stochastic Optimization
- IEMS 452 Combinatorial Optimization
- IEMS 453 Robust Optimization
- IEMS 454 Large-Scale Optimization
- IEMS 455 Machine Learning
- IEMS 457 Integer Programming
- IEMS 459 Convex Optimization
- IEMS 469 Dynamic Programming
- IEMS 490 (Selected Topics) Data-Driven Decisions Under Uncertainty
- IEMS 490 (Selected Topics) Machine Learning
- IEMS 490 (Selected Topics) Robust Optimization
- IEMS 490 (Selected Topics) Stochastic Optimization

- IEMS 490 (Selected Topics) Conic

Computer Science Department

- COMP_SCI 457 Advanced Algorithms

Electrical Engineering Department

- ELEC_ENG 495 Distributed Optimization

Kellogg Managerial Economics and Strategy Department

- MECS 560-1 Foundations of Managerial Economics I: Static Decision Models
- MECS 560-2 Dynamic Optimization

Management Science

IEMS Department

- IEMS 411 Field Research in Organizations
- IEMS 430 Systems Analysis
- IEMS 432 Systems Engineering
- IEMS 433 Theory and Practice of Evaluation
- IEMS 434 Systems Methodology
- IEMS 436 Engineering Project Management
- IEMS 441 Social Network Analysis
- IEMS 490 (Selected Topics) Computational Social Science

Civil and Environmental Engineering Department

- CEE 482 Evaluation and Decision-Making for Infrastructure Systems

Department of Economics

- ECON 414-3 Economics of Information

Kellogg Management and Organization Department

- MORS 524-1 The Individual and the Organization
- MORS 524-2 Social Processes in Organizations
- MORS 525-1 Behavior in Organizational Systems
- MORS 525-2 Organizations in their Environments
- MORS 526-1 Micro-Organizational Research Methods
- MORS 526-2 Macro-Organizational Research Methods
- MORS 522 Economics, Social Psychology and their Experiments

Media Science and Technology (Weinberg)

- MTS 525 (Selected Topics) Peer Production: Collective Action & Organization

Electrical Engineering Department

- ELEC_ENG 495 Game Theory and Networked Systems
- EECS 472 Designing and Constructing Models with Multi-Agent Languages

Logistics & Operations

IEMS Department

- IEMS 482 Routing and Scheduling
- IEMS 489 Transportation Network Design and Operation
- IEMS 490 (Selected Topics) Humanitarian and Non-profit Logistics
- IEMS 490 (Selected Topics) Service Systems

Civil and Environmental Engineering Department

- CEE 471-1,2 Transportation Systems Analysis
- CEE 479 Transportation Systems Planning and Management
- CEE 480-1,2 Travel Demand Analysis and Forecasting
- CEE 482 Evaluation and Decision-Making for Infrastructure Systems

Kellogg Operations Department

- OPNS 521 Foundations of Operations Management
- OPNS 524 Empirical Models of Operations

Electrical Engineering Department

- ELEC_ENG 495 Game Theory and Networked Systems

Stochastic Analysis & Simulation

IEMS Department

- IEMS 451 Stochastic Optimization
- IEMS 461 Advanced Stochastic Models
- IEMS 464 Advanced Queueing Theory
- IEMS 465 Simulation Experiment Design and Analysis
- IEMS 468 Stochastic Control
- IEMS 469 Dynamic Programming
- IEMS 460-2 : Stochastic Processes 2

Department of Mathematics

- MATH 450-1,2 Probability
- MATH 450-3 Stochastic Analysis III
- MATH 455-1,2 Stochastic Analysis

Kellogg Operations Department

- OPNS 522 Queueing Networks: Performance Analysis

University of Chicago

- *University of Chicago Management Science and Operations Management: Queueing Models for Service Operations Management (40911) (Half Credit Course)

Appendix C
Petition to Add a Course to the List of Approved Electives

Instructions: To petition for a course to be added to the list of approved elective courses, students must follow these steps:

- Contact their advisor(s) to obtain approval that the course is a graduate (PhD-level) course.
- Then, complete and submit the form below to the Director of Graduate Studies at least three weeks before the course begins.

Course Number and Name: ……..
Department offering the course: ……
Quarter/Year being offered: ……..

Student *(this part must be completed by the student):*

Title of your Major (optional): **……**

Explain how this course relates to your dissertation (research): **……**
……
……

Advisor *(This part must be completed by the advisor):*

Does this course have significant content at the level of a graduate (PhD) course? Please explain.
……
……
……

What are the contents that are beneficial to the student's dissertation, research progress, and the theme of student's Major?
……
……
……
……
……

Which of the following research areas does this course relate to (Analytics; Stochastic Analysis and Simulation; Optimization; Financial Engineering; Logistics and Operations; Healthcare Engineering; Applied Statistics and Statistical Learning; Management Science). If the course is related to two or more areas, please specify.
……

Student's Name and Signature: …… Date: ……..

Advisor's Name and Signature: …… Date: ……..

Appendix D
Required Course Waiver Request Form

Instructions: Use this form to request a waiver of the requirement that a course be taken for the M.S. or Ph.D. in IEMS, justified by graduate-level coursework previously done at another institution. Submit this form along with documentation of your previous graduate-level coursework, such as transcript, syllabi, course descriptions, and reading lists.

Policies:

- A waiver of a required course does not reduce the total number of courses required for the degree.
- If a core course is waived, you must take another course as a substitute for the waived core course. The substitution is subject to the approval of the Director of Graduate Studies. The substitute course must be in the same subject area and at least as valuable in assessing first-year student achievement.

IEMS course requirement to waive: _____

Substitute course (if applicable): _____

Previous graduate-level coursework:

University	Department	Course #	Course Name	Grade

I request a waiver of the requirement to take the IEMS course listed above. If it is a core course, I understand that I am required to complete the approved substitute course during my first year.

Student Name: _____

Student Signature: _____ Date: _____

I approve the waiver request and, if applicable, course substitution.

Director of Graduate Studies Signature: _____ Date: _____

Appendix E
IEMS Expectations for Teaching Assistantships

In November 2013, The Graduate School endorsed guidelines for expectations regarding teaching assistantships: https://www.tgs.northwestern.edu/funding/assistantships/graduate-and-teaching/

This document outlines the IEMS Department's policy on teaching assistantships within the department. It reiterates some of the TGS guidelines, modifies or clarifies them, and adds further guidelines.

Instructors and TAs should work together as a team to support student learning in their course. If one of them fails to meet the expectations set forth in this document, they should have a civil and candid discussion about how to do so. If they cannot reach an agreement or if problems persist, the IEMS Director of Graduate Studies should be notified (if the TA is an IEMS Ph.D. student).

The department encourages TAs to participate in departmental and university programs that enhance pedagogical knowledge and proficiency. This includes departmental TA training and resources that support students' work as TAs and their development as teachers at the Searle Center for Advancing Learning & Teaching (University-wide) https://searle.northwestern.edu/

Responsibilities of Teaching Assistants

Before the start of each quarter, the IEMS department will send students an appointment letter that clearly explains the responsibilities and duties of a TA. These responsibilities include, but are not limited to, the following:

- Developing keys and rubrics for assigned work.
- Maintaining and updating course management systems (e.g., Canvas).
- Writing homework, problem sets, or exam questions.
- Coordinating guests and invited lecturers.
- Attending or obtaining necessary training (e.g., software packages);
- Supporting instructors in a laboratory setting, which may include writing lab assignments or lessons.
- Attending lectures and providing instruction in a lecture format.
- Proctoring exams.
- Preparing drafts of narrative evaluations and making grade recommendations.
- Tutoring.
- Maintaining and submitting student records (e.g., grades) before the due dates specified by the instructor.
- Meeting with students regarding grade disputes.
- Holding office hours.
- Meeting regularly with the course instructor to request feedback and seek opportunities to continually develop pedagogical proficiencies.

Workload

The TA workload is according to the Collective Bargaining Agreement between Northwestern University and the United Electrical, Radio and Machine Workers of America. See https://www.northwestern.edu/graduate-union-resources/cba-overview/

Students shall not be required to spend more than an average of 20 hours per week on TA activities, and most work assignments should be completed during weekdays from 8:30 a.m. to 5:00 p.m., unless otherwise specified in the appointment letter or agreed upon mutually.

Being Well-Informed

Course Material

Become proficient in the course content and methodologies, using appropriate pedagogical methods. Familiarize yourself with all the material students are expected to learn, including case studies (if applicable), so you can answer their questions. If you are not already familiar with the course content, you may be required to attend lectures. Review all assignments before distributing them to students so that you are prepared to answer their questions.

Procedures
Become familiar with university and college or school policies, requirements, and deadlines pertaining to topics such as academic integrity, safety protocols, and maintaining a diverse and respectful classroom environment, as well as the registrar's procedures and deadlines. The academic integrity procedures applicable to undergraduate engineering courses can be found at:

https://www.mccormick.northwestern.edu/students/academic-integrity.html

If you suspect a violation of academic integrity, alert the instructor immediately.

Helping Students

Office Hours
Hold regular, scheduled office hours. In consultation with the instructor, choose the times of your office hours and publicize them to the class. The TA room (C236) is the usual location, but larger rooms can be reserved if needed because many students may attend office hours at once. If you need to cancel office hours, notify the instructor and students promptly and discuss scheduling makeup office hours.

Other Contact
Students may request meetings with you outside of office hours or ask questions via email. Try to accommodate these requests as long as they do not result in an excessive workload or interfere with your other academic commitments. Encourage students to use office hours to ask questions, bearing in mind that some students may be unable to attend. TAs are expected to respond to student emails within one business day.

Tutoring
No TA may be paid to tutor any undergraduate student in the work of a class taught by that same TA.

Feedback and Evaluation:

At the end of each quarter, TA performance is evaluated in two ways: (i) CTEC and (ii) instructor evaluation.

Course and Teacher Evaluation Council (CTEC)

Students evaluate the TA's performance in their class through the Course and Teacher Evaluation Council (CTEC). Some of the CTEC evaluation questions are:

- Was the TA able to answer your questions?
- Was the TA well prepared for each session?
- Did the TA communicate ideas clearly?
- Did the TA show a strong interest in teaching the course?
- Open-ended question: What are the primary strengths and weaknesses of the TA?

Instructor Evaluation:
Instructors are asked to evaluate their TA's performance by completing a survey from the IEMS department. Some of the survey questions are:

- Did the TA respond promptly to emails and other communications?
- Were the supplemental materials the TA produced of high quality and accuracy?
- Did the TA communicate with you in a respectful and professional manner?
- Did the TA work quickly and efficiently to complete assigned tasks?
- Would you recommend this TA to other instructors? Why or why not?

Feedback and Corresponding Actions:

At the end of each quarter, the IEMS department evaluates the performance of all TAs and identifies three groups:

- **Satisfactory Performance:** These include TAs who performed their duties well. The students with the best performance will be nominated to receive the Best TA Award from the IEMS Department. Also, when teaching opportunities become available, TAs in this group will be given priority to teaching the course.

- **Below Average Performance:** This includes TAs who did not perform at the expected level in some of their duties. The Director of Graduate Studies will meet with these students to provide feedback on their performance.
- **Poor Performance:** This includes TAs who had serious issues performing their duties. These students will receive a warning in an official letter from the IEMS department. Students in this group are asked to: (i) Meet with the DGS to receive feedback about their poor performance. (ii) Develop a plan explaining how they will improve their TA duties and submit it to the DGS. These students will have one more chance to be a TA and must demonstrate significant improvement in their performance. Failure to do so may result in the suspension of the student's financial support through the TA position.

Appendix F

IEMS PhD Student Conference Attendance Approval

If you are an IEMS PhD student and wish to travel to an IEMS recognized conference during your PhD career in the department you are allowed to utilize your **IEMS PhD Travel Fund**. These funds are to be used after your TGS grants have been exhausted or used in lieu of your TGS travel grant if you are not presenting at a conference. All funding is given out at the department's discretion.

To begin, complete this form in its entirety and return to the Graduate Coordinator.

Conference Name:
Conference Location:
Conference Date:
Why are you going to the conference?

Breakdown of Funds:

Airfare	**$**
Hotel	**$**
Conference Registration Fee	**$**
Estimate of Food Costs	**$**
Ground Transportation (Taxi, Uber, Rail, etc)	**$**
Other	**$**
Total:	**$**

Student Name:	**Student Signature:**
Student ID:	**Request Date:**
Advisor Name:	**Advisor Signature:**

Graduate Coordinator Signature:	**Date Submitted to Graduate Coordinator:**

Financial Coordinator Signature:		**Date Approved:**	
		Approved Amount:	

Appendix G
Course Verification Form*

***PhD students who entered the program in Fall 2024 or prior to Fall 2024 may use either this Course Verification Form or the form attached in Appendix H**

This must be completed and signed at the time of your prospectus exam to verify you are successfully progressing towards degree completion. Any courses that have not been completed must be finished by the end of the fourth year of enrollment in the program.

Student Name:		Starting Date:	

Please return this form to the Graduate Program Coordinator at the time of your prospectus exam.

Category	Course	Title	Quarter Taken	Professor	Grade	Anticipated Enrollment Quarter (if yet taken)
Core	IEMS 401	*Applied Mathematical Statistics*				
	IEMS 402	*Statistical Learning*				
	IEMS 450-1	*Mathematical Optimization I*				
	IEMS 450-2	*Mathematical Optimization II*				
	IEMS 460-1	*Stochastic Processes I*				
	IEMS 460-2	*Stochastic Processes 2*				
	IEMS 435	*Stochastic Simulation*				
	IEMS 488	*Economics of Decision Analysis*				
Application Courses	Applied Course 1					
	Applied Course 2					
Major:						
Course 1						
Course 2						
Course 3						
Minor:						
Course 1						
Course 2						

	Date Taken		
Candidacy Exam			
Prospectus Title: (Proposal)			**RESULT (Pass / Fail)**
Committee Members	Chair:		
	Committee Member 1:		
	Committee Member 2:		
	Committee Member 3:		

Student Signature: _____ Date:_____

Advisor Signature: _____ Date:_____

TGS TA Requirement	**Course**	**Course Professor**	**Quarter/Year**	**Results**

Department Signature: _____ Date:_____

Appendix H
Course Verification Form *

***PhD students who entered the program in Fall 2025 or after must use this form.**

This must be completed and signed at the time of your prospectus exam.

Please return this form to the Graduate Coordinator at the time of your prospectus exam.

Student Name:		**Starting Date:**	

Course	**Title**	**Quarter Taken**	**Professor**	**Grade**	**Anticipated Enrollment Quarter (if not yet taken)**
Core Courses You must take all three core courses listed below:					
IEMS 401	*Applied Mathematical Statistics*				
IEMS 450-1	*Mathematical Optimization I*				
IEMS 460-1	*Stochastic Processes I*				
Advanced Core Courses You must take two courses among the following: IEMS 402: Statistical Learning, IEMS 450-2: Mathematical Optimization II, IEMS 460-2: Stochastic Processes II, and IEMS 435: Stochastic Simulation					
Research Courses: You must only take two IEMS 499: Independent Study in two quarters of the first year. Do not take three IEMS 499.					
IEMS 499	*Independent Study*				
IEMS 499	*Independent Study*				
Application Courses: You must take three courses from the list of application courses, along with IEMS 488 (as your third course).					
IEMS 488	*Economics and Decision Analysis*				
Applied 1					
Applied 2					
Elective Courses: You must take five elective courses from the list of Approved Elective courses. Advanced Core Courses can also be used as electives, if they are not used to satisfy the two-course requirement for Advanced Core Courses above.					

Exam	**Date**		**Result (Pass / Fail)**
Candidacy Exam			

Prospectus (Proposal)		*Title:*	
Committee Members	*Co-Chair:*		
	Committee Member 1:		
	Committee Member 2:		
	Committee Member 3:		

TGS TA Requirement	Course	Course Professor	Quarter/Year	Results

Student Signature: _____ Date:_____

Advisor Signature: _____ Date:_____

Department Signature: _____ Date:_____