IEMS Admissions Handbook

Deadline: December 9th, 2024

Northwestern | McCORMICK SCHOOL OF ENGINEERING

Welcome!

Thank you for your interest in Northwestern University's Industrial Engineering and Management Sciences PhD program!

The application deadline for Fall admission is December 9th. The supplemental materials (including transcripts, recommendation letters, test scores, etc.) must be submitted on-line by December 16th. You may not receive full consideration if your materials are late.

Please note:

- We only admit students for the Fall Quarter - please do not apply for any other quarter.
- We do not have an MS program – applications made to an MS program will not be considered.
- Admission decisions are handled centrally in the IEMS department. Please do not contact individual faculty to ask about admissions or funding. Individual faculty are not responsible for providing funding for first-year IEMS PhD students. Contact faculty only if you need to ask questions related to research; this can usually wait until after you have been admitted. The application forms have a space in which you can enter the names of one or two professors whom you might like to have as a research advisor. This enables you to ensure that your application will reach the desk of the appropriate faculty.

Applications to Northwestern University's Graduate School, including applications to the IEMS PhD program, must be submitted electronically, including all supplemental materials. In addition, all fees must be submitted electronically as well - no checks will be accepted.

Please visit the Application Procedures page of our website for more information about the on-line application process.

If you have any questions that you cannot find answers to on the website, please do not hesitate to contact me by e-mail at Brittany.jasin@northwestern.edu.

Best,

Brittany Jasin
Graduate Program Assistant

Program Information

The PhD program in the Department of Industrial Engineering and Management Sciences (IEMS) at Northwestern is designed for analytically talented students who are interested in the creation and development of mathematical and computational tools to solve problems in business, industry, services and government. The department's areas of research excellence include simulation and engineering statistics, the invention of new methodologies for optimization, and the rigorous solution of difficult problems in production, logistics, financial engineering, health care and organizational systems analysis. Department faculty members are world-renowned in their areas of research and have been honored with awards and fellowships from leading professional societies such as INFORMS, IIE and ASA. Many hold appointments on the editorial boards of the flagship journals in their fields, and their research is supported by grants from the Department of Energy, National Science Foundation, National Security Agency, National Institutes of Health, Office of Naval Research, and many industrial sponsors.

The PhD program in IEMS is designed to produce graduates who are intellectually prepared to compete with the very best in the world. Recent graduates have gone on to academic positions in engineering, business, and applied mathematics departments at top schools including Berkeley, Carnegie Mellon, Cornell, Georgia Tech, Johns Hopkins, Purdue, Illinois, and Texas, as well as research positions in outstanding companies such as Amazon, General Motors R&D, IBM, MITRE, RAND Corporation, and United Airlines.. The quality of the department is reflected in its national ranking among the top seven programs.

The IEMS department is part of the Robert R. McCormick School of Engineering and Applied Science, which is an internationally recognized center for research and teaching, with strong focus on inter-disciplinary research. Our faculty also collaborates with the faculty in other schools within Northwestern. For example, Ph.D. students can take courses in Finance, Marketing, and Managerial Economics & Decision Sciences from the Kellogg School of Management, and write theses jointly advised by our faculty and faculty from these departments.

Applicant Criteria and Background

The preferred background for students entering the program is a bachelor's or a master's degree in engineering, science, or mathematics. Entering students will need to have learned the following topics in mathematics and statistics as preparation for core courses in the first year of the program. Therefore, applicants who have not yet learned these topics should register for the appropriate courses during the year in which they apply.

- ***Linear algebra***, at the level of the first two chapters in Strang, *Linear Algebra and Its Applications*, or the first three chapters in Strang, *Introduction to Linear Algebra*: matrix operations, linear transformations, rank, solving systems of linear equations. This material is often found in the linear algebra component of an undergraduate multivariate calculus course, so it may not be necessary to take a course devoted to linear algebra.

- ***Probability with calculus,*** at the level of Ross, *A First Course in Probability*, Pitman, *Probability*, or Durrett, *The Essentials of Probability:* random variables, probability distributions including binomial, geometric, Poisson, exponential, and normal, independence, covariance, conditional probability, conditional expectation, the central limit theorem.

- ***Statistics with calculus,*** at the level of Tamhane and Dunlop, *Statistics and Data Analysis: From Elementary to Intermediate:* sample mean and variance, confidence intervals and hypothesis testing for population means, variances and proportions, based on the normal distribution, the t distribution, the chi-square distribution, and the F distribution, and simple linear regression and correlation.

- ***Mathematical proofs:*** It is best to take a theoretical mathematics course in which students learn to do rigorous proofs. If you do not have the opportunity to do so, we strongly advise you to carefully review Solow's paperback text, How To Read and Do Proofs. A course in real analysis is the ideal preparation, but it is not necessary to take it before enrolling in the program, because Ph.D. students can take Math 321-1 Real Analysis at Northwestern in the fall of their first year.

- ***Computer programming:*** Students should be familiar with computer programming in some language before enrolling in the program, but the particular language is not important. Python, C++, Java, and MATLAB are often used by our students

Admission Criteria

Successful applicants often have many of the following characteristics:

- If applicable, a score of at least 90 on the internet-based ***TOEFL***, 600 on the paper-based TOEFL, or 7.0 on the ***IELTS***. This is a minimum requirement and no exceptions will be made.
- Good grades from a top-tier college or graduate program. It is difficult to give precise guidance about what this means because the grading schemes, curricula, and selectivity of different colleges vary so greatly. However:
- Grades in mathematics, industrial engineering, and computer science are most important. Grades in other engineering and science disciplines are also important. Grades in courses unrelated to engineering are less important.
    - At a top-tier institution, a grade point average of at least 3.7 out of 4.0 or 90 out of 100 is desirable.
    - Most of our students were in the top 2% - 10% of their classes at top-tier institutions.
    - It is very difficult for us to assess whether colleges that are much less competitive than Northwestern University provide an education that prepares students adequately for our program. This makes it difficult for us to offer admission to students at such institutions, even if they have good test scores and perfect grades, unless they have outstanding research accomplishments. The best path to admission to the PhD program in IEMS at Northwestern for such students may be to enroll first in a master's program at a top-tier institution.
- ***Research experience.*** Independent research is better than work as part of a research group. Research outside of class, leading to potential publications (e.g. an undergraduate or master's thesis), is better than a report or project done for a class, but these are better than nothing. Many successful applicants did not have substantial research experience, but most of them were able to demonstrate their potential for research with letters of recommendation.
- ***Letters of recommendation*** that attest to the applicant's potential to grow into an independent researcher and suitability for mathematically challenging PhD coursework.
- A ***statement of purpose*** that demonstrates that the applicant has goals that can be met by completing the PhD program in IEMS.
- Ability to write and speak English well.

Required Standardized Tests

Graduate Record Examination (GRE)

The Industrial Engineering and Management Sciences Department now requires the GRE requirement for Fall 2025 admissions. Any applications received with out the GRE scores will not be considered.

TOEFL or IELTS

For international applicants whose native language is not English, evidence of ability in English must be demonstrated by achieving a minimum score of 90 on the internet-based TOEFL, 600 on the paper-based TOEFL, or 7.0 on the IELTS. Applications with scores lower than those listed above will not be considered. There are no exceptions. This exam requirement is waived only if you will have received, before matriculation, a degree from a university whose language of instruction is English. Northwestern's Graduate School maintains a list of eligible institutions, and their criteria for English language instruction can differ from other institutions. If you believe you qualify for a TOEFL/IELTS waiver, please consult with the Graduate Program Assistant to ensure that you are eligible far enough in advance to schedule a potential test. Be sure to take all needed tests in time for official scores to reach The Graduate School by the application and financial award deadline (December 5th).
Usually, this means taking an examination at least 3 months before the given application deadline.

Score Reporting for TOEFL

The institutional code assigned to The Graduate School at Northwestern by ETS is 1565. If you are taking the TOEFL be sure to include this number on your test form. If your results are not sent to this code, we will not receive them. Official reports must be received before a student can be admitted. Students taking the paper-based TOEFL should reference department code 01. This will ensure that the TOEFL scores are sent to The Graduate School and not the undergraduate college. TOEFL internet-based test takers should, when prompted, request that their scores be sent to the graduate office (not the undergraduate office) and then select the program name that most closely matches their program of interest. If no match is available, the test taker may choose option 99.

Application Materials: Checklist and Advice

All application materials are submitted online via The Graduate School's website. There is an application fee of $95.

Please fill out the online application forms completely and accurately so that we can best process your application. Here are some tips:

- Use the name that appears on your official identification papers.
- List the country of your citizenship, not the country in which you are currently located or in which you attended school.
- Here are two things you can do to help your application to get to the desk of a faculty member who will be best able to evaluate it. These do not represent binding decisions on your part.
  - If you have specific interests within IEMS, indicate an intended specialization, i.e. Financial Engineering. If you are unsure, list undecided as your intended specialization.
  - If you are particularly interested in the research of one or two faculty members, put their names in the appropriate boxes in the online application.
- Please list the other universities to which you are applying and any fellowships to which you are applying. This does not affect the admissions decision, but it helps us to plan the number of admissions offers we make.

Statement of purpose: Your main goal in the statement of purpose is to convince the admissions committee that you have goals that can be met by completing the PhD program in IEMS, that you understand what PhD-level research in IEMS is, and that you have a background that prepares you to do good research in IEMS. (Or, if the admissions committee determines that the program will not help you achieve your goals, you would be better off not being admitted and not wasting your time in the program.) You do not have to have a detailed research plan. It is very important to describe any research experiences you have had: what you did, what the outcomes were, and what you learned about research.

Letters of recommendation: You need at least 2 letters. You can request more letters if they are helpful. A helpful letter is one that provides evidence about your potential to grow into an independent researcher and your ability to handle mathematically challenging PhD coursework. If you have done supervised research, we need to receive letters from your research supervisors. There is no recommendation form – it is up to the letter-writers to choose what to say. Please advise your letter-writers about what information is useful for us:

- An evaluation of the applicant's performance in research, including traits such as ability to work independently, problem-solving ability, depth of insight, appreciation of the big picture, and creativity.
- A comparison of the applicant to students in PhD programs comparable to ours or to students who were admitted to such programs. If the letter-writer is a faculty member in a PhD program comparable to ours, it is especially valuable to us to

hear how likely he or she thinks the applicant would be to be admitted to that program, or how eager he or she would be to advise the applicant's PhD dissertation. Quantitative comparisons are especially helpful, e.g., "top 5% of mathematics undergraduates at my university."
- An assessment of the applicant's ability to speak and write English, if the applicant is not a native speaker of English.
- Evidence based on first-hand experience. For example, it is helpful for an applicant's instructor to describe the strengths of the applicant's term paper or how the applicant's behavior indicated outstanding potential for PhD research. It is not helpful to write about commonplace matters (e.g. "the applicant earned an A in my class and turned in neatly written assignments promptly") or unsubstantiated generalities (e.g. "I feel the applicant would do well in your PhD program" without substantiating evidence).

Curriculum vitae: Focus on education, relevant work experience including jobs, research assistantships, and teaching assistantships, publications, and awards. You will probably need to provide explanations of awards, e.g. "academic excellence award for the best graduating senior in industrial engineering in my university" or "prize awarded to the best five undergraduate theses at my university."

Transcripts from all colleges and universities at which you studied.
- Unofficial Transcripts are accepted.
- Get your transcripts, scan them, and submit the scanned versions online. If you enroll at Northwestern University, you will submit the original transcripts in paper form at that time.
- If you are currently taking courses, if at all possible, please submit transcripts that show your grades for the current fall semester or quarter. (If it is impossible to do this and meet the December 6th application deadline, then you may submit transcripts that do not show fall grades).
- Study abroad: You must submit transcripts showing grades from any institution at which you studied, including study abroad. Usually, this requires submitting a transcript from each institution at which you took courses. The only exception is if you studied abroad and the transcript from your home institution shows the grades that you earned while studying abroad.

Official standardized test scores sent by ETS: see Required Standardized Tests
- Copies of your test score report should also be scanned and submitted with your online application.

Optional materials:
- Writing sample: If you have written something that would help the admissions committee to evaluate your potential to succeed as a researcher in IEMS, please include it. Examples include: a published research paper, an undergraduate thesis, or a term paper for a class in an area related to IEMS.
- Diversity statement: The online application allows you to submit a diversity statement, but it is only helpful to the IEMS PhD admissions committee in exceptional cases. There is no need to write a diversity statement unless you believe that in your case, diversity should be a positive factor considered in the admission decision. For example, it would be helpful to receive a diversity statement from a US citizen or permanent resident who is a member of a group under-represented in science, technology, engineering, and mathematics.
- Fellowship offer letters: If you have already received a fellowship that would support your study at Northwestern, please include a copy of it.

Application Progress

Applications for admission to IEMS are found on The Graduate School website. For application procedures and processes please see The Graduate School's admission page.

Admission Decisions

Admissions decisions are typically made around March for applicants. Please do not contact us regarding the status of your decision - we will contact you. You may track your application using GATS. April 15th is the deadline for those individuals who have been offered financial aid to accept our offer. A few additional financial aid offers may be made around April if all of our financial aid has not been committed by that time.

Frequently Asked Questions

Applications and Admissions

I am interested in applying to your Master's program...
We do not offer a terminal master's degree in Industrial Engineering and Management Sciences.

What are the application deadlines?
The deadline for all applications is midnight, December 9th, CST. The deadline for all supplemental materials is December 16th.

How can I apply?
If you wish to apply to the graduate program here at Northwestern University, you must apply online via The Graduate School.

What are the required materials?
Please see the Application Materials Checklist. Consult The Graduate School's admission website for further information on each of these items. The IEMS Department has no required program-specific items, but please include relevant research papers or term papers if you have any.

When will I hear a decision regarding my application?
PhD applications will be considered for admission and fellowship aid soon after the December 9th deadline. Admissions decisions are typically made around March for applicants. Please do not contact us regarding the status of your decision. You may track your application using the online application portal. April 15th is the deadline for those individuals who have been offered financial aid to accept our offer. A few additional financial aid offers may be made around April if all of our financial aid has not been committed by that time.

Who should I contact regarding my application or admission decision?
For all admission-related inquires please contact the Graduate Program Assistant (Brittany.jasin@northwestern.edu). Do not contact other staff members or faculty directly.

My goal is to receive a doctoral (PhD) degree, but I do not yet have a master's (MS or equivalent) degree. Should I first apply to Northwestern as an MS student?
No, you should apply for the degree that is your ultimate objective at Northwestern. All prospective doctoral students follow the same program in the IEMS department, whether or not they have a previous master's degree. PhD students in IEMS have the option of receiving the MS degree after they have finished their first year's studies and exams.

Admissions Prerequisites and Testing

What are the admission criteria?
Please see Applicant Criteria and Background.

Am I required to take the GRE?
The Industrial Engineering and Management Sciences Department has removed the GRE requirement for Fall 2025 admissions. Any scores received will not be considered during the application review process.

Do I need to submit a TOEFL or IELTS score?
If you are an international applicant, unless you have a degree from a university whose language of instruction is English (or will get one before matriculation at Northwestern), you must demonstrate evidence of ability in English. To do this, you must achieve a score exceeding the minimum threshold on one of the following exams:

- 90 on the internet-based TOEFL
- 600 on the paper-based TOEFL
- 7.0 on the IELTS

Financial Aid and Funding

Who qualifies for financial aid?
All PhD applicants will be considered for financial aid.

How do I apply for financial aid?
Application for financial aid is the same time as application for admission when you submit your online application. There is no extra application needed. A question in the financial aid section of the application asks whether you want to be considered for financial aid. Regardless of what you answer, however, if you apply for the PhD then you will be considered for aid.

What form does financial aid usually take?
Financial aid offers may vary. A typical financial aid offer provides for tuition and stipend for five years. Financial aid is contingent on satisfactory progress in the program. A typical offer requires only that students make satisfactory progress in coursework during the first year, but takes the form of research and teaching assistantships in subsequent years.

If I do not get financial aid, what are the costs of attending Northwestern?

We do not usually admit applicants unless we can offer financial aid, or the applicant already has financial support. For more information on tuition costs, please see the website of The Graduate School.

Miscellaneous Information

What graduate housing is available?
The Graduate Housing Office is a very helpful resource regarding both university and off-campus housing

What resources exist at Northwestern to help international students make the transition to life in America?
The ELP Foundations program is administered by The International Office. The purpose of the program is to help international students make the transition to life in the United States prior to starting school in the Fall. Outstanding applicants will be nominated for placement in this program. There is limited space in the program, so not all nominees will be accepted into the program. The benefits to the student include:

- Improve your spoken English for your studies, teaching, social situations
- Make friends with your peers and American graduate students
- Learn about American culture and your new hometown
- Get help with practical matters such as finding an apartment, shopping, banking, transportation, etc.