

Applied Mathematics PhD Student Guide

September 2026 Effective: Fall 2026-Summer 2027

Northwestern University reserves the right to change without notice any statement in this publication concerning, but not limited to, rules, policies, tuition, fees, curricula, and courses.



Table of Contents

Introduction and Purpose 4

Program Contacts 4

Learning Outcomes 5

Program-Specific Academic Requirements & Policies 5

 Coursework Requirements..... 5

 Minimum Grade & GPA Requirements 6

Teaching Requirement 6

Other Coursework and Activities 6

Typical Applied Mathematics PhD Timeline 7

 Conferral of MS Degree 8

Program Specific Milestone Policies 8

 Advisor 8

 Annual Reviews..... 9

 Qualifying Exam / Candidacy 9

Introduction and Purpose

Welcome to the PhD Program in Applied Mathematics, your home for the next five years or so. We hope it will be a successful, intellectually engaging, and fulfilling experience.

The policies described in this guide, in addition to those set by both The Graduate School and McCormick, are the official requirements for completion of your doctoral degree. In addition to reading and understanding this document, it is your responsibility to familiarize yourself with TGS and University policies that also apply. TGS maintains useful information for new students on its New Student Orientation website.

For any questions about the Program or TGS policies, never hesitate to ask your research advisor, the Department Chair, the Program Assistant, or the Director of Graduate Studies (DGS). Please familiarize yourself with the Department homepage, particularly to learn about the duties of the Department staff and how they can assist you.

We look forward to getting to know you and helping you achieve your goals!

Program Contacts

This section provides a general description of who has responsibility for curricular, admission, financial, and other matters in the program. The most up-to-date list of personnel can be found on the [ESAM website](#).

Director of Graduate Studies (DGS): Alvin Bayliss (a-bayliss@northwestern.edu). The DGS oversees the graduate program, advising students on academic matters and assisting with advisor selection and changes. The DGS also monitors academic progress and participates in decisions concerning academic probation and exclusion.

Department Chair: Hermann Riecke (h-riecke@northwestern.edu). The Department Chair is responsible for providing academic leadership, managing faculty affairs, overseeing curriculum and instruction, supporting student success along with the DGS, handling budgeting and resource allocation, coordinating departmental operations, and representing the department externally.

Graduate Program Assistant / Coordinator: Natalie Masini, Program Assistant (natalie.masini@northwestern.edu). This staff member aids with administrative aspects of the program, including procedures, paperwork for milestones, registration issues, and other day-to-day operations.

Financial Assistant / Coordinator: Elisa Lindstrom, Senior Accounting Specialist (elisa.lindstrom@northwestern.edu). This staff member handles financial aspects such as stipends and tuition payments.

Learning Outcomes

The PhD program is designed to provide graduate students with a broad skill set in mathematical modeling and analytical and computational solution methods that will enable them to do original research culminating in a thesis that contributes novel mathematical techniques and/or novel applications of mathematics to current problems of interest to the research community.

Program-Specific Academic Requirements & Policies

Coursework Requirements

The Graduate School requires PhD students to successfully complete at least nine quality letter-graded course units (ABC, not P/NP or S/U) authorized for graduate credit. Students must maintain at least a 3.0 cumulative GPA. You can view the full policy here:

<https://www.tgs.northwestern.edu/academic-policies-procedures/policies/phd-degree-requirements.html>

The PhD program in Applied Mathematics requires successful completion of the following coursework:

Four core ESAM courses

- ES_APPM 405-1 Data Science and Statistics
- ES_APPM 414 Differential Equations of Mathematical Physics¹
- ES_APPM 420-1 Asymptotic and Perturbation Methods in Applied Mathematics
- ES_APPM 446-1 Numerical Solutions of Partial Differential Equation

Two Research Rotation courses

- ES_APPM 499

Seven approved elective 3XX or 4XX courses

- At least four (4) ESAM courses
- At most three (3) other courses

¹ During New Student Orientation week, students must meet with the DGS to determine whether they have a sufficiently strong background to enroll in ES_APPM 414 or whether they are required to enroll in ES_APPM 314 in the Fall.

These course requirements have to be satisfied before the qualifying exam.

Minimum Grade & GPA Requirements

For all graded courses, students must obtain at least a C for the course to count towards the curriculum requirements.

To remain in satisfactory academic standing, students have to maintain a GPA of 3.5 across all courses presented for the degree, including the Research Rotations.

STUDENTS WITH GRADUATE CREDITS & WAIVING COURSE REQUIREMENTS

Students entering with an MS degree in Applied Mathematics must complete at least eleven (11) graded academic courses at Northwestern. They can petition to have the courses they have taken during their MS study counted against the core courses or other subjects. These petitions are to be directed to the DGS and the Department Chair; their approval will be based on the presented supporting documentation, e.g., text books used, course outlines, lecture notes, exams, etc. In some cases, students may be asked to take an exam to demonstrate they have mastered the course material.

If an exemption is granted, a signed waiver form should be returned to the program assistant to be placed in the student's file. Should a waiver be granted, the student must choose an approved replacement course.

Students entering with an MS degree from ESAM must take any core courses that were not taken when earning the MS degree. **Notice that all other requirements must be satisfied** (in particular, the completion of 11 full-credit courses and two research rotations).

Teaching Requirement

All PhD students in ESAM are required to complete 1 quarter of duties as a full-time teaching assistant (TA). Full-time teaching assistants are expected to work 20 hours per week.

Other Coursework and Activities

Students are required to attend the following events or participate in these activities:

- During their first year, PhD students are required to register for ES_APPM 498 and attend the weekly colloquium.
- After their first year, PhD students are strongly urged to attend the weekly colloquium to acquire the broad perspective of mathematical methods and areas of application that is expected of an applied mathematician.

Typical Applied Mathematics PhD Timeline

Quarter	Milestone	Objective	Assessment
End of 2 nd quarter	Preliminary Exam	Demonstrate mastery of core mathematical concepts	Strategy: Faculty design written exams to evaluate skills in advanced calculus, linear algebra, differential equations, and complex variables. Criteria: Receives a passing score on each exam topic.
By the end of the 3 rd quarter	For many international students: Versant or SPEAK test	Demonstrate English proficiency (international students only)	Strategy: Administration of Versant and/or SPEAK test. Criteria: Receives a passing score sufficient to TA for an undergraduate discussion section.
11-12 15-16	Annual Review	Demonstrate progress in the research project and the ability to communicate it	Strategy: Oral reporting on progress on thesis work. Criteria: Demonstrate adequate research progress.

	Fall	Winter	Spring	Summer
Year 1	ES_APPM 405-1 ES_APPM 420-1 ES_APPM 446-1 Research Rotations ES_APPM 498	Preliminary Exam ES_APPM 414 Elective Course Elective Course Research Rotations ES_APPM 498	Select Advisor Apply for Fellowships Make-up Prelims if required Elective Course Elective Course Elective Course Elective Course ES_APPM 498	Apply for Fellowships Full-time Research

Year 2	Elective Course Optional Courses Research	Optional Courses Research	Select Thesis committee Optional Courses Research	Qualifying Exam Research
Year 3	Research Conferences ²	Research Publications ³	Research	Annual Review Research
Year 4	Research	Research	Apply for Terminal-year Fellowship Research	Annual Review Prepare CV/resume Research
Year 5	Apply for jobs Research	Write Thesis Research	Write Thesis Defend Thesis	

Students achieve PhD candidacy by passing the qualifying exam.

Conferral of MS Degree

Once a PhD student satisfies all requirements for the MS degree they can apply to be awarded that degree. Typically, this would be after finishing their first year or shortly thereafter. In GSP, the form for this request can be found under the TGS Forms tab. This form is specifically used to request a master's degree along the way to the PhD in the same program. Completing this form is a necessary step before submitting other required forms for degree conferral, such as the Application for Degree and Master's Degree Completion forms, also submitted via GSP.

Program Specific Milestone Policies

Advisor

One of the most important milestones of a student's first year is the selection of a thesis advisor. The advisor is responsible for helping a student develop an academic plan, identify a research project, and create a research plan. The advisor is also primarily responsible for funding a student's studies. The advisor will also play a significant role in helping a student find the best possible career options following completion of the degree.

² Start looking for, attending, and presenting at conferences.

³ Depending on progress, start working on publications.

The Research Rotations (see below) are a key component of the advisor selection process. In addition, to help students choose advisors wisely, the Program organizes a series of presentations by core and courtesy faculty who have projects to offer that year. In some years, members of other programs may be invited to give presentations as well. All students are required to attend the presentations. Core and courtesy faculty members are listed on the Department website. Some projects may be part of a larger center or structured as a co-advising relationship.

As students identify interesting research projects, **it is their responsibility to meet with the professor** (or professors), attend group meetings, and otherwise get to know the professor's research group, and to discuss advisor selection with their peers. Students are encouraged to look broadly at all projects on offer. Being actively engaged in the process will help them find a "good home" for the next five or so years and ensure that students are well-known to the professors when it comes time for advisor matching.

To maintain satisfactory academic standing within the ESAM department, students must be matched with an advisor by the end of the Spring quarter of their first year.

Annual Reviews

The Graduate School requires doctoral programs to conduct annual academic reviews of all students enrolled in their Program. As part of this review, PhD candidates must schedule an annual meeting, during the Spring or Summer quarter, with their thesis committee to discuss and receive feedback about their research progress. A student ceases to be in good standing if they fail to schedule their annual meeting before Fall quarter.

The annual review in the summer of the second year is replaced by the qualifying exam.

Qualifying Exam / Candidacy

Students entering the Program with a BS degree or an MS degree from outside ESAM must pass the Qualifying Examination by the end of their 8th quarter in the Program. Students entering with an MS degree from ESAM must take the exam by the end of their 4th quarter in the Program. Students are encouraged to take the examination earlier, if possible. Exceptions for extenuating circumstances must be requested by petition to the Chair and signed by the student's advisor.

EXAMINATION PROCEDURE

The precise nature of the examination is decided by the research advisor in consultation with the other members of the committee. The examination will be oral and will be conducted by the student's approved thesis committee. It includes a presentation of the proposed thesis research project, along with questions drawn from course material relevant to the project. The student must identify, in consultation with the research advisor(s), at least three graduate-level ESAM courses that are most relevant to the proposed project. The list of courses must be approved by the committee prior to the examination, and the student is expected to be able to answer questions based on those courses.

Students must do the following:

- Personally contact each member of the committee to find a date and time satisfactory to each one.
- Reserve a conference room for at least 3 hours.
- Complete and submit both the PhD Prospectus form and the PhD Qualifying Exam form on GSP.
- Enter the names of the committee members in GSP under the Committee tab and identify their role as Qualifying Exam Members.

The exam is conducted by the student's approved thesis committee.

A PhD student who fails the qualifying exam but satisfies all requirements for the MS degree can apply and receive an MS degree.

Appendix

Research Rotations

Overview: Each student conducts independent research in the form of a Research Rotation with at least two different approved faculty members before the selection of a thesis advisor. This research complements the formal coursework taken during the first year and exposes students to various research areas within applied mathematics. These Rotations also provide the advisors with an opportunity to evaluate the performance and research potential of each student. These evaluations will constitute a major factor - along with the student's performance in the classes and the prelims - in the department's decision whether the student will continue in the PhD program after their first year.

TIMELINE

- August: Students are informed which faculty members are likely to take on a student.
- Students should explore faculty research and contact faculty to discuss potential rotation opportunities.

- A brief introduction to faculty research will be provided during orientation, the week before classes start.
- Students submit their preferences for Fall quarter by a specified date during the first week of classes.
- Matching of students and faculty by the end of the first week of classes
- During Fall quarter: longer faculty presentations (~30 min per faculty) to inform about Winter Rotations.
- Students should reach out to faculty to discuss potential Rotations for Winter quarter before the end of Fall quarter.
- Student reports for Fall quarter due on the Friday of finals week
- Students submit their preferences for Winter quarter by the end of finals week.
- Matching of students and faculty during the week after finals week.
- Student reports for Winter quarter due on the Friday of finals week.
- Spring quarter: advisor selection or optional third Research Rotation.

TOPIC SELECTION

The faculty member and student discuss potential research topics and decide on a short-term research project. The projects may involve any aspect of research, including literature review, development of mathematical frameworks, data analysis, method implementation, analytic investigations, and numerical development. Given the short-term nature of the project, it is not necessary or expected for the student to produce publishable results. Projects also do not need to form the basis for a thesis, but should provide a valuable research experience.

STUDENT EVALUATION

The advising faculty will ultimately determine evaluation criteria of the rotation, and students and faculty should discuss rotation expectations at the start of the rotation.

- Written report: At the end of each rotation, all students will produce a short report (1-2 pages), which will be made available to all faculty members.
- Oral presentation: In addition, students will have the option to participate in an oral research presentation session. The presentations will be 10 minutes long and allow an additional 5 minutes for questions. The session is intended for students and interested faculty. Faculty may require the oral presentation as part of their evaluation. This session may also be useful for faculty who did not have the opportunity to work with the student to learn about their interests.
- Faculty evaluation: At the end of each Research Rotation the advising faculty will fill out a short form evaluating the student. They will rate the student in several categories, including those below, and provide a brief written evaluation (~1 paragraph).

EVALUATION OF SUITABLE MATCH

Evaluation of suitable match: A key function of the Research Rotation is to facilitate establishing successful and mutually agreeable student-thesis advisor partnerships between students and faculty. By participating in the daily work of research, students can gauge how comfortable they feel working with a potential advisor. Faculty use several criteria to assess whether a student will be a good fit for their research program. Among them are:

1. Commitment. Students should take each Research Rotation seriously and show effort and commitment to the project.
2. Progress. The activities of the students during the Research Rotation and their final report should demonstrate clear progress. The progress could be comprised of reproducing or implementing previously published results and possibly slightly extending them, demonstrating sufficient understanding of the topic, or providing a suitable literature review.
3. Documentation of work. A research career depends on the clear communication of results such that others may reproduce them.
4. Interest. A hallmark of independent investigators is that they are motivated by curiosity, driven by the “need to know.” Students are encouraged to seek out published information relating to their projects and to think critically about how their project relates to the overall scientific enterprise.
5. Maturity. Scientific research depends on effective communication among researchers. Common sense, cooperation, and courtesy are essential qualities for a good mentor-mentee relationship.

LOGISTICS

Students receive credit and a letter grade for the Research Rotation through ESAM 499 Independent Study.

Checklist for Thesis Defense

This list aims to help students navigate their thesis defense and graduation. Notice that instructions provided by TGS supersede any conflicting information below.

1. Apply for a PhD degree in GSTS under the TGS Forms tab and create a new Application for a Degree form.
2. After finalizing your thesis committee, enter the committee on the PhD Final Exam Form in GSTS, and also enter their names under the Committee tab in GSTS and mark their role as Final-Thesis Member.
3. Contact committee members to set date and time. Once the date is set, enter the date on the PhD Final Exam Form.
4. Receive the advisor’s approval that the dissertation is in final form and ready to be presented to the committee for review. (“Final form” means fully proofread. Faculty members should not be expected to serve as proofreaders.)
5. Reserve a conference room. Contact the Department office staff to reserve a room, so that a public notice of the presentation can be posted.
6. Note that the deadline for taking the exam and submitting the dissertation to the Graduate School varies each quarter. Consult the timetable on the Graduate School website for exact dates each year.
7. Be reminded that the format of the dissertation must conform to the standards established by The Graduate School at [Dissertation Formatting Requirements](#).
8. At the latest, two weeks before the examination, present each examining committee member with a copy of the dissertation.

9. After the defense, complete the PhD Final Exam form under the TGS Forms tab and create a new TGS PhD Final Exam form. Each committee member must approve the form they receive via email, generated by this form.
10. After final approval, turn in the final PDF version of your dissertation to the Department office to have it bound. The Department covers the cost of one copy for the student, one for the advisor, and one for the department archives. Additional copies may be requested at the student's expense.
11. Submit the dissertation to the [ProQuest website](#). Once the dissertation is submitted to ProQuest, a Student Services representative will review the formatting and confirm by email that it is acceptable or notify you of any necessary changes.
12. Provide the Department with a 1-2 paragraph summary of your dissertation in a form that is written for a general audience and could be posted on the department website.
13. Check with the Program Assistant to ensure that all X, Y, K, and NR grades on your transcript have been changed and submitted to TGS.
14. Before final departure, complete the sign-out sheet provided by the front office, return borrowed items (office keys, theses, library books, etc.), and be sure to leave a forwarding address with the office of the Department of Engineering Sciences and Applied Mathematics.

Miscellaneous

CHANGE OF ADDRESS

The Department Office must be notified of any change of address. Students must change their home address through **both** the [HR website](#) and in Caesar. Be sure to change your address in both systems, as they are separate.

The U.S. Citizenship & Immigration Services (USCIS) requires every international student and scholar to report a change of address within 10 days of their move. It is critical for F-1 and J-1 students to update their address in CAESAR immediately upon their relocation.

J-1 and H-1 scholars will also need to inform the international office as soon as possible.

All F-1 students, J-1 students and scholars, and H-1B scholars will also need to complete a change of address form (AR-11) available [here](#). **Failure to do so will be a violation of their F-1 or J-1 status and could result in severe consequences for them and their dependent(s)!**

CONSUMPTION OF ALCOHOLIC BEVERAGES

Consumption of alcoholic beverages in the Technological Institute, except at official departmental functions and such recognized events as post-defense celebrations, is incompatible with sound safety and work-place practices and is therefore unacceptable. **We expect our students to abide by Illinois and applicable federal laws concerning all controlled substances.**

DEPARTMENT OFFICE, STUDENT DESK & RESEARCH SPACE ASSIGNMENT

Every graduate student is assigned a desk for personal use. The assignment of both desk and research space is handled by the Department on an annual basis. Office assignments may change each year, usually over the summer. No changes should be made without authorization by the Department Chair.

When not in use, please unplug any appliances (e.g., coffee makers, water heaters) to reduce the risk of fires and environmental impacts.

A black-and-white printer is provided in the Student Lounge, M443. A color printer is provided in the main office, M426. The black-and-white printer should be used, with duplexing turned on to save paper, unless color is **absolutely necessary**. Use of the printers is for academic and research purposes only, and not for personal use. Information about accessing the printers from the department-provided computers or your personal computer can be found on the Department website under student resources.

A photocopying machine for research and teaching-related copying is available in the Department Office. Copy cards for use in copying machines at the library are available through the Wildcard Office or the Main Library. Photocopying services are also located at Norris Center and 2020 Ridge for large orders. Personal copying should be kept to a minimum on the department machine.

Keys. Graduate students will receive a key for their office in the Technological Institute. To obtain your keys, you must visit the Department Office to request a key from the program assistant. Keys are not transferable. Students may not be in the Department Office outside regular working hours, generally 8:30 AM to 5:00 PM.

Postal Service. Mail is delivered once a day to the Department Office. The student mailboxes are in M426; you will find your mail and messages in your assigned box above your name label. It is advisable to check your mailbox daily. Use of the University mailing address for personal mail is not allowed by NU regulations.

Supply Cabinet (M426). Limited supplies (pens, notebooks, etc.) are available for research purposes. These supplies are not for personal or class use. Please only take one of each item at a time.

INTERNATIONAL STUDENTS

Upon arrival, all international students must register immediately with the International Student Office, 630 Dartmouth Place, Evanston Campus, which will act as advisor on all matters concerning employment practice, visa renewals, etc.

PARKING

The University Police Parking Division controls the NU parking lots. Students requiring a sticker that will enable them to park in the various University parking lots should obtain an application from the Parking Office located at 1841 Sheridan Road, Evanston (open Monday through Friday, 8:00 AM to 4:00 PM). Applications are issued upon presenting your University I.D. card, driver's license, and payment of a fee. Additional information can be found [here](#).

STUDENT LOUNGE & KITCHEN

The graduate student lounge is located in room M443. It is managed by the ESAM graduate student leadership. All students are expected to comply with the rules set by the graduate student leadership to keep the lounge a pleasant place for students to gather. Access to the student lounge is by an access code for a numeric pad on the door. Contact the program assistant if you do not know the access code.

Please do not share the access code with non-ESAM people. Use of the lounge is intended only for students and postdocs in ESAM or in ESAM research groups.

Kitchen use is restricted to ESAM department members. Please comply with the kitchen rules that are posted. Do not leave personal items in the kitchen. After washing your dishes, be sure to dry them and put them away promptly. The microwave and toaster oven should not be left unattended while in use. Clean up any food that splatters, drips, or spills. Remember, it is easier to clean up the mess when it is still fresh. As a courtesy to other department members, please only take tea and other supplies on a single-use basis. Finally, to prevent flooding, make sure the hot water dispenser is completely turned off after use. There is no janitorial service to clean up this space, so it is each user's responsibility to keep the area clean and clear of personal belongings.

STUDENT ORGANIZATIONS

The **Northwestern Student chapter of SIAM** (Society for Industrial and Applied Mathematics) was established in 2011. Each year (usually at the end of the Spring Quarter), an election is held to fill the offices of President, Vice President, Secretary/Treasurer, Activities Chairman, and Faculty Representative. The Officers serve as liaisons to the Faculty and Department administration in representing the students' interests. They also organize various social and professional activities throughout the year. Students are automatically members and are encouraged to participate. For international students, the club provides valuable interaction for the development of English proficiency.

The Women of Engineering Sciences and Applied Mathematics ([WESAM](#)) Group brings together students, postdocs, and faculty to promote equal opportunity for women in the mathematical sciences. The WESAM group organizes events aimed at science outreach, professional development, and community building. It meets monthly to discuss articles, plan events, and plan fun events for the group. Contact **Prof. Mangan** for more information.