

Program Requirements and Administrative Rules for the Ph.D. in Mathematical Sciences

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1. Requirements for the Ph.D. Degree

1.1. Credit Requirements

For the Ph.D. degree, a student must successfully complete a minimum of 90 credit hours of graduate work beyond the bachelor's degree (or a minimum of 60 credit hours beyond the master's degree), including at least 30 credit hours of dissertation research, as follows:

General Courses (credited for students with master's degrees)	30 credits
Research Preparation Phase	24-30 credits
Research-Related Courses, Independent Studies, or External Projects	18-24 credits
Extra-Departmental Studies	6 credits
Dissertation Research	at least 30 credits

Remarks:

- To be considered a full-time student and considered for funding, students must register for a minimum of 8 credits per semester. Typically, full-time Ph.D. students in Mathematical Sciences should register for 9 credits per semester. For the latest information, consult the WPI policies for maintaining full time student status.
- If a student with a master's degree is not granted a 30-credit waiver for general courses upon initial admission, they can apply for this waiver after passing the GCE examination by submitting an application to the Graduate Program Committee (GPC). The application must include the transcript of their completed master's degree, their WPI transcript, and a rationale statement formulating their waiver request.

1.2. Plan of Study

No later than two weeks before the end of the first semester of study for full-time students (two weeks before the end of the second semester of study for part-time students), a student is required to submit a formal plan of study leading to the Ph.D. degree to the Graduate Program Committee for review. The plan of study may subsequently be modified with review by the Graduate Program Committee. International students may be subject to additional documentation of their full-time status as part of their visa requirements. Please consult WPI's International Student Handbook for up-to-date guidance. Plan-of-study forms can be obtained from the Resources page on the departmental website.

1.3. General Comprehensive Examination - Candidacy for the Ph.D. Degree

A student must pass the general comprehensive examination to become a Ph.D. candidate. See Section 4 for a description of the examination. A student who enters the Ph.D. program having passed an equivalent examination at another institution may petition the Graduate Program Committee to waive the general comprehensive examination.

1.4. Extra-Departmental Studies Requirement

A student must complete at least six credit hours of courses, at the 500 level or higher, in WPI departments other than Mathematical Sciences. Cross-listed courses can be counted toward meeting the extra departmental studies requirement. The student's advisor must approve the choice of cross-listed courses.

1.5. Mathematical Sciences External Project

A project with an external sponsor may be completed as part of the Ph.D. degree. See Section 3 for a description of the project.

1.6. Preliminary Examination

Successful completion of the preliminary examination is required before a student can register for dissertation credits. See Section 5 for a description of the examination and the examination committee. A student who enters the Ph.D. program having passed an equivalent examination at another institution may petition the Graduate Program Committee to waive the preliminary examination.

1.7. Dissertation Proposal

At least four months prior to the defense of the dissertation, a student must submit a written dissertation proposal to their dissertation committee and present a public seminar on the research plan described in the proposal. The proposal must be approved by the dissertation committee. See Section 6 for details. Exceptions to this four-month requirement should be rare and must be approved by the GPC.

1.8. Dissertation

The completion and oral defense of a dissertation are required. See Section 6 for details.

1.9. Residency

Any student pursuing the Ph.D. must establish residency by being in full-time status for at least one uninterrupted academic year. For more information, see the WPI Graduate Catalog.

1.10. Waivers

In exceptional circumstances the Graduate Program Committee may waive or modify particular degree requirements and plans of study in response to a student petition.

2. Academic Advisor

Upon entering the Ph.D. program, each student is assigned an academic advisor by the Graduate Program Committee. It is the responsibility of the academic advisor to guide the student in initial course selection, to help the student fill out his or her plan of study, and to advise the student generally on matters pertaining to his or her academic program. A student may change academic advisors at any time with proper notice to the Graduate Coordinator.

3. External Project

PhD students have the option of earning up to nine Research Preparation credits by completing an external project. The purposes of the external project are to broaden perspectives on the relevance and applications of mathematics and to improve skills in communicating mathematics and formulating and solving mathematical problems. Students participating in an external project are required to work with a sponsor external to the department and are encouraged to find sponsors affiliated with academia, business, industry, or government. The project must be started after the student has passed the General Comprehensive Examination. The policy governing the project is as follows:

- **Duration.** The External Project is limited to 9 credit hours of work.
- **Nature of the Project.** The project must involve a problem originating with a sponsor external to the department.
- **Faculty Project Advisor.** The project must be conducted under the supervision of a project advisor who is a member of the Mathematical Sciences faculty.
- **Project Proposal.** Prior to the start of the project, a proposal outlining the nature, scope, and expected outcomes of the project must be approved by the project advisor, the external sponsor, and the Graduate Program Committee. The project proposal should identify the external sponsor, indicate where the project work is to take place, delineate a timeline for the project, and specify the number of credit hours to be obtained for the project.
- **Project Evaluation.** The project advisor is responsible for supervising and grading the project.
- **Project Report and Oral Presentation.** The project must culminate in a project report approved by the faculty project advisor and a public oral presentation at WPI.

4. The General Comprehensive Examination

4.1. Purpose and Structure

The purpose of the General Comprehensive Examination (GCE) is to determine whether a student possesses the fundamental knowledge and skills necessary for study and research at the Ph.D. level. It consists of two three-hour exams. One exam is on real analysis, based on MA 503, and the other is on linear algebra, based on MA 502. Syllabi and previous year's exams are available online at the following website:

<https://www.wpi.edu/academics/departments/mathematical-sciences/resources/phd-qualifying-exams>

Students are responsible for all topics listed in the WPI Graduate Catalog descriptions of the above courses as well as for related undergraduate prerequisite material.

4.2. Administration

The Graduate Program Committee is responsible for scheduling the GCE exams. A facilitator from the committee assigns the writing and grading of each exam to a group of faculty members. The Graduate Program Committee will then inform students and their advisors about the results of these exams.

- **Schedule.** The GCE is offered three times a year, in January, May, and August. A student must register a request to take the GCE with the Mathematical Sciences office at least one month before the proposed examination date.
- **Exam Regulations.** The GCE examinations are completed in person under the supervision of members of the department. The administration of any exam in other settings requires strong rationale and advance approval by the GPC. Students with approved academic accommodations should submit their accommodation letters to the GPC in advance by directly contacting the Director of the Office of Accessibility Services.
- **Passing Requirements.** Students must pass both exams by the end of January of their second year, if they entered the program in the fall, or by the end of May of their second year, if they entered in the spring. A student who passes the GCE becomes a Ph.D. candidate. A student who fails to pass both exams by this deadline will not be allowed to continue in the Ph.D. program, and will no longer be guaranteed funding for future semesters, but is encouraged to earn a Master's degree by completing the MS degree requirements.

5. The Preliminary Examination

5.1. Purpose and Structure

The purpose of the preliminary examination is to determine whether a Ph.D. candidate's understanding of advanced areas of mathematics is adequate to conduct independent research and successfully complete a dissertation. The examination is given in two parts, a written part followed by an oral part, and covers subject matter in three areas determined by the student's preliminary examination committee. The preliminary examination is intended to test a student's overall breadth in advanced mathematical topics as well as knowledge of their area of specialization, and the three areas should be chosen accordingly.

5.2. Administration

5.2.1. Scheduling and Outcomes

A student must make the first attempt by the end of their third year (sixth year if part-time) in the Ph.D. program. At least two months before the proposed date for the written exam, the student must request the examination with the Mathematical Sciences department by submitting syllabi covering all three topics for the examination. All three syllabi must be sent at the same time. The student must work with different faculty member(s) for each of the three topics. A student who passes the examination is considered a dissertator and is allowed to register for dissertation credits. A student who fails will be allowed to take the examination a second time within one year of the first attempt. A student who fails a second time will not be allowed to continue in the Ph.D. program.

5.2.2. Preliminary Examination Committee

The student, in collaboration with the advisor, forms the preliminary examination committee. This committee and its chair are approved by the Graduate Program Committee. The committee chair must be a member of the Mathematical Sciences faculty other than the student's dissertation advisor. The other committee members must be members of the Mathematical Sciences faculty or faculty from other departments at WPI or other colleges or universities as may be desirable. The committee must have at least three members, including the chair. The student must provide a brief justification or a readily accessible list of publications for any committee member external to the department. The GPC may request additional documentation from the student as deemed necessary.

The preliminary examination committee is responsible for formulating syllabi, administering, and grading the written part of the examination, conducting the oral part, and informing the student of the results. The oral part must be conducted no more than one week after the written part of the examination. In case of failing, the committee decides which part or parts the student needs to re-take to pass the examination. The committee may exercise its discretion in handling any extenuating circumstances or problems.

6. The Dissertation

The Ph.D. dissertation is a significant work of original research conducted under the supervision of a dissertation advisor. The dissertation advisor chairs the dissertation committee, which determines acceptability of the dissertation proposal and, upon completion, the dissertation.

6.1. Dissertation Advisor

A student's dissertation advisor is either a dual-mission tenured or tenure-track member of the Mathematical Sciences faculty. Any other dissertation advisor would need approval by the Graduate Program Committee. For rules governing exceptions, see the WPI Graduate Catalog.

6.2. Dissertation Committee

A student's dissertation advisor chairs the dissertation committee. Under the direction of the advisor, the student selects the rest of the dissertation committee. The committee must have at least five members. The committee should be made up of members of the Mathematical Sciences faculty and at least one member external to the department who is a recognized expert in the area of the student's dissertation. Ph.D. students must provide a brief justification or a readily accessible list of publications for any external committee member. The GPC may request additional documentation from the student when deemed necessary.

The committee must be approved by the GPC three weeks prior to the public seminar on the dissertation proposal. To modify the committee membership, the student must submit an appropriate justification for the modification to the GPC and obtain their approval. This committee will participate in the dissertation proposal and the oral defense.

6.3. Dissertation Proposal

At least four months prior to completion of the dissertation defense, a student must present a formal seminar to the public describing his or her proposed dissertation research plan. A formal written dissertation proposal summarizing the proposed research plan must be submitted to the approved dissertation committee at least two weeks before this presentation date. The proposal must be approved by the dissertation committee.

6.4. Final Examination - Oral Defense

The final examination is a public oral dissertation defense, the purpose of which is to present the dissertation to the dissertation committee and to the general community.

A student must register a request to schedule the oral defense with the Department of Mathematical Sciences at least one month before the proposed date and must provide copies of his or her dissertation to each member of the dissertation committee at least one month prior to the oral defense. A student's dissertation committee, with the dissertation advisor acting as chairperson, determines by majority vote whether a dissertation is acceptable.