Graduate Student Handbook
Department of Mathematical Sciences
Michigan Technological University

Revised January 22, 2019

1 The MS degree

1.1 Degree plans

There are three different plans under which the master's of science (MS) degree can be earned. Regardless of the plan, students must complete the core courses in their chosen concentration (see below).

1. Plan A (Thesis option): Complete 21 credits of approved coursework, complete a research project leading to a written thesis, and defend the thesis in a public presentation.
2. Plan B (Report option): Complete 24 credits of approved coursework, complete a research project leading to a written report, and defend the report in a public presentation.
3. Plan C (Coursework plus examination): Complete 30 credits of approved coursework and pass the departmental qualifying exam. This exam is given twice a year, early in the fall and spring semesters. It is also a requirement for the PhD degree, although the passing level for PhD students is higher than for Plan C MS students. See the description of the qualifying exam below for more information.
4. Plan D (Coursework for M.S. in Applies Statistics): Complete 30 credits of approved coursework

A Plan A thesis represents a more substantial body of research than does a Plan B report. A thesis should represent original, publishable research. It will typically result in a paper that is submitted to a refereed journal, although submission of such a paper is not a degree requirement. On the other hand, Plan B reports can vary widely in content. Some possibilities are:

- The student completes a significant programming project in support of a faculty member's research.
- The student investigates a topic in detail and presents a high-quality exposition of some aspect of it.
- The student does some preliminary, original research on a topic, together with a literature review of known results.
- The student performs consulting duties on a research project, providing mathematical, statistical, or computational expertise for other researchers (possibly from another department).

1.2 Concentrations and core courses

All MS students must choose one of four concentrations and complete the core coursework in that concentration. Note: It is important to recognize that many of these courses are offered only in alternate years. Students must plan carefully to complete the MS degree in the expected two academic years.

Applied Mathematics

- Core courses:
  - MA5501 Theoretical Numerical Analysis
  - MA5510 ODEs
  - MA5565 PDEs
  - MA5627 Numerical Linear Algebra
  - MA5629 Numerical PDEs

- Elective courses (choose two):
  - MA5401 Real Analysis
  - MA5630 Numerical Optimization
  - MA5580 Topics in Applied Mathematics
  - MA6500 Advanced Topics in Applied Mathematics
  - MA6600 Advanced Topics in Computational Mathematics

Discrete Mathematics

- Core courses:
  - MA5221 Graph Theory
  - MA5222 Design Theory
  - MA5231 Error-Correcting Codes
  - MA5301 Algebra I

- Elective courses (choose two):
  - MA5201 Combinatorial Algorithms
  - MA5280 Topics in Applied Combinatorics
  - MA5302 Algebra II
  - MA5320 Commutative Algebra
  - MA5360 Number Theory
  - MA6222 Advanced Topics in Design Theory
  - MA6231 Advanced Topics in Coding Theory
  - MA6280 Advanced Topics in Combinatorics, Algebra, or Number Theory
  - MA6300 Advanced Topics in Algebra

Pure Mathematics

- Core courses:
  - MA5221 Graph Theory
  - MA5301 Algebra I
  - One of
    - MA5510 Ordinary Differential Equations
    - MA5565 Partial Differential Equations

- Elective courses (choose four):
  - MA5222 Design Theory
  - MA5231 Error-Correcting Codes
  - MA5302 Algebra II
  - MA5320 Commutative Algebra
  - MA5360 Number Theory
  - MA5501 Theoretical Numerical Analysis
  - MA6222 Advanced Topics in Design Theory
  - MA6231 Advanced Topics in Coding Theory
  - MA6280 Advanced Topics in Combinatorics, Algebra, or Number Theory
  - MA6300 Advanced Topics in Algebra
  - MA6701 Probability

Statistics

- Core courses:
  - MA5711 Mathematical Statistics I
  - MA5712 Mathematical Statistics II
  - MA5731 Linear Models
  - MA5741 Multivariate Statistical

- Elective courses (choose three):
  - MA5702 Statistical Consulting
  - MA5730 Nonparametric Statistics
  - MA5732 Generalized Linear Models
  - MA5750 Statistical Genetics
  - MA5761 Computational Statistics
  - MA5770 Bayesian Statistics
  - MA5790 Predictive Modeling
  - MA5791 Categorical Data Analysis
  - MA6700 Advanced Topics in Statistics
  - MA6701 Probability

M.S. in Applied Statistics

- Core courses:
  - MA4760 Mathematical Statistics I
  - MA4770 Mathematical Statistics II
  - MA5701 Statistical Methods
  - MA5761 Computational Statistics
  - MA5790 Predictive Modeling

- Elective courses (choose five):
  - MA3740 Statistical Programming & Analysis
  - MA4710 Regression Analysis
  - MA4720 Design & Analysis of Experiments
  - MA5702 Statistical Consulting
  - MA5711 Mathematical Statistics I
  - MA5712 Mathematical Statistics II
  - MA5730 Nonparametric Statistics
  - MA5731 Linear Models

- MA5732 Generalized Linear Models
- MA5741 Multivariate Statistical Methods
- MA5750 Statistical Genetics Spring
- MA5770 Bayesian Statistics Fall
- MA5781 Time Series Analysis and Forecasting Spring
- MA5791 Categorical Data Analysis

With prior approval of an advisor, cognate courses (at most two) may also be used as electives.

1.3 General advice for MS students

1. If you choose a research-based plan (Plan A or Plan B), you should find an advisor by the end of your first semester if possible, and no later than the end of your second semester.
2. If you choose Plan C, you should take the qualifying examination no later than your second semester. Some students require more than one try to pass the exam.

2 The PhD degree

The PhD degree is offered in the following concentrations: Applied Mathematics, Discrete Mathematics, and Statistics. The requirements are listed below. It is important to note that this list is not chronological; indeed, not all students will complete the requirements in the same order.

1. Choose a concentration and complete the core MS coursework in that concentration.
2. Find an advisor and form a PhD dissertation committee. (Note that the committee must include one faculty member from another department.)
3. Complete at least two 6000-level courses in your concentration.
4. Complete the "breadth" requirement by taking a sequence of two courses in another concentration. The following pairs of courses have been designated as sequences:
   - MA5222, MA5231 (Design Theory, Error-correcting codes)
   - MA5301, MA5302 (Algebra I, Algebra II)
   - MA5501, MA5510 (Theoretical Numerical Analysis, Ordinary Differential Equations)
   - MA5510, MA5565 (Ordinary Differential Equations, Partial Differential Equations)
   - MA5501, MA5629 (Theoretical Numerical Analysis, Partial Differential Equations)
   - MA5565, MA5629 (Partial Differential Equations, Numerical Partial Differential Equations)
   - MA5711, MA5712 (Mathematical Statistics I, Mathematical Statistics II)
5. Pass the qualifying examination (see the description below). This is a written exam covering advanced undergraduate material; it must be passed by the end of the fourth semester (summer semesters do not count) in the PhD program.
6. Pass the comprehensive examination (see the description below). This multi-part exam covers graduate coursework; it must be passed by the end of the eighth semester in the PhD program (summer semesters do not count).
7. (Recommended) Present a dissertation proposal to the satisfaction of your dissertation committee. (Note: Depending on your committee, this proposal may be written or oral. Check with your advisor.)
8. Write a dissertation detailing the results of a substantial and original research project.
9. Defend the dissertation with a public presentation and examination by your committee.

2.1 The qualifying examination

The qualifying examination covers advanced undergraduate material. Each student takes two 3-hour written examinations, with the subjects determined by the concentration:

1. Applied Mathematics: linear algebra and real analysis;
2. Discrete Mathematics: linear algebra and algebra or combinatorics;
3. Pure Mathematics: linear algebra and algebra or real analysis;
4. Statistics: linear algebra and mathematical statistics

The syllabus for each subject and a selection of past exams are available on the departmental graduate program web page. The qualifying examination is administered each fall and spring semester in week 3 or 4.

Important note: Students must sign up to take the qualifying examination approximately six weeks before it is given. The deadline will be announced by email by the graduate program secretary. A student who wishes to withdraw from the exam must inform the graduate program secretary at least three weeks before the date of the exam; a student who fails to do so and yet does not show up for the exam will be failed. This rule does not apply to a student who cannot take the exam due to circumstances beyond his or her control.

The qualifying examination serves two purposes:

1. A PhD student must pass the exam by the end of the fourth semester in the program to continue in the PhD program. A student failing to fulfill this requirement can still complete an MS degree if he or she has not already done so.
2. An MS student must pass the exam to earn the degree under Plan C. MS students are limited to four attempts to pass the exam.

The qualifying examination is graded as “PhD Pass”, “MS Pass”, or “Fail”. PhD students must pass at the higher level; an MS student who passes at the PhD level may be a good candidate to continue for the PhD.

2.2 The comprehensive examination

The comprehensive examination covers graduate coursework and consists of three parts: two 3-hour written subject exams, and a specialty exam that can be written or oral. The subject exams are determined by the area of concentration:

1. Applied Mathematics: Any two of (i) ordinary differential equations, (ii) partial differential equations, (iii) numerical linear algebra/numerical optimization.
2. Discrete Mathematics: Any two of (i) algebra, (ii) coding theory, (iii) design theory.
3. Statistics: Mathematical statistics, linear models.

The syllabus for each subject and a selection of past exams are available on the departmental graduate program web page. The comprehensive examination is administered each fall and spring semester in week 3 or 4.

The specialty exam is intended to make sure the student has the background knowledge to conduct research in his or her chosen area. The format of the exam (written or oral) is determined by the student's advisor.

Rules:

1. The specialty exam must be scheduled so that it and the two written subject exams are all completed within a 14-day period.

2. Students have two tries to pass the comprehensive exam. If a student fails only one part of the exam on the first try, only that part must be re-taken on the second try. If a student fails two or all three parts on the first try, all three parts must be re-taken on the second try.

3. The comprehensive exam must be passed by the end of the eighth semester in the program (summer semesters do not count).

Important note: Students must sign up to take the comprehensive examination approximately six weeks before it is given. The deadline will be announced by email by the graduate program secretary. A student who wishes to withdraw from the exam must inform the graduate program secretary at least three weeks before the date of the exam; a student who fails to do so and yet does not show up for the exam will be failed. This rule does not apply to a student who cannot take the exam due to circumstances beyond his or her control.

2.3 Typical milestones

How long should it take you to complete your PhD program? Those who enter the program with a Master's may complete the PhD in as little as three years. Others, perhaps entering with a Bachelor's, may take four or five years. Durations greater than eight calendar years require approval from the Graduate School.

The table below shows some typical milestones for our program, and indicates a typical range of times by which you should reach that milestone.

Table 1. Typical milestones in a PhD program and typical timeframes in which they are completed.

What:	When (semesters):
Choose a research advisor	Within 2
Complete required coursework	5 to 6
Choose a committee	4 to 6
Pass qualifying exam	2 to 4
Pass comprehensive exam	4 to 6
Enter Research Mode / Start writing products to be included in dissertation	4 to 6
Dissertation Defense / Final Oral Examination	6 to 10

3 Process for changing your advisor(s)

Before initiating the process to change your graduate advisor, please consider all the options listed on the Graduate School's website for ***how to address difficulties in the student-advisor relationship (link tohttps://www.mtu.edu/gradschool/resources-for/students/academic/succeeding/index.html).***

Once you have decided to change your graduate advisor, you must follow the steps listed below.

1. Meet with your graduate program director to initiate the process to change advisor. If meeting with the graduate program director is not feasible or appropriate, meet with the Chair of the department.

2. Discuss the following with the graduate program director (or Chair) and, if appropriate, the current advisor:
    - Whether additional resources within or outside the department (such as the Ombuds office) could help resolve the situation.
    - The impact of the change of advisor on your time to complete the degree. Coursework, qualifying exams, and the comprehensive exams are all factors that could be impacted with a change in advisor.
    - Your current and future funding.
    - Research already conducted. Whether this will be incorporated into the dissertation, thesis, or report, and if so, how.
    - Impact on immigration status (if any). Consult International Programs and Services (IPS), if necessary.
    - Record the agreement from the discussions in writing, including indications of agreement from all affected faculty advisors, and provide copies to the student, the graduate program director, and all affected faculty advisors.

3. File an updated *Advisor and Committee Recommendation Form* for approval by the Graduate School (https://www.mtu.edu/gradschool/documents/policies-procedures/forms/advisor-committee.pdf).

4. If the student and the graduate program director are unable to reach agreement on the advisor change, contact the assistant dean of the Graduate School to determine additional steps to resolve the situation.

4 Student progress/written feedback

Student progress evaluation/feedback verifies that students are making timely progress toward degree completion and provides students with feedback concerning degree progress from their advisor and from the program. Continued funding and/or enrollment in the program is based on satisfactory progress. This ensures that students are informed of any concerns that might affect the department's assessment of their progress and that they are given ample opportunity to remedy those concerns.

Students who are completing a report, thesis, or dissertation need to complete the written feedback at least annually. See Appendix A for the form used in our department. When completed by the student and advisor, the copies are provided to the student, advisor, graduate program director, and Department Chair. If deficiencies are identified in a student's performance, written feedback will be provided twice yearly, specifically addressing the area(s) of deficiency, timeline for making up the deficiency, and consequences for continued unsatisfactory performance.

5 Required paperwork

The graduate school requires MS and PhD students to submit certain forms documenting their progress through the degree requirements (for example, completion of necessary courses, passage of required exams, scheduling of an oral defense, etc.). These forms can be found at the following web pages:

MS	www.mtu.edu/gradschool/administration/academics/forms-deadlines/masters/
PhD	www.mtu.edu/gradschool/administration/academics/forms-deadlines/doctoral/
MyMichiganTech	www.MyMichiganTech.mtu.edu has your personalized timeline.

The graduate program secretary can help students to file these forms; however, it is the responsibility of each student to file the necessary forms in a timely manner. Please note that each form has an associated deadline, and that the graduate school may not accept a form after the deadline.

Graduate Student Annual Progress Report (Year)

DUE APRIL DD, 20YY

Name_____ **Advisor**_____

Program (circle one) Applied Math Discrete/Pure Math Statistics

Degree (circle one) MS PhD Year accepted to MTU_____

Current Status (circle one) GTA GRA GA Fellowship _____ Self-Support____
(e.g., Finishing, NASA)

Expected graduation date _____

Course #	Course/Requirement	Credits	Instructor	Grade	Term
REQUIRED COURSES COMPLETED					
ELECTIVES COMPLETED					

Total Credits		**Remaining Credits**	

<u>Please describe activities for Fall 2018 through Spring 2019; plans for Summer 2019</u>

Teaching Assignments

Current Research

Activities

Conference Attendance/Presentations

Publications

Short-Term Research Plans and Goals (next academic year)

Long-Term Research Plans and Goals (12 months & beyond)

Other (Ex: qual/comp exam passed, writing thesis/dissertation, final defense scheduled, committee service)

The following have read the above progress report and have been involved in discussions with the student.

Supervisor Signature Date

Recommended actions: Yes_____No _____

Student Signature Date