

# GRADUATE HANDBOOK

2018-2019

DEPARTMENT OF MATHEMATICS, STATISTICS, AND  
COMPUTER SCIENCE

at the

UNIVERSITY OF ILLINOIS AT CHICAGO

[www.math.uic.edu/gradstudies](http://www.math.uic.edu/gradstudies)

**2018–2019 Graduate Handbook**  
**Department of Mathematics, Statistics, and Computer Science**  
**University of Illinois at Chicago**

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**Table of Contents**

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*Table of Contents*

1. GRADUATE PROGRAM OFFICERS .....	4
2. DEPARTMENT OF MATHEMATICS, STATISTICS, AND COMPUTER SCIENCE (MSCS) .....	5
3. MSCS RESEARCH FACULTY .....	5
4. GRADUATE ADMISSION .....	5
Degree Admission .....	6
Non-Degree Admission .....	6
Prerequisites for Admission to Doctoral Programs .....	6
Prerequisites for Admission to Master’s Programs .....	6
MS program with <i>Statistics</i> : Applicant must have taken the equivalent of Applied Linear Algebra (Math 310), Analysis I (Math 313), and Introduction to Probability (Stat 401).	
5. FUNDING, DEGREE DEADLINES, AND POLICIES ON GOOD STANDING .....	7
Student Progress Petitions .....	8
MSCS Funding Application Procedures .....	9
Teaching Assistantships .....	9
Graduate College (GC) Tuition and Fee Waivers .....	10
University Fellowships and Awards .....	10
Work-Study Program .....	10
6. PROGRAM ADMINISTRATION .....	10
Program Administrators .....	11
7. DEGREE PROGRAMS .....	11
8. REQUIREMENTS for the MASTER OF SCIENCE (MS) in MATHEMATICS .....	12
Requirements for the MS degree in Mathematics <i>with</i> a major area concentration are as follows: .....	12
Requirements for the MS degree in Mathematics earned <i>without</i> a major area concentration .....	13
5. Earn a high pass on the Department’s written Master’s Exam in one of four areas of concentration.	
9. MS EXAM AND MS THESIS .....	13
Schedule .....	14
Grading and Solutions .....	14
Re-Grade Policy .....	14
Distribution of MS Exam Questions .....	14
MS Thesis Committee .....	15
10. REQUIREMENTS for the MS in the TEACHING of MATHEMATICS (MST) .....	15

11. REQUIREMENTS for the DOCTOR OF PHILOSOPHY (PhD) in MATHEMATICS .....	17
12. DOCTORAL PRELIM EXAM & DOCTORAL CANDIDACY .....	17
Doctoral Candidacy .....	17
Prelim exam committee .....	18
Minor Sequence .....	18
Grading of the Minor Sequence .....	18
Oral Prelim Exam (Statistics students only) .....	19
13. WRITTEN PRELIMS .....	19
Schedule .....	20
Grading .....	20
Written Prelims in Pure and Applied Mathematics .....	20
Written Prelims in Mathematical Computer Science .....	21
Written Prelims in Probability and Statistics .....	22
14. PhD THESIS COMMITTEE and DEFENSE .....	22
15. REQUIREMENTS for the DOCTOR OF ARTS (DA) .....	23
Written Prelims and Doctoral Candidacy (DA students only) .....	24
Teaching Practicum (DA students only) .....	24
Thesis Proposal (DA students only) .....	25
16. ADVISING SYSTEM .....	26
Role of the Faculty Mentor .....	26
Thesis Advisors .....	26
17. COURSE REGISTRATION and GRADUATION .....	27
Course Registration .....	27
Course Load .....	27
Graduation .....	27
Special Courses .....	27
Zero Hours Registration .....	28
Restricted Courses .....	29
Incomplete Grades .....	29
Transfer of Credit .....	29
Leave of Absence .....	29
Mathematics Library .....	29
Mathematics Graduate Student Association (MGSA) .....	30
Suggestions and Concerns .....	30
The Colloquium .....	30
Appendix 1: To the Faculty .....	31
Faculty Mentors/Advising .....	31
Prelim Exam Administration (Written) .....	31
Prelim Exam Administration (Oral – Statistics only) .....	31

Master’s Exam Administration.....	32
Appendix 2: Graduate Course Detail.....	35
Graduate MATH Courses.....	35
Graduate MCS Courses .....	38
Graduate STAT Courses.....	39
Graduate MTHT Courses .....	41

## 1. GRADUATE PROGRAM OFFICERS

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Associate Director of Graduate Studies	Maureen Madden	momadden@uic.edu

## Important Addresses

### 1. MSCS Graduate Studies Offices

Department of Mathematics, Statistics, and Computer Science (MC 249)

Phone: 312/413-2175

Fax: 312/996-1491

339 & 341 Science Engineering Office Bldg (SEO), 851 South Morgan Street

[dgs@math.uic.edu](mailto:dgs@math.uic.edu)

<http://www.math.uic.edu/gradstudies>

### 2. Office of Graduate Admissions (MC 018)

Phone: 312/996-4350

Fax: 312/413-7628

1100 Student Services Bldg (SSB), 1200 West Harrison Street

[uicadmit@uic.edu](mailto:uicadmit@uic.edu)

<http://www.uic.edu/depts/oar>

### 3. Graduate College (MC 192)

Phone: 312/413-2550

Fax: 312/413-0185

612 University Hall (UH), 601 South Morgan Street

[gradcoll@uic.edu](mailto:gradcoll@uic.edu)

<http://www.uic.edu/depts/grad>

### 4. Office of International Services (MC 326)

Phone: 312/ 996-3121

Fax: 312/ 996-9432

1220 Student Services Building (SSB), 1200 West Harrison Street

[ois@uic.edu](mailto:ois@uic.edu)

<http://www.ois.uic.edu>

## 2. DEPARTMENT OF MATHEMATICS, STATISTICS, AND COMPUTER SCIENCE (MSCS)

The University of Illinois at Chicago (UIC), one of the three campuses of the University of Illinois, is located within five minutes of downtown Chicago by public transportation. The city offers excellent concerts, opera, and theater; a wide variety of museums and galleries; and superior restaurants for almost any taste. The parks and lakefront are also known for entertainment and recreation.

The Department of Mathematics, Statistics, and Computer Science belongs to the American Mathematical Society's Group I of leading research mathematics departments in the country. MSCS has more than 50 research faculty, including 14 Sloan Foundation Fellows and 17 CAREER Scholars (or Presidential Scholars). Six of the senior faculty have been invited to address the International Congress of Mathematicians.

The Department offers graduate degree programs to 160 graduate students in the areas of Pure Mathematics, Applied Mathematics, Mathematical Computer Science, Probability and Statistics, and Mathematics Education, and offers MS (Master of Science), PhD (Doctor of Philosophy), MST (Master of Science in Teaching of Mathematics), and DA (Doctor of Arts) degrees.

The Department's broad range of activities offer graduate students rich, extensive study opportunities for pursuing career goals. We average 12 announced research seminars, which bring eminent mathematicians, computer scientists, and statisticians to campus, each week. The Department boasts strong programs in computer mathematics, combinatorics and complexity, geometry and topology, partial differential equations, and logic.

We regularly interact with other mathematics departments in the metropolitan Chicago area, in particular with the University of Chicago and Northwestern University. Our students have become involved with the Division of Mathematics and Computer Science at Argonne National Laboratory. Graduate students enrolled in our supercomputing course have access to advanced computing architectures and supercomputers.

The Department also has an active program in mathematics education. Through this program the Department maintains contact with educators and teachers in the Chicago area and is involved in promoting excellence in the mathematical training of primary and secondary teachers.

## 3. MSCS RESEARCH FACULTY

An up-to-date list of our current faculty can be found at <http://www.math.uic.edu/people/faculty>. For a list of our faculty by position, see [http://www.math.uic.edu/people/faculty\\_by\\_position](http://www.math.uic.edu/people/faculty_by_position); for a list by research area, see [http://www.math.uic.edu/people/faculty\\_by\\_area](http://www.math.uic.edu/people/faculty_by_area).

## 4. GRADUATE ADMISSION

Application is made to a degree program in a particular area. Students who do not designate a program will be treated as Pure Mathematics applicants. Students who wish to change their program after admission may do so after meeting the requisite entrance requirements for the

program. For questions about program options and admission requirements, consult the website or contact the [Associate Director of Graduate Studies](#).

A list of required application materials, application deadlines, and links to the graduate application form are accessible from the MSCS Graduate Studies website. A complete application packet is required *before* the applicant will be considered for admission.

### **Degree Admission**

Admission is selective and competitive. Applicants must have a baccalaureate from an accredited college or university, a grade point average of at least 3.0 (A = 4.00) for the final 60 credit hours of undergraduate study, and at least 20 credit hours of undergraduate work in mathematics beyond calculus with a minimum grade point average of 3.0 (A = 4.0). Applicants with an undergraduate degree in an area other than mathematics may be considered for admission *after* completing prerequisite coursework.

The general GRE (Graduate Record Examinations) is *required* of all degree program applicants *except* those applying for the MST program. While applicants are not required to take the GRE subject test in mathematics or computer science, it is strongly encouraged. No other exams may be substituted.

Applicants whose native language is *not* English must take the Test of English as a Foreign Language (TOEFL). The required minimum score is 100 (internet-based), with a minimum score of 20 on the Speaking portion.

### **Non-Degree Admission**

Applicants who do not meet the prerequisites for degree admission may apply for graduate non-degree admission. This will give the applicant access to UIC to take any necessary prerequisites. A baccalaureate degree from an accredited college or university is required for non-degree admission. A few restrictions apply: non-degree students are not eligible for funding; no more than 12 credit hours of graduate level coursework can be applied to the degree; and only courses in which an A or B is earned can be transferred to the degree.

### **Prerequisites for Admission to Doctoral Programs**

Applicants for the doctoral programs (PhD or DA) must have a BS or BA in Mathematics or a related field. Applicants should complete coursework related to their research field of interest as outlined below for the various MS in Mathematics degree programs.

### **Prerequisites for Admission to Master's Programs**

MST program (Elementary School Option): Applicant must hold a valid K–8 Illinois teaching certificate or the equivalent.

MST program (Secondary School Option): Applicant must have three semesters of engineering calculus plus the equivalent of two of these courses: Advanced Calculus/Analysis (Math 313 or

MTHT 430), Linear Algebra I (Math 320), and Abstract Algebra (Math 330 or MTHT 435), or a course on proofs (Math 215).

MS program in Mathematics with Pure Mathematics concentration: Applicant must have one year of work in linear algebra and abstract algebra plus one year of study in analysis or advanced calculus.

MS program in Mathematics with Applied Mathematics concentration: Applicant must have proficiency in differential equations (Math 220), applied linear algebra (Math 310), and knowledge of advanced calculus (Math 410).

MS program in Mathematics with Mathematical Computer Science concentration: Applicant must have taken the equivalent of Programming Tools and File Management (MCS 275), Introduction to Data Structures (MCS 360), Discrete Mathematics (MCS 361), Linear Algebra I (Math 320) or Applied Linear Algebra (Math 310), Introduction to Probability (Stat 401), one upper-division mathematics or computer science course, and must be proficient in a structured programming language such as Python and C++.

MS program with Statistics: Applicant must have taken the equivalent of Applied Linear Algebra (Math 310), Analysis I (Math 313), and Introduction to Probability (Stat 401).5. FUNDING, DEGREE DEADLINES, AND POLICIES ON GOOD STANDING

Students must remain in *good standing* to continue in MSCS toward degree completion and to be considered for funding.

A student is in *good standing* by satisfying the following:

- Students admitted into the MS program must complete the course requirements and pass the MS exam within four semesters.
- Students admitted into the MS program, continuing into the PhD or DA program must pass one written prelim within three years of entry into the MS program, and pass both written prelims and meet the requirements for doctoral candidacy within four years.
- Students admitted directly to the PhD or DA program without a previous MS degree must earn a high pass on the MS exam by the end of the second year in the program, pass at least one written prelim within three years from entry into the program, and pass both written prelims and meet the requirements for doctoral candidacy within four years
- Students admitted directly to the PhD or DA program with a previous MS degree must pass at least one written prelim by the end of the second year, and pass both written prelims and meet the requirements for doctoral candidacy within three years.

The extent to which students in *good standing* can be considered for funding is contingent on the time spent completing the degree requirements:

- MS students are expected to complete the program within 4 semesters, and thus are eligible for no more than 4 semesters of support from University sources.
- Students completing the MS at UIC and continuing to the PhD or DA are expected to complete the doctoral program within 6 years from entry into the MS program, and thus are eligible for no more than 6 years of support from University sources.

- PhD and DA students without a previously earned MS degree are expected to complete the program within 6 years, and thus are eligible for no more than 6 years of support from University sources.
- PhD and DA students entering the program with a previously earned MS degree are expected to complete the program within 5 years, and thus are eligible for no more than 5 years of support from University sources.

The following table illustrates MSCS policies governing *good standing and degree completion*:

End of Year	Admitted to MS	Admitted to UIC MS, cont. to PhD	Admitted to PhD without a MS	Admitted to PhD with MS
1				
2	Complete degree	High pass on MS exam	High pass on MS exam	Pass one prelim
3		Pass one prelim	Pass one prelim	Meet requirements for doctoral candidacy
4		Meet requirements for doctoral candidacy	Meet requirements for doctoral candidacy	
5				Complete degree
6		Complete degree	Complete degree	

### Student Progress Petitions

Students who do not meet the requirements for good standing must petition the Graduate Studies Committee to continue. The petition and required supporting documents are outlined below.

Students required to petition due to Prelim and/or MS Exam Requirements must submit two items: **(1)** a plan for completing the MS exam and/or Prelim(s), and **(2)** a faculty letter which evaluates your plan and timeline, and provides justification for how this plan will help you progress toward graduation. **Your plan** must include the following:

- Your planned minor sequence and the timeline (term and year) for completing the sequence
- The written prelim exam(s) you plan to take and when you plan to complete them with qualifying scores
- Your plan for completing the degree, including progress toward identifying your expected research area and potential thesis advisor

Students required to petition due to Degree Completion Requirements must submit **three items**: **(1)** a formal research statement, **(2)** a plan for degree completion, and **(3)** a letter by the thesis advisor (see details below).

The Graduate Studies Committee expects the **research statement** to be developed under the direct supervision of the thesis advisor. At least one faculty member in a closely related research field will evaluate the research statement, and the Graduate Studies Committee (GSC) will then decide whether to approve it. **Your research statement** must contain the following:

- An introduction to the general field of interest
- A review of related current research literature, with full references
- A list of accomplishments that have already been made toward completion of the thesis
- A detailed description of work currently in progress, including original research explained in detail; if no original research exists, the statement must justify why future progress is expected.
- A planned scope of the thesis
- A letter by the thesis advisor which evaluates the research statement and the plan, and provides justification for how the student will progress toward graduation

The **plan for degree completion** must state a realistic and concrete timeline for completion and defense of the thesis, including a breakdown of research tasks, and a timeline for writing, editing, and revising.

### **MSCS Funding Application Procedures**

*New* graduate degree-seeking applicants must submit the [Application for Graduate Appointment](#) form during the admission process to be considered for any available teaching assistantships, fellowships, or GC tuition and fee waivers. It is important that the Graduate College admission application, fee, and other required supplemental materials are received by the MSCS application deadline to receive full consideration for available funding.

Continuing degree-seeking students may apply for funding for Spring and Summer terms by filling out the relevant intranet forms, and by submitting the teaching schedule request available from the MSCS website.

### **Teaching Assistantships**

MSCS employs graduate students as teaching assistants (TAs) to support the Department's undergraduate courses. Most positions are 50% (full-time) teaching assistantships; 25% awards are occasionally offered. Teaching Assistantships carry a stipend and an assistantship waiver, including a full tuition waiver and partial fee waiver. Positions are awarded on the basis of academic merit, with teaching abilities, communication skills, and the needs of the Department taken into account. Only MSCS graduate students in good standing and who are eligible to work in the United States are eligible for these positions (see [Section 5: Policies on Good Standing, Degree Deadlines, & Funding](#)).

TAs must express an interest in continuing their support for each subsequent year by completing the annual Academic Assessment with their faculty mentor each spring semester. TAs with one-semester appointments will need to submit this form each semester. The continuing aid application and related deadlines are announced each term.

Most TA appointments are made for the full academic year, beginning in the fall semester. Summer TA positions are based on the needs of the Department.

## Graduate College (GC) Tuition and Fee Waivers

The Department receives a limited number of Graduate College (GC) tuition and fee waivers, which provide the student with a full waiver of tuition and a partial waiver of fees. They are awarded one semester at a time, based on academic merit. GC waivers require 12 credit hours of enrollment if awarded for the fall or spring, or 6 credit hours of enrollment if awarded for the summer. Only MSCS graduate students in *good standing* may be considered for a GC waiver (see [Section 5: Policies on Good Standing, Degree Deadlines, & Funding](#)).

## University Fellowships and Awards

The Graduate College website posts a complete list of awards and fellowships available through the University. The University Fellowship is one of the most prestigious awards given by the Graduate College. These fellowships enable students to pursue graduate studies and research without a service requirement. University Fellowships carry a stipend along with a fellowship tuition and service fee waiver; and require 12 credit hours of enrollment for fall and spring, and 6 credit hours for summer. Most fellowships and awards available through the University require an endorsement from the Department.

## Work-Study Program

Students who are U.S. citizens or permanent residents (or have applied for such) and who can demonstrate financial need may be eligible for the Work-Study Program. Awards are based on financial need and academic progress. Students can obtain an Free Application for Federal Student Aid (FAFSA) by contacting the [Office of Financial Aid](#).

## 6. PROGRAM ADMINISTRATION

Graduate students in the Department have two important responsibilities during the pursuit of their academic goals. The first is planning a program of study with the assistance of a **Faculty Mentor**, who serves as the Graduate College-mandated academic advisor. The second is following the rules and procedures outlined in the [Graduate College catalog](#) and the MSCS Graduate Handbook. In some cases, Departmental policies are stricter than Graduate College policies. **In any case, students are responsible for being aware of all policies and requirements and satisfying them according to university regulations and deadlines.**

The Graduate College Catalog has three primary purposes: to provide information about UIC, to inform prospective and current students of the general rules and procedures governing graduate study, and to describe the programs offered through the Graduate College.

The MSCS Graduate Handbook has more specialized purposes: to provide information about the Department, to inform prospective and current students of Departmental rules and procedures concerning graduate study and student progress, and to provide a detailed description of the graduate programs offered by MSCS.

## Program Administrators

The *Director of Graduate Studies* (DGS) implements policies and procedures, advises students and faculty on policy and procedural matters, serves as academic advisor to non-degree students and oversees admissions to the program and recommendations for funding.

The *Associate Director of Graduate Studies* serves in the absence of the Director of Graduate Studies, provides advice regarding University policies and procedures, makes teaching assignments for MSCS teaching assistants, and assists with the admissions process.

The *Faculty Mentors* help students make academic decisions and guide students in the selection of courses to support their academic goals. Faculty approval is required at every stage of a student's program of study. Later in the academic career, the thesis advisor assumes the role of faculty mentor.

The *Graduate Studies Committee* (GSC) is responsible for formulating policies related to all MSCS graduate study programs. The GSC acts on student petitions requesting an exception to Departmental policies. Student petitions and questions related to policies and procedures should *first* be directed to the Director of Graduate Studies.

## 7. DEGREE PROGRAMS

The Department offers a wide variety of programs of study at the master's and doctoral levels. The scope of the Department's activities is reflected in the richness of opportunities available to graduate students.

The Master of Science (MS) in Mathematics degree is designed to lay the foundation for doctoral work and to prepare students for a career in business, government, or industry. Students can earn the degree with a concentration in Pure Mathematics, Applied Mathematics, and Mathematical Computer Science.

Pure Mathematics is designed to tailor a program suitable to the student's interests and needs to the extent possible. Students with strong mathematical backgrounds who intend to continue for a doctoral degree are encouraged to complete one or more of the basic 500-level course sequences leading to a written prelim exam while they are earning the master's degree.

Applied Mathematics is designed for students who have a bachelor's degree in mathematics, or a strong mathematical background together with a degree in computer science, engineering, physics or biology. While earning their master's degree, students are allowed to seek additional courses (up to 8 credit hours) in the aforementioned disciplines, suitable to their interests. Students who intend to pursue a doctoral degree in mathematics are encouraged to also complete one or more of the basic 500-level courses offered in the prelim sequences.

Mathematical Computer Science is designed primarily for students who have bachelor's degrees in mathematics, computer science, or engineering with a modest background in computer science and mathematics. Students are encouraged to seek additional courses in other departments suitable to their interests.

Master of Science in Statistics is designed to give students initial coursework in probability, statistical methods, statistical theory, and optimal decision. After completing this program, students have two directions of study available – applied statistics or theoretical statistics. Students are encouraged to become familiar with some areas of the natural science, engineering, or the social science for statistical application.

Master of Science in Teaching of Mathematics (MST) is a special degree program designed to strengthen the preparation and background of teachers in secondary or elementary schools. The *secondary school option* includes courses for high school mathematics teachers as well as a program of study that leads to State of Illinois teacher certification for those who are not already certified. The *elementary school option* is designed to broaden the student's understanding of learning and teaching mathematics in grades K–8. **The MST program does not prepare students to enter the Department's doctoral programs.** The MS programs and MST program serve very different purposes; coursework in one is not necessarily applicable to the other.

The Doctor of Philosophy (PhD) in Mathematics degree is designed to provide the highest level of training for independent research. The Department offers programs in Pure Mathematics, Applied Mathematics, Mathematical Computer Science, and Probability and Statistics that lead to the Doctor of Philosophy (PhD) degree.

The Doctor of Arts (DA) in Mathematics degree is designed to train educators for undergraduate instruction in universities, four-year, and two-year colleges. The goal of the DA program is to produce graduates who have demonstrated breadth in their understanding of mathematics, demonstrated mastery of the ability to learn new mathematics independently and are prepared to teach a wide range of topics in two-year and four-year colleges.

## 8. REQUIREMENTS for the MASTER OF SCIENCE (MS) in MATHEMATICS

**Requirements for the MS degree in Mathematics *with* a major area concentration are as follows:**

1. Fulfill the Graduate College requirements pertaining to the master's degree, including the completion of 9 hours of 500 level coursework *excluding* any of the Department's Independent Study courses (596).
2. Earn a minimum of 32 credit hours of advisor-approved graduate credit (excluding thesis research) as follows:
  - a. 12 hours of Departmental 500 level courses earning a grade of A or B. Courses selected may include independent study (596) but may NOT include the TA Workshop (Math 589). For the Mathematical Computer Science concentration, at least two courses must be MCS courses. For the Probability and Statistics concentration, at least two courses must be STAT courses.
  - b. Satisfy core course requirements for the selected area of concentration:
    - Pure Math: Math 417, 516, 533, and 4 hours from Math 446, 517, 534, 535, 536
    - Applied Math: Math 417, 480, 481
    - Mathematical Computer Science: MCS 401, 421, and 471
    - Probability and Statistics: Stat 401, 411, and 481

- c. Any remaining hours must be selected with faculty mentor's approval from 400 or 500 level courses. Courses may include Independent Study (596), the TA Workshop (589), or courses outside the Department.
- 3. a. Pass the Department's (written) Master's Exam in the area of concentration, **or**
- b. Achieve a grade point average of at least 3.5 for the core courses, earn 5 credit hours in master's thesis research (Math 598, MCS 598 or Stat 598), write an acceptable thesis, and pass an oral defense.

Students who have completed the core courses at another institution must meet with their faculty mentor to identify suitable courses to substitute for those previously taken. Once the course substitutions have been identified, the student must submit a request to the Director of Graduate Studies, signed by the faculty mentor, listing the recommended course substitutions.

### **Requirements for the MS degree in Mathematics earned *without* a major area concentration**

Earning the MS degree without a major area concentration is intended for exceptional students and requires prior approval of the Graduate Studies Committee.

The requirements for the MS degree in Mathematics earned *without* a major area concentration are as follows:

1. Fulfill the Graduate College requirements pertaining to the master's degree.
2. Earn a minimum of 32 credit hours of advisor-approved credit in part by completing a program of 24 credit hours from the Department, approved in advance by the Graduate Studies Committee and selected from the following courses:  
MATH 417, 430, 435, 436, 442, 445, 446, 480, 481  
MCS 401, 411, 421, 423, 441, 471, 472  
STAT 411, 416, 431, 451, 461, 481, 486  
Any Departmental 500-level course *excluding* topics courses
3. Complete 12 hours of Departmental 500 level coursework with an A or B, *excluding* Special Topics courses. 8 hours can be selected from outside the Department.
4. Achieve an overall grade point average of 3.25 or better for the program.
5. Earn a high pass on the Department's written Master's Exam in one of four areas of concentration.

### **9. MS EXAM AND MS THESIS**

The Department's comprehensive written Master's Exam (MS exam) is based on 400-level and 500-level course material and has an option for each of the Department's major areas of concentration. To earn the MS in Mathematics students must pass the exam within one year after completion of 32 credit hours applicable to the degree.

Students must register for the exam at least three weeks before the exam date. The registration form is posted on the MSCS Graduate Studies website along with previous exams and solutions.

## Schedule

The MS Exam is a three-hour exam given twice a year. The fall exam is given during the week preceding the first week of instruction, and the spring exam is given the week following spring break.

## Grading and Solutions

The MS exam is graded on a scale of 0 to 160 points. Each question is worth 20 points. Each exam consists of multiple questions. Every question the student answers will be graded. The 8 questions with the highest numerical scores are then used to determine the student's MS exam score. A minimum passing score on this exam is 90 points. A minimum score of 110 points earns a "high pass" designation. More information on how the MS exam score may impact advancement in a doctoral program is outlined in [Section 5: Policies on Good Standing, Degree Deadlines, & Funding](#).

MS exam scores will be distributed by email to students by the Graduate Studies office approximately two weeks after the exam. The MS exam and solutions are then posted on the MSCS Graduate Studies website. Students may obtain a copy of their exam by contacting the Grad Studies office; students' exams are retained for two years.

## Re-Grade Policy

Students who wish to have a portion of their MS exam re-graded should understand that this process could result in the raising or *lowering* of the exam score. Requests for a re-grade of any portion of the exam must be made no later than two weeks following the distribution of the exam scores. To make a request, students must obtain a copy of their exam from the Graduate Studies office, review the solution key posted on the MSCS Graduate Studies website, and submit a request in writing along with a detailed rationale for *each* question to be re-graded to the Director of Graduate Studies.

## Distribution of MS Exam Questions

The **written master's exam for Pure Mathematics** has 18 questions distributed as follows:

Math 330, 431	Algebra	3 questions
Math 313, 414	Analysis	3 questions
Math 417	Complex Analysis	3 questions
Math 430	Logic	3 questions
Math 435	Number Theory	3 questions
Math 445	Point-Set Topology	3 questions

The **written master's exam for Applied Mathematics** has 15 questions distributed as follows:

Math 313, 414	Analysis	3 questions
Math 417	Complex Analysis with Applications	3 questions
Math 480	Applied Differential Equations	3 questions
Math 481	Applied Partial Differential Equations	3 questions
MCS 471	Numerical Analysis	3 questions

The **written master's exam for Mathematical Computer Science** has 12 questions distributed as follows:

MCS 401	Computer Algorithms I	2 questions
MCS 421	Combinatorics	2 questions
MSC 423	Graph Theory	2 questions
MCS 425	Codes and Cryptography	2 questions
MCS 441	Theory of Computation I	2 questions
MCS 471	Numerical Analysis	2 questions

The **written master's exam for Probability and Statistics** has 12 questions distributed as follows:

Stat 401	Introduction to Probability	4 questions
Stat 411	Statistical Theory	4 questions
Stat 481	Applied Statistical Methods II	4 question

### **MS Thesis and Defense (optional)**

Students opting to earn the master's degree by writing and defending a thesis must achieve a minimum grade point average of 3.5 for the core courses, find a thesis advisor, and notify the Director of Graduate Studies *by the end of their second semester* in the program. Students must complete at least 5 credit hours of master's thesis research (Math 598, MCS 598 or Stat 598) beyond the 32 credit hours of advisor-approved credit required for the degree. A satisfactory thesis must be completed and successfully defended within one year of completion of 32 credit hours applicable to the degree.

All degree requirements must be satisfied before the thesis defense can be scheduled. The defense cannot be scheduled until all members of the Thesis Committee have received a copy of the thesis and had an opportunity to consult with the thesis advisor. Anyone may attend the thesis defense.

### **MS Thesis Committee**

Students opting to write a master's thesis must pass an oral defense of their thesis. At least 30 days prior to the defense, students must complete the Committee Recommendation form electronically and obtain the signatures of the thesis advisor and Director of Graduate Studies. The form is then forwarded to the Graduate College for final approval.

MS Thesis committees consist of at least three members, one of whom must be tenured and a full member of the Graduate Faculty. The Chair of the committee (thesis advisor) must be a member of the MSCS Graduate Faculty. The committee vote is pass or fail. The student will not pass the defense if more than one vote of fail is received. A second defense may be recommended by the committee to the Director of Graduate Studies; a third defense is *not* permitted.

## **10. REQUIREMENTS for the MS in the TEACHING of MATHEMATICS (MST)**

The purpose of the MST program is to strengthen the preparation of mathematics teachers. Students may select one of two options for this degree – Secondary School Option or Elementary School Option.

The MST degree (Secondary School Option) offers courses for certified secondary teachers as well as students seeking certification. The requirements for the **MST degree, Secondary School Option** are as follows:

1. Fulfill the Graduate College requirements pertaining to the master's degree.
2. Earn a minimum of 32 credit hours of faculty mentor-approved graduate credit as follows:
  - a. 12 hours of Departmental 500 level courses earning a grade of A or B, *excluding* Independent Study (596) courses.
  - b. 16 hours of Departmental core courses: MTHT 411 (Advanced Euclidean Geometry II), MTHT 435 (Abstract Algebra)\*, MTHT 510 (Introduction to Higher Geometry), MTHT 530 (Mathematical Analysis for Teachers II)  
\*May substitute Math 435 (Number Theory) if a proof-based abstract algebra course has been taken.
3. Advisor-approved electives in mathematics to fulfill the 32 credit hours requirement.
4. If seeking certification, students must fulfill additional requirements to be eligible for state certification in Illinois.  
*NOTE:* Teaching certification is not automatically awarded upon successful completion of degree and certification requirements.

The MST degree (Elementary School Option) offers courses for elementary teachers holding a current Illinois teaching certificate. The requirements for the **MST degree, Elementary School Option** are as follows:

1. Fulfill the Graduate College requirements pertaining to the master's degree.
2. Core course requirements (22 credit hours):
  - MTHT 465 (Teaching Algebra for Understanding)
  - MTHT 550 (Concepts in Elementary School Mathematics II)
  - MTHT 565 (Teacher Geometry: An Activity Approach)
  - MTHT 589 (Practicum in Teaching Elementary School Mathematics)
  - CI 484 (Curriculum and Instruction in the Middle School)
  - EPSY 446 (Characteristics of Early Adolescence)
3. Electives (14 credit hours):
  - MTHT 450 (Concepts in Elementary School Mathematics I)
  - MTHT 460 (Geometric Measurement and Numerical Methods)
  - MTHT 470 (Teaching Mathematics with Science: An Activity Approach I)
  - MTHT 480 (Microcomputers in Elementary School Mathematics I)
  - MTHT 560 (Introduction to Analytic Geometry and Calculus)
  - MTHT 575 (Principles of Probability and Statistics)

## 11. REQUIREMENTS for the DOCTOR OF PHILOSOPHY (PhD) in MATHEMATICS

The student's major focus in the Doctor of Philosophy (PhD) program is the production of a thesis that is a significant piece of mathematical research acceptable to the Department. PhD students should complete all requirements for doctoral candidacy as soon as possible so they can concentrate on their research and thesis.

### **The requirements for the PhD in Mathematics are as follows:**

1. Fulfill the Graduate College requirements pertaining to the PhD degree.
2. Provide proof of an equivalent MS degree, earn a high pass on the Department's Master's Exam, or write a master's thesis and pass an oral defense.
3. Pass two written prelims and fulfill the minor sequence with qualifying scores:
4. Sum of the scores for two written prelims is at most 4.
5. Sum of the numerical grade for the minor sequence and the sum of the scores for the two written prelims is at most 6.
6. Pass an oral prelim exam (Probability and Statistics students only) *after* completing requirements 2 and 3.
7. Complete a thesis acceptable to the Department which makes a contribution to original research, and pass an oral defense of the thesis.
8. Earn a total of 96 credit hours of graduate credit\* of which at least 40 hours must be from the Department's 500-level courses, and 32 hours must be in thesis research\*\*.

\* Students entering the PhD program with a previously earned master's degree in a related field may petition the Director of Graduate Studies to apply 32 credits toward the PhD. Final approval from the Graduate College is required.

\*\*Students cannot enroll in more than four hours of Thesis Research (599) per term until they are formally admitted into doctoral candidacy by the Graduate College.

## 12. DOCTORAL PRELIM EXAM & DOCTORAL CANDIDACY

The purpose of the prelim examination is to determine the student's readiness to undertake thesis research. The prelim examination is administered in accordance with Graduate College rules as stated in the Graduate College catalog, and requires the student to be enrolled at the time of the exam.

### **Doctoral Candidacy**

Doctoral students who successfully complete their prelim examination *and* obtain the written approval of a faculty member to serve as the thesis advisor are formally recommended to the Graduate College as *doctoral candidates*. At least one year must lapse between admission to doctoral candidacy and the thesis defense. *Doctoral candidates* must enroll every semester (fall and spring) through the semester they successfully defend the thesis. One way to maintain enrollment is to request permission to enroll for "zero credit hours". Interested students should contact the [Graduate Studies](#) office for more details.

To become a doctoral candidate, students in the PhD program specializing in Probability and Statistics must earn a qualifying score for the two written prelims and the minor sequence and earn a “pass” on the oral prelim exam. The minor sequence may not include any courses from the STAT rubric.

To become a doctoral candidate, students in the DA program or the PhD program specializing in Pure Mathematics, Applied Mathematics, or Mathematical Computer must earn a qualifying score for the two written prelims and the minor sequence and be accepted by a faculty member as a thesis student.

More information on how the admission to doctoral candidacy impacts advancement in a doctoral program is outlined in [Section 5: Policies on Good Standing, Degree Deadlines, & Funding](#).

### **Prelim exam committee**

The Dean of the Graduate College appoints the committee for the prelim examination upon the recommendation of the Department. The committee consists of five members, three of whom must be UIC Graduate Faculty with full membership, and two of whom must be tenured. The Chair of the committee must be a full member of the UIC Graduate Faculty.

### **Minor Sequence**

Students declare their minor sequence using the Minor Sequence Request form, accessed from the website. This form must be approved by the advisor and submitted to the Director of Graduate Studies for approval.

The minor sequence is a breadth requirement and consists of a sequence of two 500-level courses described in the Handbook as leading to a written prelim. The minor sequence *may not* overlap an area in which a written prelim is taken. Doctoral students may satisfy the minor sequence in one of two ways, either by completing the sequence of two 500-level courses leading to the prelim OR by passing a written prelim.

### **Grading of the Minor Sequence**

*Note for Mathematical Computer Science Students: If two written prelims in Mathematical Computer Science are chosen, then the minor sequence must be selected from another area of the Department.*

Minor sequences other than those designated in this Handbook as leading to a written prelim, must be approved *in advance* by the Director of Graduate Studies. To make a request, the Minor Sequence Request form must also include:

1. A brief outline of the proposed minor sequence, specifying the two 500-level courses to be taken. The list may contain alternatives.
2. A brief explanation of how the proposed minor sequence is relevant to the student’s major mathematical area.
3. Confirmation that the minor proposal is acceptable to the other department(s), if any.

4. Written approval of the student's thesis advisor or faculty mentor.

The two course grades earned in the minor sequence are converted into a numerical score as follows:

Two A's:	1
One A and One B:	2
Two B's:	3
All other combinations:	5

Students who obtain a "5" may repeat one of the courses once, or they may petition the Director of Graduate Studies to approve another minor sequence.

### **Oral Prelim Exam (Statistics students only)**

PhD students in the Probability and Statistics program must pass an oral prelim exam, which should be done soon after successfully completing the two written prelims and the minor sequence. To arrange a date for the oral prelim exam, students must submit the Committee Recommendation form, endorsed by the thesis advisor, to the Graduate Studies office at least 30 days prior to the oral prelim exam.

The oral prelim exam is administered in accordance with the Graduate College regulations on prelim exams. The committee for the oral prelim exam is appointed by the Dean of the Graduate College upon the recommendation of the Department. The committee consists of five members; three members must be UIC Graduate Faculty with full membership, and two must be tenured. The committee must include the student's thesis advisor, two examiners in the written prelim areas, and one examiner in the minor sequence. If the student takes a minor course sequence in one or more other departments, then a member of one of them normally serves on the committee.

The committee vote is pass or fail. The student will not pass the oral prelim exam if more than one vote of fail is received. A second oral prelim exam may be recommended by the committee to the Director of Graduate Studies; a third oral prelim exam is *not* permitted.

## **13. WRITTEN PRELIMS**

Two written prelims must be selected from the list of approved written prelims outlined below. Each written prelim is based on a designated sequence of two graduate courses and must be passed with qualifying scores. Past prelims are archived on the MSCS Graduate Studies website for review.

Students should be aware that completion of the written prelims affects the student's good standing status and continued advancement in the doctoral program (see [Section 5: Policies on Good Standing, Degree Deadlines, & Funding](#)).

The approved written prelims are:

1. Algebra
2. Analysis
3. Geometry and Topology
4. Logic
5. Differential Equations
6. Methods in Applied Mathematics
7. Combinatorics
8. Algorithms and Complexity
9. Computational Science
10. Probability and Statistics (*required* for all Statistics students)
11. Linear Inference, Sampling, and Design
12. Game Theory
13. Number Theory

Doctor of Arts written prelims (DA students may select at most *one* of these):

13. Mathematics Education (DA students only)
14. History of Mathematics (DA students only)

### **Schedule**

The written prelims are given once per year, at the end of the spring semester at a time arranged between the examiners and the examinees. Students are allowed three hours to complete the written prelim. Students with extenuating circumstances may petition the Director of Graduate Studies for a written prelim to be administered at another time.

Students must [register for prelims online through the MSCS intranet](#). Students who have registered to take a written prelim, but no longer wish to sit for the exam *must notify* the examiners at least 10 days before the prelim is given. Failure to do so will result in a failing score for the prelim.

### **Grading**

Written prelim scores are assigned on the basis of 1 (best), 2, 3, and 5 (fail). The sum of the scores of the two written prelims may not exceed 4. Students may retake a written prelim repeatedly as long as the time limit is not exceeded (see [Section 5: Policies on Good Standing, Degree Deadlines, & Funding](#)). The examiners will report the score to the Graduate Studies office. This office will report the score to the student in writing and maintain a record of the score. Written prelims are to be graded within two weeks of the prelim date.

### **Written Prelims in Pure and Applied Mathematics**

The topic of the prelim clusters below cover the basic range of topics in pure and applied mathematics, as offered by our department. At an early stage, the program of study should include 500-level course sequences that lead to written prelims and the minor sequence, as well as advanced topics courses that expose students to possible research areas and potential thesis advisors. While students are allowed to choose any clusters for their examinations, they are encouraged to discuss their choice with their Faculty Mentors in order to find the best fit for the student's research interests. Prelim 1: **Algebra**

Math 516 Second Course in Abstract Algebra I  
Math 517 Second Course in Abstract Algebra II

Prelim 2: **Analysis**

Math 533 Real Analysis I  
Math 535 Complex Analysis I

Prelim 3: **Geometry and Topology**

Math 547 Algebraic Topology I  
Math 549 Differentiable Manifolds I

Prelim 4: **Logic**

Math 502 Mathematical Logic *plus* one of the following:  
Math 504 Set Theory  
Math 506 Model Theory I  
Math 511 Descriptive Set Theory

Prelim 5 : **Differential Equations**

Math 576 Classical Methods of Partial Differential Equations (offered every  
spring semester)  
Math 585 Ordinary Differential Equations (offered every fall semester)

Prelim 6: **Methods in Applied Analysis**

Math 539 Functional Analysis I (offered every fall semester)  
MCS 571 Numerical Analysis of Partial Differential Equations (offered every  
spring semester)

### Written Prelims in Mathematical Computer Science

The Department offers graduate study in a number of areas within mathematical computer science and computer-related mathematics. *Students who select two written prelims in Mathematical Computer Science must select a minor sequence in another area (Math or Stat).*

Each prelim in Mathematical Computer Science contains three questions from each course; the prelim score is comprised of the top five answers. Thus, it is possible to achieve a maximum score on the prelim by completing two of the courses listed for the written prelim.

Prelim 7: **Combinatorics**

MCS 521 Combinatorial Optimization  
MCS 531 Error-Correcting Codes  
MCS 591 Advanced Topics in Combinatorial Theory

Prelim 8: **Algorithms and Complexity**

MCS 501 Computer Algorithms II  
MCS 503 Mathematical Methods of Algorithm Analysis  
MCS 541 Computational Complexity

**Prelim 9: Computational Science**

MCS 563	Analytic Symbolic Computation
MCS 571	Numerical Analysis for Partial Differential Equations
MCS 572	Introduction to Supercomputing

Advanced work is offered in other areas including automatic theorem proving, compiler design, cryptography, computational number theory, database computing, database theory, parallel computational control, parallel programming tools, and programming language design. Students may also take courses offered by the College of Engineering's Department of Computer Science.

**Written Prelims in Probability and Statistics**

Doctoral students in Probability and Statistics take an initial program of courses in mathematics, probability, and statistics. Students have two broad directions of research available to them: statistics and probability.

PhD students in Statistics are *required to pass the Probability and Statistics prelim (written prelim 10) and select one of the remaining Statistics prelims (written prelim 11 or 12).*

**Prelim 10: Probability and Statistics (required for all Statistics PhD students)**

Stat 501	Probability Theory I
Stat 511	Advanced Statistical Theory I

Statistics PhD students *must* select one from Written Prelims 11 and 12:

**Prelim 11: Linear Inference, Sampling, and Design**

Stat 521	Linear Statistical Inference <i>plus</i> one of the following:
Stat 522	Multivariate Statistical Analysis
Stat 531	Sampling Theory I
Stat 535	Optimal Design Theory I

**Prelim 12: Game Theory**

Stat 571	Non-Cooperative Games <i>plus</i> one of the following:
Stat 572	Cooperative Game Theory
Stat 591	Advanced Topics in Statistics, Probability, & Operation Research

## 14. PhD THESIS COMMITTEE and DEFENSE

To obtain a PhD, students must also write a thesis acceptable to the Department and pass an oral defense of the thesis. At least one year must pass between admission to doctoral candidacy and the thesis defense.

*Thirty days prior* to the thesis defense, the student's advisor recommends a thesis committee in consultation with the student. This is done by completing the [Committee Recommendation form](#). The thesis committee is appointed by the Dean of the Graduate College upon the recommendation of the Department. The committee consists of at least five members. One member must be from outside the university or from another UIC department. At least two

members must be tenured graduate faculty at UIC. At least three members must be from the Department. The thesis advisor serves as Chair of the committee and must be a member of the MSCS graduate faculty.

In exceptional situations, and with the approval of the Graduate Studies Committee, a student may choose a thesis advisor outside the Department. If approved, the student must find a co-advisor within the Department.

The thesis defense cannot be scheduled until all members of the Thesis Committee have received a copy of the thesis and had an opportunity to consult with the thesis advisor. The committee vote is pass or fail. The student will not pass the thesis defense if more than one vote of fail is received. In the event of a failed exam, a second exam may be recommended by the committee; a third attempt is not permitted. Anyone may attend the thesis defense.

## 15. REQUIREMENTS for the DOCTOR OF ARTS (DA)

Students in the DA program focus on major areas of mathematics and conduct research in the methodology and techniques for successful teaching of mathematics. The course requirements for the DA degree expose students to the broad selection of topics taught at the undergraduate level. The DA thesis must be of publishable quality and represent a scholarly and substantive investigation of a topic in mathematics or mathematics education.

The requirements for the **Doctor of Arts degree in Mathematics** are as follows:

1. Fulfill the Graduate College requirements pertaining to the DA degree.
2. Provide proof of an equivalent MS degree or earn a high pass on the Department's written Master's Exam, or write a master's thesis and pass an oral defense. The MST degree is not sufficient equivalency.
3. Earn at least 96 credit hours of graduate credit as follows:
  - Breadth in Mathematics (48 credit hours): At least 24 hours selected from 500-level courses in at least 3 different prelim areas.
  - Education and Mathematics Education (12 credit hours): Advisor-approved courses selected from the following list:
    - Math 591 (Seminar on Mathematics Curricula)
    - Math 592 (Seminar on Mathematics: Philosophy and Methodology)
    - LRSC 500 (Introduction to the Learning Sciences)
    - LRSC 501 (Research Methods I)
    - LRSC 503 (Foundations of Scientific Inquiry)
    - LRSC 511 (Analysis of Teaching and Learning Interactions)
    - LRSC 512 (Design of Learning Environments)
    - CI 547 (Integrating Literacy Instruction)
    - CI 562 (Design and Conduct of Literacy Research)
    - CI 570 (Critical Issues in Science Education)
    - CI 594 (Special Topics in Curriculum and Instruction)

Electives (8 credit hours): advisor-approved courses selected from mathematics, science, economics, or statistical methods in psychology and education.

Teaching Practicum (8 credit hours of Math 596): completion of a project in which the candidate demonstrates accomplishment in undergraduate teaching (see below).

Thesis Research (20 credit hours of Math 599). *Before* thesis research can begin, a two-page thesis proposal and proposed thesis committee members must be approved by the DA Committee (see below).

4. Pass two written prelims and fulfill the minor sequence by achieving qualifying scores as follows:
  - a. Sum of the scores for the two written prelims is at most 4
  - b. Sum of the numerical scores for the minor sequence and the sum of the scores for the two written prelims is at most 6
5. Complete a thesis acceptable to the Department and pass the oral thesis defense.

#### **Written Prelims and Doctoral Candidacy (DA students only)**

To be formally recommended to the Graduate College as *doctoral candidates*, students in the DA program must earn qualifying scores for two written prelims and a minor sequence *and* select a thesis advisor. There are two written prelims designated exclusively for the Doctor of Arts program; DA students are *not* required to select a prelim from this group. Students who select a prelim from the DA group may take at most *one* from this group and must first petition the DA Committee for approval. The petition should outline a course of study including a reading list or detailed description of materials involved.

DA written prelims (for DA students only; at most one prelim may be selected from this group)

Prelim 13: **Mathematics Education**

Prelim 14: **History of Mathematics**

At least one year must pass between admission to doctoral candidacy and the thesis defense. Doctoral candidates must enroll every semester (fall and spring) through the semester they successfully defend the thesis. One way to maintain enrollment is to request permission to enroll for “zero credit hours”. Interested students should contact the [Graduate Studies office](#) for more details.

#### **Teaching Practicum (DA students only)**

DA candidates must complete a Teaching Practicum in which they demonstrate accomplishment as teachers of undergraduate mathematics. The Teaching Practicum consists of a program that develops teaching skills under the guidance of University faculty who supervise the practicum and evaluate the student’s performance. (Exceptions to the Teaching Practicum requirement must be approved by the Director of Graduate Studies.)

A 1–2 page Teaching Practicum Proposal describing the teaching practicum must be submitted to the DA committee for approval. The proposal must include:

- A description of the proposed teaching practicum, endorsed by the advisor,
- The course and semesters in which the practicum will take place, pre-approved by the Associate Head for Instruction who facilitates the teaching schedule.

Teaching Practicum examples:

- Supervised teaching of an approved class for two semesters, with preparation and use of various instructional materials and a limited education research project. There should be demonstrable effort devoted to developing new course materials, such as course worksheets or computer laboratory modules.
- Team-teaching an advanced undergraduate course with a faculty sponsor.

### **Thesis Proposal (DA students only)**

Before thesis work can begin, DA students must be formally admitted to doctoral candidacy by the Graduate College. Within six months of admission to doctoral candidacy, the DA candidate must submit a thesis proposal and proposed thesis committee members to the DA committee for approval.

The two-page Thesis Proposal must contain:

1. The main problem area of the thesis, discussion of related research, and outline of research questions.
2. If applicable, a list of students and UIC courses affected, class time to be used for the investigation, and a copy of the proposed IRB (Institutional Review Board)\* submission.
3. A list of proposed thesis committee members. Students writing a thesis in an area of mathematics education will actively involve the thesis committee. Substitutions to the committee may be made at a later date.

\* IRB approval is required for *all* research involving students. Allow one additional semester *before* beginning research to review the thesis proposal with the thesis committee, obtain approval from the advisor, and secure approval from the IRB.

The DA thesis must consist of an original, creative and scholarly contribution to the teaching of college mathematics and can be any one of the following:

- An expository and/or historical treatment of a mathematical topic making a contribution to the teaching of mathematics, OR
- A research study in the area of mathematics education, OR
- A two-part thesis consisting of: (1) an expository and/or historical treatment of mathematical course material that is created and evaluated; and (2) an instructional part that may be an outgrowth of the Teaching Practicum. The two parts are not required to involve the same mathematical topics, although this is desirable.

## 16. ADVISING SYSTEM

### **Role of the Faculty Mentor**

Students are responsible for planning their programs of study with the assistance of a faculty mentor who will assist the student in making the best possible academic decisions. Although students are assigned a faculty mentor during their first term of enrollment, students are encouraged to consult with *any* and *several* graduate faculty who can recommend courses related to their research and/or career goals.

Resources useful in program planning include the MSCS Graduate Handbook, the [Graduate College catalog](#), and the [MSCS list of 500-level courses to be offered during the next academic year](#) (see [Appendix 2](#)). Most 500-level sequences begin fall semester. Courses should be selected with prelim exams in mind.

Students are expected to be *thoroughly prepared* when they meet with their faculty mentor, to be familiar with the requirements of their program, and also to have thought out their course of study as completely and carefully as possible. In particular, students should be prepared to answer any questions about their academic record. Students should take the MSCS Graduate Handbook to planning sessions with their faculty mentor.

The Graduate Studies office can access a record of the student's courses and exams taken. The Director of Graduate Studies serves as the faculty mentor to non-degree students until a program of study has been selected.

### **Thesis Advisors**

Doctoral students will consult with their assigned faculty mentors on academic issues until a faculty member has agreed to serve as the student's *thesis advisor*. Once this occurs, the thesis advisor will advise the student on courses, seminars, and other activities that support the student's research. The thesis advisor has the primary responsibility for directing the student's thesis. In exceptional cases, and with the approval of the Director of Graduate Studies, an advisor may be selected from outside of the MSCS Department, but the student must find a co-advisor among the MSCS Department graduate faculty.

In an effort to identify potential thesis advisors, students are encouraged to attend MSCS colloquia and seminars to learn more about the types of faculty research being conducted in the Department. Taking independent study courses with faculty can be helpful in determining the level of interest a student may have in the professor's research and the compatibility of the work styles.

Students should also maintain close contact with the Graduate Studies office to ensure that they are aware of Graduate College requirements and ongoing Departmental deadlines.

## 17. COURSE REGISTRATION and GRADUATION

### Course Registration

Students may drop courses online through the second week of Fall or Spring terms and during the first week of the Summer term. All other course withdrawals or adds *must* be approved by the Director of Graduate Studies. To drop or add a course after the tenth week of Fall and Spring or after the fifth week of summer, students must also obtain Graduate College approval.

Students who are recipients of financial awards (TFW, TA, RA, GA) should make sure that the requested course withdrawal does NOT jeopardize their award.

It is very important for students to register in advance for courses they intend to take. Failure to do so may result in courses with low enrollment being cancelled or courses with high demand reaching full capacity, thereby preventing additional enrollment.

### Course Load

The Graduate College defines full-time enrollment as 9 or more credit hours. Graduate students are allowed to enroll in a maximum of 20 credit hours each Fall and Spring term. Most graduate courses are 4 credit hours each.

Students granted a Graduate College (GC) tuition and fee waiver must complete 12 credit hours during the fall and spring terms of the award; 6 credit hours is required for a summer award. These rules also apply to fellowship tuition waivers. Students whose enrollment falls below this level may be responsible for the full balance of their tuition and fees.

### Graduation

Students who intend to graduate should make an appointment with the Assistant Director of Graduate Studies to verify that all of their degree requirements have been met. Students must electronically file an "intent to graduate" by the deadline posted on the Graduate College website.

### Special Courses

Special courses are available for more advanced students. These courses include independent study (reading) courses, graduate student seminar courses, and thesis research.

#### Graduate Student Seminar (593)

Graduate students may earn one additional credit hour for attending weekly seminars in the Department by enrolling in a Graduate Student Seminar course (593). Seminars frequently host visitors or invite graduate students to present their research.

#### Independent Study (596)

Students may enroll in an Independent Study course (596) with a professor to study a topic not offered as a regular course for the semester. These courses range from 1–4 credit hours based on

the amount of work that is involved. To enroll in an Independent Study course, students must obtain a permission form from the MSCS Graduate Studies website and meet with the professor to discuss the details of the course and complete the form. Approvals are required from the instructor, the advisor, and the Director of Graduate Studies. After completing the form along with the signatures, the student will be given permission to enroll in the section assigned to the faculty member supervising the study.

#### Research Seminar (595)

Graduate students may earn one additional credit hour for attending scheduled research seminars in the Department by enrolling in a Research Seminar course (595). Faculty, students, and visitors present current research developments.

#### Thesis Research (599)

Doctoral students may enroll in a Thesis Research course (599) once a thesis advisor has been selected. Students who have not been admitted to doctoral candidacy are limited to 4 credit hours of Thesis Research per term. Once admitted to doctoral candidacy, students can enroll for a maximum of 16 credit hours per term. To enroll, students must obtain a permission form from the MSCS Graduate Studies website and obtain the approval of the thesis advisor and Director of Graduate Studies. The student will enroll in the section assigned to their thesis advisor.

### **Zero Hours Registration**

Zero Hours registration is for students who have completed all degree requirements except for the master's thesis or doctoral thesis and need to satisfy a registration requirement until the term of their defense or graduation. Zero credit registration requires a Graduate Student Petition and a Thesis Hours Approval form. Once approved, students register for zero credit hours for the appropriate course for their situation in the section assigned to their thesis advisor: master's thesis (598) or doctoral thesis research (599).

SEVIS (federal immigration) regulations do not allow an international student on a visa to register for more than zero hours in a subsequent term if the student was registered for zero hours previously, unless the student is admitted into a different program.

#### **There are two options:**

##### Zero Hours – Option A (for MS or Doctoral students)

Students requesting Option A need to petition one time for approval. Students approved for Option A will register for zero hours until the degree is awarded. Range IV tuition and all related fees, including CampusCare student healthcare, are assessed.

##### Zero Hours – Option B (for Doctoral students only)

Students requesting Option B must petition for each renewal and specify Option B. No fees are assessed; only Range IV tuition is assessed. Students who elect Option B are ineligible for access to certain on-campus facilities, such as the gym and CampusCare student healthcare. With each petition, students may elect either one or two terms of Option B and must file a new petition if future terms of Option B are required.

### **Restricted Courses**

Courses listed as MTHT are for the MST program only and do not meet the requirements for the MS, PhD, and DA degrees. Students interested in switching programs or earning a degree in another program should contact the Director of Graduate Studies for more information.

### **Incomplete Grades**

The grade of “incomplete” (I) should be used only in extenuating circumstances. It may be given only if, for reasons beyond a student’s control, required coursework is not completed by the end of the semester. The student and professor must have a clear understanding of how and when the incomplete is to be removed; these agreements should always be in writing.

Students must complete the required work *within one year* of receiving the “I” grade. The professor will submit the final grade using a Supplemental Grade Report form. If the final grade is not submitted within one year, the “I” will remain permanently on the student’s record. “I” grades are not factored into the student’s grade point average. Consult the Graduate College catalog for additional details.

### **Transfer of Credit**

Graduate credits earned in MSCS courses while the student was a degree-seeking student in another program may be transferred to the MSCS degree *if* the courses were not used to meet the requirements for another degree and only for courses in which grades of A or B were earned. The transfer of credit is NOT automatic and must be requested by contacting the Graduate Studies office.

Doctoral students who have a previously earned MS degree in mathematics may request 32 credit hours for this degree, thereby reducing the required hours for the PhD or DA from 96 to 64. Interested student must send an official transcript along with proof of the MS degree to the Graduate Studies office.

Non-degree students moving to a degree-seeking program are limited to 12 credit hours of transfer credit in which an A or B was earned. Once admitted to the degree program, the student should contact the Graduate Studies office to request to transfer any qualified courses.

### **Leave of Absence**

Students should refer to the Graduate College Catalog for information regarding a Leave of Absence. Degree seeking students wishing a semester leave must first obtain the approval of the Director of Graduate Studies, followed by the Graduate College. International students and doctoral candidates, whose continued enrollment is required, may not be eligible for a leave of absence.

### **Mathematics Library**

The Mathematics Library, located on the second floor of Daley Library, contains the University’s mathematics holdings. Its books and journal collections are a valuable research asset.

## **Mathematics Graduate Student Association (MGSA)**

All MSCS graduate students are automatically members of the Mathematics Graduate Student Association (MGSA). The purpose of the association is to promote the interests of the graduate students in the Department. Members belong to a listserv which serves as an avenue for communication among the members of MGSA and also keeps students informed of various dates, deadlines, and general information published by the Graduate Studies office.

## **Suggestions and Concerns**

Suggestions for improving the Department's graduate studies programs should be communicated to the Director or Assistant Director of Graduate Studies, or expressed to the MGSA. *A complaint concerning a course grade* should first be discussed with the professor before bringing the matter to the attention of the Director of Graduate Studies. *Complaints concerning Departmental exams* should be communicated in writing to the Director of Graduate Studies along with all pertinent data and background information.

## **The Colloquium**

The colloquium provides an excellent opportunity for graduate students and faculty to expand their mathematical horizons. Over the course of the academic year, colloquium speakers lecture on many areas of mathematics, statistics, and computer science. Graduate students are encouraged to attend as many colloquia as possible, as well as the Colloquium Tea following the lectures.

## Appendix 1: To the Faculty

### Faculty Mentors/Advising

Faculty mentors and thesis advisors need to be familiar with policies and procedures outlined in this Handbook and the Graduate College catalog. The Graduate College requires all students to be assigned an advisor in the program in which their degree work is done; the *faculty mentor* fills this role until a thesis advisor is selected. Faculty should keep records of their students' registrations and changes.

Each degree has certain course restrictions, as outlined in this Handbook. The Graduate Studies office maintains a record of the requirements met by each student. Issues regarding policy and procedural questions should be referred to the Graduate Studies office. In addition to this Handbook, faculty members are encouraged to consult the Graduate College catalog for additional details regarding the rules governing the prelim exam, master's thesis exam, and the thesis defense.

### Prelim Exam Administration (Written)

Faculty members appointed as prelim examiners are responsible for...

1. Setting the prelim exam date/time and informing the students
2. Administering and grading the prelims. *Examiners should not make any marks on the students' solutions they grade until the grades are set. At that point they record their grades and comments that they agree are appropriate on the exam papers.*
3. Retaining the students' prelim exam papers
4. Entering the scores (1, 2, 3, or 5) into the Graduate Records database and emailing students their grades using the "Enter Prelim Grades" tool on the MSCS intranet
5. Sending a PDF copy of the exam and its solutions to the Graduate Studies office after the exam, for posting on the website

The Graduate Studies office will...

1. Update the website with the current list of prelims and prelim examiners
2. Announce the prelim registration period to the graduate student listserv and collect the registration forms
3. Send a prelim exam roster electronically to each examiner
4. Place a written copy of the score in the student's academic file and retain the score summary sheet in the DGS office and the graduate records database.
5. Post the exam and solutions on the website, after the exam scores are distributed.

### Prelim Exam Administration (Oral – Statistics only)

The oral prelim should be taken *soon* after completing both written prelims and the minor sequence for the PhD degree. It is strongly advised that "soon" be interpreted as meaning "within several weeks" and certainly "within a semester".

The Graduate College must approve the oral prelim committee prior to the exam. Recommendations for committee members are made using the Graduate College Committee Recommendation form, first submitted to the Graduate Studies office at least 30 days in advance

of the proposed exam date. This provides sufficient time for the Graduate College to approve the committee and return an Exam Report form to the Department prior to the exam.

The Committee Chair is responsible for conducting the oral prelim, obtaining the committee signatures on the Exam Report form, and returning the form to the Graduate Studies office immediately following the exam. The results of this exam must be reported to the Graduate College Dean by the Graduate Studies office within 48 hours of the exam date.

### **Master's Exam Administration**

Each year the Department Head appoints a Master's Exam Chair and Master's Exam Coordinators for each area: Pure Mathematics (PM), Applied Mathematics (AM), Statistics (STAT), and Mathematical Computer Science (MCS). The Master's Exam is given twice per year; scores are reported to the students approximately two weeks following the exam. Students take the exam using an assigned exam ID number; no names should appear on the exam paperwork.

*Before the exam, the Master's Exam Chair is responsible for...*

1. Reserving the exam room.
2. Reminding Exam Coordinators (PM, AM, MCS, and STAT) to solicit questions from tenured and tenure-track faculty who have recently taught the relevant courses.
3. Obtaining the exam roster from the Graduate Studies office two weeks before the exam
4. Preparing exam envelopes for each examinee, containing the exam and displaying the exam ID number on the envelope. Traditionally, ID numbers 100–199 are assigned to Pure Mathematics, 200–299 to Applied Mathematics, 300–399 to Statistics, and 400–499 to Mathematical Computer Science. A minimum of 2 extra exams for each area should also be prepared.
5. Reminding Exam Coordinators (Pure Mathematics, Applied Mathematics, Statistics, and Mathematical Computer Science) to arrange to have faculty present at the start of the exam to answer student questions.
6. Arranging for faculty in each exam concentration area to be present at the start of the exam to answer students' questions.

*On exam day, the Master's Exam Chair is responsible for...*

1. Setting up the exam room to ensure that students taking like exams are not seated next to each other.
2. Providing stacks of colored paper (all one color) for students to use in working the problems. The use of colored paper is intended to reduce the possibility of students bringing pre-written solutions to the exam.
3. Proctoring the full exam.
4. Using the exam roster to check off each exam envelope as it is submitted.

*After the exam, the Master's Exam Chair is responsible for...*

1. Checking each exam envelope to make sure the student's ID number appears on each page.
2. Emailing Exam Coordinators to pick up their exam packets.

3. Providing exam instructions to the Exam Coordinators. In particular, faculty should not make any marks on the students' solutions until the grades are set.
4. Specifying the date in which the exam scores should be returned and following up with each Exam Coordinator to ensure that the scores are ready by this date.
5. Emailing the MS Exam Score Summary sheet (Excel spreadsheet) to each Exam Coordinator to record their students' scores. Each Exam Coordinator will list the student's score for each question next to the appropriate exam ID number, indicate the top 8 scores, and list the sum of the top 8 scores. A note of Fail for scores 89 and below, Pass for scores from 90 up to and including 109, or High Pass for scores 110 and above should also be indicated. The spreadsheet is then returned to the Master's Exam Chair and the Graduate Studies office.
6. Conducting a final check of the Score Summary sheet to make sure the scores below the top 8 are dropped, the sum is correct, and the proper label of Fail, Pass, or High Pass is indicated.
7. Reminding the Exam Coordinators to return student exam packets to DGS.
8. Reminding the Exam Coordinators to send a PDF copy of the exam and solutions to the DGS office for posting on the website; this is essential to those students requesting to have a question re-graded.

*Before the exam, the Master's Exam Coordinator for each area is responsible for...*

1. Soliciting questions from tenured and tenure-track faculty who have recently taught the relevant courses.
2. Ensuring that the exam questions match the approved list of exam topics outlined in the current Handbook, compiling the area exam, and submitting the exam to the MS Exam Chair.
3. Arranging for faculty from the area to be present at the start of the exam to answer student questions.

*On exam day, the Master's Exam Coordinator for each area is responsible for arriving at the start of the exam to answer student questions, along with other faculty from each field.*

*After the exam, the Master's Exam Coordinator for each area is responsible for...*

1. Separating each student exam by question, placing the individual questions in envelopes, and distributing the envelopes to the faculty for grading along with instructions. *Faculty should not make any marks on the students' solutions they grade until the grades are set.*
2. Specifying the date in which the exam scores should be returned and following up with faculty to ensure that the scores are ready by this date.
3. Completing the MS Exam Score Summary sheet, listing the student's score for each question next to the appropriate exam ID number, indicating the top 8 scores, and listing the sum of the top 8 scores along with an indication of Fail for scores 89 and below; Pass for scores from 90 up to and including 109; High Pass for scores 110 and above.
4. Conducting a final check of the Score Summary sheet to make sure the scores below the top 8 are dropped, the sum is correct, and the proper label of Fail, Pass, or High Pass is indicated.
5. Forwarding the MS Exam Score Summary sheet to the MS Exam Chair and the Graduate Studies office.

6. Forwarding a PDF copy of the exam and solutions to the Graduate Studies office for posting on the website; this step is essential to students requesting to have a question re-graded.
7. Returning the students' exam questions to their respective envelopes and delivering the envelopes to the Graduate Studies office for filing.

*Before the exam, the Graduate Studies office is responsible for...*

1. Announcing the MS exam date and registration period to the graduate student listserv.
2. Collecting MS exam registration forms.
3. Informing the MS Exam Chair of the number of registered students by area and their associated exam ID numbers. Traditionally, ID numbers 100–199 are assigned to Pure Mathematics, 200–299 to Applied Mathematics, 300–399 to Statistics, and 400–499 are Computer Science. A minimum of 2 extra exams for each area should also be prepared.
4. Sending MS exam instructions and exam ID numbers to students at least one week prior to the exam.

*On exam day, the Graduate Studies office is responsible for...*

1. Assisting the MS Exam Coordinator in preparing the room for the exam.
2. Checking each student's UIC ID card as they enter the room.
3. Assisting students in locating their assigned seat.

*After the exam, the Graduate Studies office is responsible for...*

1. Listing the student's name next to their exam ID number on each MS Exam Score Summary sheet once it is received from the MS Exam Administrators.
2. Reporting the exam results by email to each student.
3. Placing a written copy of the score in the student's academic file, recording the score in the graduate student database, and retaining the official MS Exam Score Summary sheet for each area in the DGS office.
4. Posting the exam and solutions on the web following the exam.

## Appendix 2: Graduate Course Detail

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### Graduate MATH Courses

<b>MATH</b>	<b>Title</b>	<b>Credits</b>
410	Advanced Calculus I	4
411	Advanced Calculus II	4
414	Analysis II	4
417	Complex Analysis with Applications	4
419	Models in Applied Mathematics	4
425	Linear Algebra II	4
430	Formal Logic I	4
431	Abstract Algebra II	4
435	Foundations of Number Theory	4
436	Number Theory for Applications	4
442	Differential Geometry of Curves and Surfaces	4
445	Introduction to Topology I	4
446	Introduction to Topology II	4
480	Applied Differential Equations	4
481	Applied Partial Differential Equations	4
494	Special Topics in Mathematics	4
496	Independent Study	1-4
502	Mathematical Logic	4
504	Set Theory	4
506	Model Theory I	4
507	Model Theory II	4
511	Descriptive Set Theory	4
512	Advanced Topics in Logic	4
514	Number Theory I	4
515	Number Theory II	4
516	Second Course in Abstract Algebra I	4
517	Second Course in Abstract Algebra II	4
518	Representation Theory	4
520	Commutative and Homological Algebra	4
525	Advanced Topics in Number Theory	4
531	Advanced Topics in Algebra	4
533	Real Analysis I	4
534	Real Analysis II	4
535	Complex Analysis I	4
536	Complex Analysis II	4
537	Introduction to Harmonic Analysis I	4
539	Functional Analysis I	4
546	Advanced Topics in Analysis	4
547	Algebraic Topology I	4
548	Algebraic Topology II	4

<b>MATH</b>	<b>Title</b>	<b>Credits</b>
549	Differentiable Manifolds I	4
550	Differentiable Manifolds II	4
551	Riemannian Geometry	4
552	Algebraic Geometry I	4
553	Algebraic Geometry II	4
554	Complex Manifolds I	4
555	Complex Manifolds II	4
568	Topics in Algebraic Topology	4
569	Advanced Topics in Geometric and Differential Topology	4
570	Advanced Topics in Differential Geometry	4
571	Advanced Topics in Algebraic Geometry	4
576	Classical Methods of Partial Differential Equations	4
577	Advanced Partial Differential Equations	4
578	Asymptotic Methods	4
580	Mathematics of Fluid Mechanics	4
581	Special Topics in Fluid Mechanics	4
582	Linear and Nonlinear Waves	4
584	Applied Stochastic Models	4
585	Ordinary Differential Equations	4
586	Computational Finance	4
589	Teaching and Presentation of Mathematics	2
590	Advanced Topics in Applied Mathematics	4
591	Seminar on Mathematics Curricula	4
592	Seminar on Mathematics: Philosophy and Methodology	4
593	Graduate Student Seminar	1
594	Internship in Mathematics	0-8
595	Research Seminar	1
596	Independent Study	1-4
598	Master's Thesis	0-16
599	Thesis Research	0-16

## Expected Frequency of Graduate MATH Courses

### Every year:

- 516 Algebra 1 (Fall)
- 517 Algebra 2 (Spring)
- 533 Real Analysis (Fall)
- 535 Complex Analysis (Spring)
- 547 Algebraic Topology 1
- 549 Differentiable Manifolds 1
- 552 Algebraic Geometry 1 (Fall)
- 553 Algebraic Geometry 2 (Spring)

### Regularly, but not every year:

- 502 Mathematical Logic
- 504 Set Theory 1
- 506 Model Theory 1
- 507 Model Theory 2
- 511 Descriptive Set Theory
- 514 Number Theory 1
- 515 Number Theory 2
- 520 Commutative and Homological Algebra
- 537 Harmonic Analysis
- 539 Functional Analysis
- 548 Algebraic Topology 2
- 550 Differentiable Manifolds 2
- 551 Riemannian Geometry
- 554 Complex Manifolds 1
- 555 Complex Manifolds 2
- 576 Classical Methods of Partial Differential Equations
- 577 Advanced Partial Differential Equations

## Graduate MCS Courses

<b>MCS</b>	<b>Title .....</b>	<b>Credits</b>
401	Computer Algorithms I .....	4
411	Compiler Design.....	4
415	Programming Language Design .....	4
421	Combinatorics.....	4
423	Graph Theory .....	4
425	Codes and Cryptography.....	4
441	Theory of Computation I.....	4
451	Object-Oriented Programming in C++ .....	4
471	Numerical Analysis.....	4
472	Introduction to Industrial Math and Computation .....	4
481	Computational Geometry.....	4
494	Special Topics in Computer Science .....	4
496	Independent Study.....	1-4
501	Computer Algorithms II.....	4
507	Mathematical, Statistical and Scientific Software.....	4
521	Combinatorial Optimization.....	4
541	Computational Complexity .....	4
548	Mathematical Theory of Artificial Intelligence.....	4
563	Analytic Symbolic Computation .....	4
565	Mathematical Theory of Databases.....	4
571	Numerical Analysis of Partial Differential Equations .....	4
572	Introduction to Supercomputing.....	4
573	Topics in Numerical Analysis of Partial Differential Equations .....	4
590	Advanced Topics in Computer Science.....	4
591	Advanced Topics in Combinatorial Theory.....	4
593	Graduate Student Seminar .....	1
595	Graduate Seminar.....	1
596	Independent Study.....	1-4
598	Master's Thesis.....	0-16
599	Thesis Research (Doctoral).....	0-16

**Graduate STAT Courses**

<b>STAT</b>	<b>Title .....</b>	<b>Credits</b>
401	Introduction to Probability.....	4
411	Statistical Theory .....	4
416	Nonparametric Statistical Methods .....	4
431	Introduction to Survey Sampling.....	4
451	Computational Statistics.....	4
461	Applied Probability Models I .....	4
471	Linear and Non-Linear Programming.....	4
473	Game Theory.....	4
475	Mathematics and Statistics for Actuarial Sciences I	4
481	Applied Statistical Methods II .....	4
486	Statistical Consulting .....	4
494	Special Topics in Statistics, Probability, & Operations Research .....	4
496	Independent Study.....	1-4
501	Probability Theory I .....	4
502	Probability Theory II.....	4
511	Advanced Statistical Theory I.....	4
512	Advanced Statistical Theory II.....	4
521	Linear Statistical Inference .....	4
522	Multivariate Statistical Analysis.....	4
531	Sampling Theory I.....	4
532	Sampling Theory II.....	4
535	Optimal Design Theory I.....	4
536	Optimal Design Theory II.....	4
591	Adv. Topics in Statistics, Probability, & Operations Research.....	4
593	Graduate Student Seminar .....	1
595	Research Seminar .....	1
596	Independent Study.....	1-4
598	Master's Thesis.....	0-16
599	Thesis Research (Doctoral).....	0-16

## Expected Frequency of Graduate STAT Courses

### Every semester:

- 401 Introduction to Probability
- 411 Statistical Theory

### Every year:

- 451 Computational Statistics
- 461 Applied Probability Models I
- 481 Applied Statistical Methods II
- 501 Probability Theory I
- 511 Advanced Statistical Theory I
- 521 Linear Statistical Inference

### Every semester or year:

- 494 Special Topics in Statistics, Probability, and Operational Research
- 591 Advanced Topics in Statistics, Probability and Operations Research

### Every other year:

- 431 Introduction to Survey Sampling
- 502 Probability Theory II
- 512 Advanced Statistical Theory II
- 522 Multivariate Statistical Analysis
- 531 Sampling Theory I
- 532 Sampling Theory II
- 535 Optimal Design Theory I
- 536 Optimal Design Theory II

## Graduate MTHT Courses

<b>MTHT</b>	<b>Title</b>	<b>Credits</b>
400	Methods of Teaching Secondary Mathematics I	4
401	Methods of Teaching Secondary Mathematics II	4
411	Advanced Euclidean Geometry	4
420	Computers in Secondary School Mathematics	4
430	Mathematical Analysis for Teachers I	4
435	Abstract Algebra	4
438	Educational Practice with Seminar I	6
439	Educational Practice with Seminar II	6
450	Concepts in Elementary and Middle School Mathematics	4
465	Teaching Algebra for Understanding	4
466	Introduction to Calculus and Graphing Calculator	4
467	Introduction to Number Theory with Application	4
468	Geometry with Applications for Middle Grade Teachers	4
470	Teaching Mathematics with Science: An Activity Approach I	4
490	Topics in Teaching Secondary Mathematics	1-5
491	Topics in Teaching Elementary/Junior High School Math	1-5
496	Independent Study	1-4
510	Introduction to Higher Geometry	4
530	Mathematical Analysis for Teachers II	4
550	Concepts & Methods in Elementary & Middle School Mathematics II	4
560	Introduction to Analytic Geometry and Calculus	4
565	Teaching Geometry: An Activity Approach	4
575	Principles of Probability and Statistics	4
589	Practicum in Teaching Elementary School Mathematics	4
590	Topics in Teaching Secondary Mathematics	1-5
591	Topics in Teaching Elementary/Junior High School Math	1-5
592	Topics in Advanced Mathematics for Teachers	1-5
596	Independent Study	1-4