# A Handbook for
# Current Graduate Students

## (For Academic Year 2022 – 2023)

**Department of Mathematical Sciences**
**University of Wisconsin-Milwaukee**

**The Department's Graduate Committee will update this Handbook each academic year. While every attempt will be made to update the relevant information at various departmental webpages simultaneously, it is inevitable that some of the information at these webpages do not get updated timely. If you have questions, please contact the Associate Chair for the Graduate Program.**

# Table of Contents

# 1. Overview

The Department of Mathematical Sciences offers graduate programs of study in mathematics with specializations in the fields of algebra, analysis, topology, applied mathematics, probability, statistics, and actuarial science.

The programs of study at the master's level are designed to suit both the student intending to con
tinue toward a Ph.D. as well as the student who wishes to begin a professional career upon completion of the master's program.

The student in the Ph.D. program may prepare for a career in teaching at the college level and for a career in research in the academic, industrial, government, or business communities.

## 2. Administration of the Graduate Program

The Associate Chair for the Graduate Program and the Graduate Committee are responsible for the programs. The Associate Chair for the Graduate Program and the Graduate Program Assistants manage the day-to-day operations.

## 3. Who to Contact if You Have Questions

Graduate Study Related Issues (selection of courses, checking degree requirements, transfer of credits, etc.): The Associate Chair for the Graduate Program.

Teaching Related Issues (add/drop students from your classes, verifying your students' prerequisites, etc.): Your Course Coordinator (if you have one), or the Associate/Assistant Chair for Undergraduate Study. As a TA, your supervisor is the Department's Chair.

International Student Issue (visa etc.): Center for International Education or Katie Wehrheim.

## 4. General Policies & Regulations

[UWM Graduate School Academic Policies and Procedures](UWM Graduate School Academic Policies and Procedures)

### 4.1 GPA Requirement

UWM requires a minimum of cumulative 3.0 GPA (4.0 basis) in all work taken toward the degree. The student will receive an academic warning if the semester grade point average falls below 3.0. The student will receive a "Graduate Dean's OK Required to Continue" if the cumulative grade point average falls below 3.0. If the semester GPA and cumulative GPA are both below 3.0, the Graduate Dean's OK will take precedence over an Academic Warning. The student will be prevented from further registration unless the student petitions the Graduate School and receives a positive recommendation from the student's graduate program unit.

### 4.2 Credit Requirement

Graduate students enrolled for a minimum of 8 credits per semester or 6 credits during a summer session are considered full time, with the exceptions described below. Fellowship recipients are subjected to different fellowship requirements depending on the fellowships; refer to the award descriptions of the fellowships.

Teaching and Research Assistants (TAs and RAs) who are employed for one-third (33%) time or more must enroll for a minimum of 6 credits per semester. They are considered full-time with this minimum enrollment.

In addition, the Department of Mathematical Sciences requires its graduate students who are employed for 33% time or more as TAs or RAs to complete a minimum of 15 credits of graduate courses offered by the Department of Mathematical Sciences per academic year.

## 4.3 Transfer Credit

**Master's:** The maximum number of transfer credits allowable is the higher of (a) 12 semester credits or (b) 40% of the total number of credits required for graduation. To qualify, the work must meet the following criteria:

- Graduate level, from an accredited institution.
- Taken within five years of admission to your UWM degree program.
- Not have been used to meet previous degree requirements.
- Grade of B or better (B- is not acceptable).
- Approved by the Associate Chair for the Graduate Program.

To transfer credits, the student must first discuss the transferability of the credits with the Associate Chair for the Graduate Program, and then submit a Graduate Transfer Credit Evaluation Form to the Graduate School for processing.

**Ph.D.:** If you earned a Master degree before enrolling in the Ph.D. program in our Department, you may qualify for an automatic 27 credit waiver. Contact the Associate Chair for the Graduate Program for more information.

## 4.4 Change Program of Study

To change the program of study, such as change from an M.S. program in Physics to an M.S. program in Mathematics, the student needs to formally apply for admission to the graduate program into which the student wishes to change. There is no transfer between programs at UWM.

Within the Department of Mathematical Sciences, there are two distinguished graduate programs at the M.S. level: Actuarial Science and Mathematical Sciences. Though all graduate students in these programs are students in the Department of Mathematical Sciences, in order to change the program of study among these programs, a student must apply for admission to the program into which the student wishes to change. However, this does not apply to change the options of study within the Mathematical Sciences group of options (Standard Mathematics, Statistics , and Dual Master's Degree), as students can change (or select) their option(s) without further application. However, an option should be decided early so the student can follow the requirements to complete the degree within the time limits. See **Master's Requirement** and **Maximum Number of Years of Support** for further information.

There is only one graduate program at the Ph.D. level: Mathematical Sciences. A change of field of study within Mathematical Sciences does not require a formal application but needs to be approved by the student's Ph.D. advisor. See **[UWM Graduate School Academic Policies and Procedures](#)** for further information.

## 4.5 Promotion from M.S. to Ph.D.

An M.S. student who wishes to pursue a Ph.D. degree (in the same or a different program) needs to apply for admission to the Ph.D. program without paying the application fee. The student submits the application in the semester the student expects to complete the M.S. degree, and the Departmental Admission Committee makes the decision on whether or not an admission is granted. An M.S. student who is promoted to the Ph.D. program must be conferred the M.S. degree (the degree conferred date is shown on the student's transcript in PAWS) before officially becomes a Ph.D. student.

## 4.6 Dismissal and Appeal of Dismissal

Students who are not making satisfactory progress towards fulfilling the requirements for a Master's or Ph.D. degree are subject to dismissal from the program. The Associate Chair for the Graduate Program and the Graduate Committee make this decision and hear the appeals.

# 5. Financial Support

Financial supports in the form of Fellowships, Teaching Assistantships, and Research Assistantships are awarded on a competitive basis. All applicants to the program are automatically considered for each of these types of awards. Awards are renewable for students making satisfactory progress in their degree programs. In a typical year, 20-30 of these awards are given to new students entering the program. In addition, students may apply for other forms of financial aid such as loans by contacting the [Department of Financial Aid](#) or a third party.

## 5.1 Assistantship and Fellowship

- **Graduate Teaching Assistants:**
  Most students are supported as Teaching Assistants (TAs). These half-time teaching positions include a remission of all tuition and the opportunity for health insurance coverage. The TA stipend for the 2018-2019 academic year ranged from $13,750 to $16,600 depending on the degree program and progress toward the degree.

- **Research/Project Assistantships:**
  Some faculty members have support for research assistants (RA) or project assistants (PA) as part of their research funding. These positions pay a semester,

academic year, or full-year stipend, have remission of tuition, and offer health insurance.  The duties of the positions are determined by the faculty members. These faculty members select who they want for their positions from among current students and admitted applicants. There is no separate application for these positions.

- **Graduate School Fellowships:**
  Student with excellent records may apply for a Graduate School Fellowship. The UWM Graduate School currently offers two fellowships for full-time study: The Distinguished Graduate Student Fellowship, which is for new and continuing UWM graduate students; and the Distinguished Dissertation Fellowship, which is for current UWM Ph.D. students who have either achieved dissertator status or will achieve dissertator status during the award year. These fellowships pay a 9-month stipend, remit all tuition, offer health insurance, provide a modest travel stipend, and do not require any teaching during the year. The fellowships are not renewable. Application deadline is January 15 each year. For more information, visit

  http://uwm.edu/graduateschool/types-of-funding/

- **Advanced Opportunity Program (AOP) Fellowships:**
  These fellowships are available to qualified new and continuing graduate students who are members of groups underrepresented in graduate study, students with disabilities, and/or students who are first-generation college graduates with demonstrated financial need. This fellowship is renewable for up to two years for M.S. and three years for Ph.D. students. More information is available at the program website. Application deadline is January 15 each year.

## 5.2 Awards

The Department uses the Chancellor's Graduate Student Award and the Research Excellence Award as supplements to other support to form a whole package of financial support for the student. Should the financial support offer change, such as changing from a Teaching Assistantship to a Research Assistantship, the department may also change these awards in the new financial support offer.

- **Chancellor's Graduate Student Award:**
  Depending on fund availability, the department offers Chancellor Graduate Student Award, ranging from $1,000 to $6,000 as supplements to the student's other support. These awards are renewable for up to five (5) years, depending on satisfactory progress being made toward the degree. No application is necessary; every applicant or current graduate student is automatically considered for the award.

- **Research Excellence Award:**
  The Research Excellence Award (REA) program is designed to incentivize growth of extramural support for graduate students. The department offers this

award to high-quality, talented graduate students. Subject to fund availability, new applicants and current graduate students with excellent records are offered REA as supplements to their other support. No application is necessary; every applicant or current student is automatically considered for the award. Preference may be given to graduate students who have made excellent progress in research.

## 5.3 Tuition Remission

Graduate assistants who hold appointments at 33% of full time or more are eligible for tuition remission for the semester(s) of appointment. Courses covered by the remission must be relevant to the student's program of study.

**Note on fees:** Payment of segregated fees or special course fees are the responsibility of the student. Graduate Assistants can arrange for the payment of these fees through payroll deduction.

## 5.4 Summer Support

Summer support, usually in the form of TA, is available upon applications and depends on the available TA positions. The Department may use other funds in addition to TA positions to provide summer supports for the student. Preference is given to Ph.D. students. The Department sends out summer support request forms to all current students each spring semester.

## 5.5 Financial Support Award Authority

The Associate Chair for the Graduate Program and the Graduate Committee oversee the award of financial supports for all graduate students.

The Chair of the Department appoints the TAs upon the recommendation of the Graduate Committee. The Chair of the Department also supervises the TAs. The Associate Chair for the Graduate Program, with input from the Graduate Committee, allocates the Chancellor's Graduate Student Award and the Research Excellence Award funds, and is responsible for nominating graduate students for Graduate School Fellowships.

Faculty members who have RA funds in their research grants select and award their RAs.

## 5.6 Maximum Number of Years of Support

The maximum number of years of departmental financial supports (the total number of years of TA, RA, and other fellowships) is:

- two (2) for the M.S. student; and
- seven (7) for the Ph.D. student, regardless whether the student's initial enrollment is in the M.S. or the Ph.D. program.

## 5.7 Ph.D. Milestone Progress Requirement for Support

Making satisfactory progress in the degree program is a necessary condition for receiving financial support from the Department. The student in the Ph.D. program is expected to achieve the following milestones (see **Ph.D. Milestone Procedures** in this Handbook for more information):

1. Passing the Ph.D. Prelim Examination by

- the end of the third academic year if the student was admitted into the Ph.D. program directly;
- the end of the fourth academic year (including the years in the M.S. program) if the student was initially admitted into the M.S. program.

2. Achieving dissertator status by the beginning of the sixth academic year from the initial enrollment, regardless whether the student's initial enrollment is in the M.S. or the Ph.D. program.

Usually, students in the Ph.D. program can achieve these milestones a year earlier than the deadlines. It is possible for a well prepared Ph.D. student who has an M.S. degree from another institution to pass the prelim after one year of study in our program.

# 6. Teaching Assistant Policies & Regulations

## 6.1 Graduate School's Graduate Assistant Policies and Procedures

It is the student's responsibility to read the Graduate School's Graduate Assistant Policies and Procedures. These policies and procedures are available at:

http://uwm.edu/graduateschool/graduate-assistant-policies-procedures/

## 6.2 English Proficiency for International Teaching Assistants

The UWM International Teaching Assistant Assessment (MITAA) is a requirement for some international teaching assistants who are non-native English speakers and who will be assigned classroom duties as part of a graduate teaching assistantship. A Department representative must be available to participate in the assessment. There is no charge for the MITAA.

Not all prospective international teaching assistants must take the MITAA. The

assessment generally is not required if the student has one of the following recent standardized test scores:

- 23 or better on the Speaking section of the internet-Based TOEFL (iBT)
- 7.0 or better on the Speaking section of the IELTS

The assessment also might not be required for students who are graduates of an American university or college. For more information, contact the ESL Programs Office.

## 6.3 Departmental Policies

Undergraduate teaching is one of the primary responsibilities of the Department of Mathematical Sciences; graduate students play an important role in this function. As a part of their training, and as a necessary condition for most forms of financial aid, all teaching assistants are involved with departmental teaching activities each semester they are in residence.

Balancing your roles as a student and a TA can be difficult, and we are here to help you navigate issues like these. Please do not hesitate to contact any member of the Department administration if you have questions.

**TA Responsibilities:**

As a TA in the Department of Mathematical Sciences at the University of Wisconsin-Milwaukee, your responsibilities are:

- teaching lectures and/or discussion sections in accordance with the outline and directives as provided by your course coordinator (if you have one)
- arriving to your classroom in a timely manner and teaching for the designated period of time
- familiarizing yourself with course material and preparing in advance for future classes
- managing the classroom to foster a positive learning environment
- managing online homework assignments (if they are being used)
- holding office hours for three hours per week on at least two different days
- attending lectures (if requested by your coordinator)
- attending meetings held by your coordinator
- proctoring and grading quizzes and exams, including make-up exams
- maintaining and managing grade data for each of your students
- entering grades in PAWS for each of your students
- submitting final exams and grade sheets to the department staff (Jane Miles)
- attendance at both the university and department TA orientation sessions
- attendance at ongoing department TA professional development activities

- for those who have not taught for the UWM Math Department before, enrollment in and satisfactory completion of MATH 799 – Teaching Mathematics to Undergraduates.  In addition, the department sends out emails that contain information on class policies, procedures, and important dates, etc., to all instructional stuff members of the department each semester. Please read it carefully and keep a copy for your reference.

## More general guidelines:

**Teaching tips:**

1) Know the subject matter of your lessons very well. Teach yourself anything that is new.
2) Visit your classroom before the semester starts to know its location and if it has a blackboard (chalk) or whiteboard (markers).
3) Get students to talk, not just raise hands, on day one. It is hard to fix later if they don't.
4) Dress nicely on day one to make a clear distinction between you and your students.  Always practice good hygiene (daily showers; teeth brushed; clean clothes).
5) Always write on a board starting from the far left side rather than in the middle.
6) If something is important, write it on the board (e.g., the name of a new topic). If you speak for a while and write nothing on the board, nothing will go in student's notes!
7) Look at students more than the blackboard. Remember to turn around and face the class.
8) Do not lecture for more than 15 minutes without injecting an alternative activity (e.g., having the students work on a problem, ideally in pairs).
9) Illustrate new ideas with examples (wouldn't you like your teachers to do this too?).
10) Work out your examples before class and double-check your calculations.
11) Convey interest and confidence in what you're saying! If it comes across that you're bored or confused about the lesson, your students will stop paying attention.
12) When you ask the class if there are any questions, wait (perhaps count to 5 slowly in your head) before moving on. Time goes slower than you think at the front of the room.
13) If a student asks a question or makes a comment, don't suggest it is dumb even if it conveys an elementary misunderstanding. We have all misunderstood simple things.
14) If you tell a student "I don't know," follow up with "I'll find out." And then find out.
15) Do not yell at or make fun of students. It's hard to regain their respect once it is lost.

**What to do, administratively:**

1) Communicate! Reply in a timely manner to emails from coordinators, other instructors, other TAs, and students.  In particular, you are expected to check your email regularly (at least twice a day).
2) Know dates and times of exams, and be here to proctor and grade; grading may be done at a common time. Mark exam weeks on your calendar and do not go away those weeks.  In an emergency it is your duty to find a substitute that meets the instructor's approval.
3) Record exam and quiz grades before returning any exams or quizzes to the students.
4) Speak with the course coordinator or other TAs if you have questions about the course.
5) Speak with the course instructor if you have concerns about any of your students, especially if any student misses class for a week or if you suspect student cheating.
6) If you are unfamiliar with a topic in the course, review it before it is covered in class.
7) Start class on time, end class on time.
8) Tell students your office hours and try to include "by appointment" as an option.
9) Keep your door open during office hours, and leave a note on the door if you go away briefly.
10) Maintain a professional relationship with students; ignore any Facebook friend requests.

**What not to do, administratively:**

1) Do not disappear.
2) Do not miss any TA meetings without having a discussion in advance with the coordinator.
3) Do not schedule travel that will take you out of town while you have teaching duties without informing both the department administration and the course coordinator well in advance.
4) Do not cut special deals (e.g., on grades) with students before speaking to the course coordinator.
5) Do not accept excuses for missing major events (e.g., a midterm) without documentation.  If something is questionable, ask the coordinator.  The coordinator set the policy for the course and the ultimate decision regarding excuses lies with them!
6) Do not leave your phone's ringtone on in class.
7) Do not wait until the last minute to make copies of a quiz; the copy machine may be broken or may be being used by several other instructors!

## 6.4 Link to MAA Math TA Resource

The Mathematical Association of America has developed an extensive handbook for Mathematics Teaching Assistants. We strongly recommend that all Teaching Assistants read this handbook and use it as a reference outlining aspirations for effective interactions in the classroom.

http://www.maa.org/programs/students/student-resources/a-handbook-for-mathematics-teaching-assistants

# 7. Other Departmental Awards

## 7.1 Graduate Student Conference Travel Award Program

The Department of Mathematical Sciences Travel Award program, subject to the availability of departmental funds, offers limited funding to our full time master's and doctoral students for presenting at and/or attending graduate program-related conferences. Such activities are an important part of the professional development of graduate students, offering opportunities to establish professional networks, contacts for collaborative research, and sources of potential future employment. The Department typically supports one trip per student per academic year.

**Eligibility**

- Full-time graduate student in the Department of Mathematical Sciences at UWM
- Travel must be discussed with and approved by the student's advisor
- Students must attempt to apply for funding from other sources, such as the UWM Graduate School Travel Support Program
- Submit application prior to the conference

**Application**

Students are encouraged to submit applications at least 2 months *before* the event. Submit a paper copy of each of the following:

1. Departmental application form
2. Proof of application of additional support
3. Travel Approval Requests (2 Forms): Campus Travel Form & L&S Travel Form

If presenting at the conference, attach a printed copy of the abstract you are presenting from the conference's website.

**Selection Process**

Preference will be given to:

- Students presenting at a conference (either oral or poster).
- Students who have not received a department conference travel award before.

**Travel Guidelines**

Awardees must comply with the State and campus travel policies and procedures and any other Department instructions. Students planning to drive personal vehicles or rental cars must be registered and authorized by UWM. See the Drivers and Vehicles Web site.

## 7.2 Morris and Miriam Marden Award in Mathematics

The Morris Marden Graduate Award will be given for a mathematical paper of high quality with respect to both exposition and mathematical content. The paper need not be written specifically for the Marden Award; papers originally written for coursework, independent study, professional reports, dissertation, or other reasons are acceptable.

Applicants must be UWM graduate students and should submit

1. a PDF file of the paper and
2. a letter of support from a faculty member describing the relevance and intellectual merits of the paper.

The length of the paper is expected to be between 10 and 25 pages, but these limits are not strict.

Students will receive email notification on how to apply for the award in spring from the award committee Chair.

## 7.5 Ernst Schwandt Teaching Award

The Department of Mathematical Sciences annually recognizes demonstrated outstanding teaching performance by Mathematical Sciences Graduate Student Teaching Assistants through the Ernst Schwandt Award.

Nominations are accepted from members of the Department of Mathematical Sciences (faculty, TAs, lecturers, staff); self-nominations are accepted.

To nominate someone for the award, submit a letter of nomination describing how the nominee merits the award.

Students will receive email notification on how to apply for the award in spring from the award committee Chair.

## 7.6 Dhirendra Sikdar Scholarship (award moved to The School of Freshwater Sciences).

## 7.7 Mark Lawrence Teply Award

The Department of Mathematical Sciences' Mark Lawrence Teply award is designed to recognize students who show remarkable potential in their research fields. The award is a memorial of Professor Teply's (b.1942-d. 2006) commitment to the graduate program. Along with this recognition, winners are awarded funding to be spent on books in their chosen field of research. The award is hoped to be given out each academic year in the Department of Mathematical Sciences at the University of Wisconsin-Milwaukee. Book purchases must be arranged through the department's staff during the six weeks following the spring awards ceremony.

Full-time graduate students in the UWM Department of Mathematical Sciences who have reached dissertator status, but have not yet defended their theses are eligible to submit a one page description of the books in their field which they would most like to add to their own reference libraries. Applicants are expected to be in good academic standing, and have a well defined research focus.

This merit based award is highly competitive. Winners must demonstrate outstanding potential as researchers in the mathematical sciences. Some specific criteria considered include the following.

1. Written statement of application (see above)
2. Reference from a graduate faculty member in the Department of Mathematical Sciences
3. Graduate GPA
4. Scholarly progress

Application Procedure

Submit the following by April 1 to the award committee Chair:

1. written statement of application;
2. an unofficial copy of your graduate transcripts; and
3. the name of a graduate faculty member in the Department of Mathematical Sciences whom you would want the selection committee to contact for a recommendation.

Students will receive email notification on how to apply for the award in spring from the award committee Chair.

# 8. Master's Requirements

Historically, six options for the master's degree are offered: the standard mathematics option (A), the industrial mathematics option (discontinued 2022) (B), the atmospheric sciences (moved to the School of Freshwater Sciences, 2022); the statistics option (D), the actuarial science option (E), and the foundations of advanced studies option (discontinued in 2022) (F).

In addition to these six options, the Department and the Department of Technomathematics of Fachhochschule Aachen (FHA), Germany, have a Dual Master's Degree Program in Mathematics. The students enrolled in this program will be able to earn Master's degrees from both institutions upon completion of the common course requirements.

Students who plan to continue for a Ph.D. degree with a focus on mathematics/statistics should elect an option from options A, B, D, and F, or the dual master's degree option.

## A. Standard Mathematics Option

### Major Professor as Advisor

The student must have a major professor to advise and supervise the student's studies as specified in Graduate School regulations. The entering graduate student is assigned a temporary advisor by the Associate Chair for the Graduate Program.

### Credits and Courses

Minimum degree requirement is 30 or 36 credits, depending upon which option the student chooses: either 30 credits from Math and MthStat courses, at least 12 credits of which are numbered 800 or above; or at least 36 credits in Math and MthStat courses open for graduate credit.

Under the 36-credit option, no more than 12 credits below the 500 level from within the Department of Mathematical Sciences can be counted as program credits required for the degree.

Under the 30-credit option, up to 9 credits may be in approved courses from outside the Department. Under the 36 credit option, up to 12 credits may be taken in approved courses from outside the Department.

### Thesis

A thesis is optional. A student choosing the thesis option must enroll in Math 890 (790). A maximum of 3 credits of thesis may be counted toward the degree

requirements, however, thesis credits cannot be used to satisfy the 800 and above course credit requirement. An acceptable thesis will represent an original contribution and may involve applications, a novel exposition, or computational aspects of a mathematical problem or theory. The student must pass an oral defense of the thesis.

**Examination or Project**

Each student who does not elect the thesis option must satisfy one of the following requirements:

(a) Pass a written comprehensive examination. See M.S. **Exam Information** in this Handbook for more information.
(b) Present a satisfactory oral and written report on a comprehensive project done under the supervision of a faculty advisor.

The project option is open only to students who complete the 36 credit graduation requirement. Students electing the project should register for 1 to 3 credits of the Master's Seminar 891 (791). Students planning to continue for a Ph.D. should select the written comprehensive examination option.

**Time Limit**

Under the 30 credit option, the student must complete all degree requirements within five (5) years of initial enrollment. Under the 36 credit option, the student must complete all degree requirements within seven (7) years of initial enrollment.

# B. Industrial Mathematics Option (discontinued 2022).

# C. Atmospheric Sciences Option (moved to the school of Freshwater Sciences)

# D. Statistics Option

**Major Professor as Advisor**

The student must have a major professor to advise and supervise the student's studies as specified in Graduate School regulations. Each entering graduate student is assigned a temporary advisor by the Department Graduate Program Coordinator.

**Credit and Courses**

The minimum requirement is 30 graduate credits. Students must complete the following:

1. Math 535 (or 735 (631)/736 (632)),.
2. Math 783 (571) or 768.
3. Math 723 (621)/724 (622) (or 823 (711)/824 (712)).
4. MthStat 563, 564, and the sequence 761/762.
5. At least one other 560-level MthStat course, such as MthStat 562, 565, 566 or 568.

Students who already have taken some of these courses as undergraduates, or equivalent courses at another institution, should choose alternatives from the following list, subject to the advisor's approval:

- MthStat courses numbered 700 or above.
- Statistics course offered by the Division of Biostatistics of the Medical College of Wisconsin.
- Math 413, 414, 416, 823 (711)/824 (712), 827 (713), 828 (714), 721, 768, or 883 (771); MthStat 596/597.

**Thesis Option**

Students have the option of writing a thesis, subject to the advisor's approval. Students who write a thesis are exempt from the Master's Proficiency Exam, and they earn 3 credits toward the degree by enrolling in Math 890 (790). Students who choose the thesis option must pass an oral defense of the thesis.

**Master's Proficiency Exam**

Students who do not complete the thesis option are required to pass a written comprehensive examination that tests basic knowledge of statistical theory and either mathematical analysis or algebra. See M.S. **Exam Information** in this Handbook for more information.

**Time Limit**

Students must complete all degree requirements with 5 years of initial enrollment.

# E. Actuarial Science Option

**Objective**

The program provides a mathematically rigorous education in actuarial science, prepares students for actuarial professional exams, and develops their economics and business reasoning skills. Students obtain thorough knowledge in the fundamentals of actuarial science such as applied probability models, applied statistics, credibility, financial economics, life contingencies, loss models, and risk

theory. Emphasis is placed on developing skills that are highly valued by employers and thus are essential for a successful career as actuary. This program is intended for students who will seek employment as an actuary upon completion of the degree. Those interested in entering the department's Ph.D. program should consider a different Master's option.

**Major Professor as Advisor**

The student must have a major professor, selected from the members of the Actuarial Science Committee, to advise and supervise the student's studies. The entering student is assigned an advisor by the chair of the committee. Before the start of studies, each student in the program must develop a plan of study in consultation with the Committee.

**Credits and Course Work**

The minimum degree requirement is 30 credits. In order to graduate, the following requirements must be completed:

- Eighteen credits among MthStat 596, 597, 691, 692, 795, and either Math 783 (571) or 768. Students already proficient in some of these areas may substitute up to six credits of other courses in actuarial science, probability or statistics at the 700 level or above. (All substitutions have to be approved by the Actuarial Science Committee and the Graduate Program Coordinator.)
- At least 12 credits from the following list: Math 311, 890 (790), 892 (792), 799, MthStat 563, 564, Econ 701, 804 (702), BusMgmt 705. Students already proficient in these areas but having less than two actuarial exams passed must substitute at least six credits of other courses in probability or statistics at the 700 level or above. Credits for Math 890 (790), 892 (792) and 799 can be counted toward the degree requirement only for students who have passed two actuarial professional exams and only when these courses cover topics in actuarial science, probability, or statistics.

Students who have completed program courses for undergraduate credit should discuss alternative graduate-level courses to substitute for those courses in their programs of study.

**Thesis**

A thesis is not required for the actuarial science option. Rather, students must pass three departmental written proficiency exams, which are based on the learning objectives of the actuarial professional exams P/1, FM/2, and one of MFE/3F, MLC, C/4. Waivers for departmental exams are granted for students who have passed the corresponding professional exams.

**Professional Development**

For future advancement in the field of actuarial science, "Validation by Educational Experience" (VEE) credits are required. VEE credits may be earned from the Society of Actuaries (SOA) and Casualty Actuarial Society (CAS) with a grade of B- or better in the following courses: MthStat 563, 564 (VEE-Applied Statistics); Econ 701, 804 (702) (VEE-Economics); BusMgmt 705 (VEE-Corporate Finance). Courses taken at other universities may be used to meet the VEE requirement of the SOA/CAS.

**Time Limit**

Full-time students are expected to complete the program in two years. Students must complete all degree requirements within five years of initial enrollment.

## F.  Foundations of Advanced Studies Option (discontinued  2022)

## Dual Master's Degree

The program is designed in such a way that students typically will be able to complete all the course requirements within a two-year time period (one year at each institution). Within this program, students can choose courses that will allow them to concentrate in the areas of Statistics, Numerical Analysis or General Mathematics. Complete information on the admission policy and graduation requirements, including sample schedules, is available at the Department of Mathematical Sciences web page

http://uwm.edu/math/graduate/

# 9. Ph.D. Requirements

## 9.1 Major Professor as Advisor

The student must have a major professor to advise and supervise the student's studies as specified in Graduate School regulations. The entering graduate student is assigned a temporary advisor by the Associate Chair for the Graduate Program.

## 9.2 Course of Study

Minimum degree requirement is 54 graduate credits beyond the bachelor's degree, at least 27 of which must be earned in residence at UWM. The student, in consultation with the major professor, must select both a primary and a secondary

area of specialization. The primary area may be chosen from one of the following eight fields with minimum credit requirements as shown. The secondary area may be chosen from another of these fields or may be chosen from another appropriate department. Minimum course requirements for all work in both areas of specialization require approximately two full years of study.

**Algebra field**
12 credits in algebra
3 in complex analysis
3 in real analysis
3 in topology
3 in applied mathematics
3 outside the field (means not algebra, the same for the descriptions below)

**Analysis field**
3 credits in algebra
6 in complex analysis
6 in real analysis
3 in topology
3 in applied mathematics
3 outside the field

**Applied mathematics field**
3 credits in algebra
6 in complex analysis
3 in real analysis
12 in applied mathematics
3 outside the field

**Probability and statistics**
3 credits in complex analysis
6 in real analysis
12 in probability and statistics
3 in applied mathematics

**Topology field**
3 credits in algebra
3 in complex analysis
3 in real analysis
12 in topology
3 in applied mathematics
3 outside the field

**Actuarial science field**
6 credits in actuarial science
6 in applied mathematics

6 in probability & statistics
6 in real analysis
3 in business or economics
*NOTE:* Admission to this program is limited to students who have made significant progress towards and are close to achieving a professional designation from an internationally recognized actuarial organization.

## 9.3 Foreign Language (requirement removed 2021)

## 9.4 Computer Proficiency

The student shall pass an examination on a higher programming language and/or other appropriate advanced computer skills; the examination is administered by the Department's Computer Committee. The Computer Committee may accept advanced computer science course work in lieu of the examination.

## 9.5 Residence

The student must meet minimum [Graduate School residence requirements](#).

## 9.6 Doctoral Preliminary Examination

When the student is sufficiently prepared — normally when the student has earned 24 credits in specified areas above the 700 level — a doctoral preliminary examination to determine the student's knowledge and achievement is taken.

For students in mathematics, the exam is an oral exam consists of three (3) different fields. It evaluates the student's general knowledge of mathematics, as well as the student's knowledge of the major area of concentration. The student chooses three (3) different fields from these five (5) options: algebra, analysis, applied mathematics, probability and statistics, and topology, and selects three examination committee members whose expertise represent the three selected fields. The Associate Chair for the Graduate Program must approve both the selected fields and the committee members. See **Ph.D. Milestone Procedures** in this Handbook for more information.

Students must pass this examination to continue in the program. With permission of the examination committee, the student may repeat this examination once. If the student does not have a master's degree in mathematics before this examination, the committee will determine whether the student's performance is sufficient to qualify for the master's degree.

## 9.7 Doctoral Dissertation Proposal Hearing

After passing the requirements and the doctoral preliminary examination, the student participates in a doctoral dissertation proposal hearing. At this hearing, the student is examined on the student's chosen area of research and a dissertation topic is approved. See **Ph.D. Milestone Procedures** in this Handbook for more information.

## 9.8 Dissertation

The primary requirement for the Ph.D. in mathematics is the candidate's completion, under the supervision of the Department advisor, of an original and significant mathematical investigation presented in the form of a dissertation. The investigation is to be in the field of algebra, analysis, applied mathematics, probability and statistics, topology, or actuarial science.

## 9.9 Dissertation Defense

The candidate must, as the final step toward the degree, present a colloquium based on the dissertation and must pass an oral examination in defense of the dissertation. If the candidate does not successfully defend a thesis within five years of admission to candidacy, the candidate may be required to take another doctoral preliminary examination and be readmitted to candidacy. See **Ph.D. Milestone Procedures** in this Handbook for more information.

## 9.10 Time Limit

All degree requirements must be completed within ten years from the date of initial enrollment in the doctoral program. Note that students seeking the Ph.D. degree are limited to a maximum of seven years, inclusive of time spent in pursuit of an initial M.S. degree, of departmental financial support.

## 9.11 Minor Area for Other Ph.D. Majors

A doctoral student planning a physical science major other than mathematics may fulfill requirements for mathematics as the minor area of concentration by completing 12 credits of approved mathematics courses with a grade of B or better, at least 6 credits of which must be in courses 800 or above.

A doctoral student planning a non-physical science major may fulfill requirements for mathematics as the minor area of concentration by completing 12 credits with a grade of B or better in approved mathematics courses 300 or above.

# 10. M.S. Exam Information

The Department's written comprehensive Master's Exam is given in three subjects: Algebra, Analysis, and Statistics. Master's students who choose to take the M.S. Exams to satisfy the capstone requirement (alternatives for the capstone requirement are a thesis or project, see **Master's Requirements** in this Handbook for detail) must pass any combination of two of these exams except those who choose the statistics option. Master's students who choose the M.S. Statistics option must pass the M.S. Statistics exam and either the M.S. Algebra exam or the M.S. Analysis exam. Students can pass the exams one at a time; and there is no limitation on the number of times a student can take each exam. Each of the exams lasts three hours and is offered three times a year in one week in January, May/June, and August. The January and August M.S. exams are offered in the week preceding the first week of instruction, and the May/June M.S. exams are offered in the second week after the spring semester ends.

Students must sign up for the exams at least one week ahead of the scheduled exam dates. Approximately a month before the next scheduled exam week, the Department will send an email to inform the students about the coming M.S. exam and ask the students to sign up. If no students sign up for a particular subject exam, this subject exam will be cancelled. In the past, most students have taken the M.S. Algebra and the M.S. Analysis exams. Copies of past M.S. exams can be obtained from the Departmental main office, while example M.S. exams can be found using the links below.

## MS Algebra Exam
The M.S. Algebra exam is based on the course sequence Math 735 (631) – 736 (632) and it covers these topics: linear algebra, group theory, rings and modules.

The M.S. Analysis exam is based on the course sequence Math 723 (621)-724 (622) and it covers these topics: sequences, continuity, differentiation, integration, series and functions of several variables.

## MS Statistics Exam
The M.S. Statistics exam is based on the course sequence MthStat  763–764 and it covers these topics: Regression and Time Series.

# 11. M.S. Graduation Procedures

## For Graduate School Policies and Procedures, visit

http://uwm.edu/graduateschool/masters-toolbox/

## Before the semester in which you expect to graduate:

1. Meet with the [Associate Chair for the Graduate Program](#) to make sure you will meet the course and credit requirements by the end of the semester in which you intend to graduate. If your M.S. option is one of Actuarial Science or Statistics, you should also check the concentration requirement for your option.

   See the Concentration Verification of Completion forms:

   1) [Verification – Actuarial Science](#)
   2) [Verification – Statistics](#)

2. If you plan to take the M.S. Exams for your M.S. capstone requirement (exit requirement), note that our department offers these exams three (3) times a year in January, May/June, and August, and plan accordingly.
   Note: You will need to pass two (2) out of these three (3) exams: Algebra Exam, Analysis Exam, and Statistics Exam. Our department will send out an email notice about the coming M.S. Exams. You can take these exams as many times as time permits, so you may want to take them as early as possible.
3. If you plan a thesis/project for your M.S. capstone, it is advised that you find an advisor before the semester in which you plan to graduate. Note that some M.S. options (e.g. Industrial Mathematics) require a thesis, and the project option requires 36 credits.
4. Apply for graduation by the posted deadline for the semester in which you intend to graduate.
5. Information on registration requirements, application deadlines, and the online graduation application link are available [here](#).

## During the semester in which you expect to graduate (for those who are completing a thesis/project):

1. Check the graduate school's deadlines, enrollment requirement, and other policies [here](#), and plan your defense/hearing accordingly.
   *Note: If you are completing a thesis, you must follow the graduate school's deadlines on formatting, defense, and submission. If any of these deadlines are not met, you must re-apply and graduate in the next semester. You will not be required to register for the next semester if your thesis has been defended, passed, and accepted by the Graduate School before the first day of classes for the next semester. The date of graduation, however, will be the next semester. If you are writing a project, you do not need to submit your project to the Graduate School, and you will just need to pass your project hearing by the end of the semester.*
2. Form your thesis/project committee at least two (2) weeks before your defense/hearing date and get approval from the Associate Chair for the Graduate Program. Three (3) graduate faculty members are required. Schedule

your defense/hearing with your committee members, and reserve a room for your defense/hearing through the [departmental online room request system.](#) You must include your advisor's name, defense/hearing title, and an abstract (for our departmental announcement) with your room request. You should schedule your defense/hearing for two (2) hours and make the room reservation accordingly.

3.  Fill in and print the departmental [Masters Project or Thesis Report Form,](#) and take it to the defense/hearing. This form is for departmental records and will not be submitted to the Graduate School.
4.  If your M.S. capstone is a thesis, you will need to submit the Thesis & Dissertation Approval and Publishing Options Form along with your thesis to the Graduate School.  See [here.](#)

Have your advisor complete and sign a Concentration Verification of Completion form. This form must be submitted with the signed Graduation Application. If you do not graduate when anticipated, you must re-apply to graduate in the next semester, but a second graduation fee is not required.

# 12. Ph.D. Milestone Procedures

## For Graduate School Policies and Procedures, visit

[http://uwm.edu/graduateschool/doctoral-toolbox/](http://uwm.edu/graduateschool/doctoral-toolbox/)

## 12.1 Preliminary Exam

When you are sufficiently prepared – normally you have earned 24 credits in specific areas above the 700 level math courses, take these steps to schedule and complete your preliminary exam:

1.  Form your exam committee. Choose three faculty members representing three (3) different fields from these five (5) fields: algebra, analysis, applied mathematics, probability and statistics, and topology. The Associate Chair for the Graduate Program must approve both the selected fields and the committee members. Your preliminary exam committee members are usually the faculty members from whom you took the corresponding courses.
2.  After your examination areas and committee have been approved, schedule your preliminary exam with your committee members and apply for the preliminary exam online using the [doctoral milestone system](#).
3.  Reserve a room for the exam through the [departmental online room request system](#). You should schedule your preliminary exam for two (2) hours and make the room reservation accordingly. Normally, a preliminary exam takes an hour and thirty minutes to two hours to complete.
4.  Print the [Departmental Ph.D. Preliminary Exam Form](#) and take it to the exam. The Departmental Ph.D. Preliminary Exam Form is for our department's record and will not be sent to the Graduate School.

## 12.2 Proposal Hearing

When you are ready (to be decided by you and your Ph.D. dissertation advisor), take these steps:

1. Form your proposal hearing committee and schedule your proposal hearing with the committee.  Work with your advisor to select your proposal hearing committee members and obtain the approval from the Associate Chair for the Graduate Program. Our Department requires that you form a proposal hearing committee with five (5) graduate faculty members with at least one member outside your dissertation field. Note the difference here with the statement in the graduate school webpage "the committee must have at least three UWM graduate faculty members, including your chosen major professor". Here, the departmental policy is consistent with the graduate school policy and it supersedes the statement there.
2. Start the online application for your proposal hearing through the doctoral milestone system.  Reserve a room (for two hours) for your proposal hearing through the departmental online room request system.
3. Fill in and print the Departmental Ph.D. Proposal Hearing Form and take it to your proposal hearing.
4. After your proposal hearing, return the Departmental Ph.D. Proposal Hearing Form to the Associate Chair for the Graduate Program.

## 12.3 Apply for Dissertator Status

To become a dissertator, you must have:
1. your Ph.D. candidacy in place (have passed your preliminary exam),
2. satisfied the course requirements for both the primary field and the secondary field – this requires careful planning well ahead of time,
3. satisfied both the foreign language requirement and the computer proficiency requirement, and
4. passed your proposal hearing.

Check these with the Associate Chair for the Graduate Program. Usually you can start your dissertator status application through the Ph.D. milestone system after your proposal hearing has been approved by your committee.

Note that
a) If you are a teaching assistant, your pay will increase significantly after you become a dissertator. You can attain dissertator educational status at any point during the semester. However, in order to be paid at the dissertator rate during the semester, you must achieve dissertator status on or before the Registrar's add deadline. There are two cases: 1) You attain dissertator status by the first contractual date as defined by the published academic year

calendar of the semester, then you will be paid at the dissertator rate at the beginning of the semester. 2) You attain dissertator status between the contractual date and the Registrar's add deadline, then you will be paid the dissertator rate starting with the first payroll period after the add deadline.

b) It is a Graduate School policy that after you become a dissertator, you will need to (and can only) register for three (3) credits of reading and research (Math 990). You will not be able to take other classes.  For details on the dissertator policy, including the continuous registration requirement, visit http://uwm.edu/graduateschool/doctoral-toolbox/.
Our Department has a partial exemption to the three credit rule: as dissertator, you may take one three (3) credit 800-level course in your field plus one (1) credit of Math 990.

## 12.4 Apply for Dissertation Defense and Graduation

The procedure for this milestone step is detailed at the Graduate School web page at

http://uwm.edu/graduateschool/doctoral-toolbox/.

Note that
  a. The Graduate School sends out emails to remind all UWM graduate students of the deadlines for application for graduation, thesis defense, and thesis submission (to the Graduate School), before each semester starts.
  b. If any of the deadlines are not met, you must apply and graduate in the next semester.  You will not be required to register for the next semester if the dissertation has been defended, passed, and accepted by the Graduate School before the first day of classes for the next semester. The date of graduation, however, will be the next semester.

When you and your committee have selected a defense date you must reserve a room for the defense through the departmental online room request system. You must include your advisor's name, defense title, and an abstract (for our departmental announcement) with your room request. You should schedule your dissertation defense for two (2) hours and make the room reservation accordingly.

# 13. Graduate Program Forms

Available online in the UWM Mathematical Sciences webpage:

https://uwm.edu/math/our-people/employee-resources/graduate-program-forms/

14. Courses:  Available online in the Course Catalog.

Available online in the UWM Course Catalog:

https://catalog.uwm.edu/courses/actsci/

https://catalog.uwm.edu/courses/math/

https://catalog.uwm.edu/courses/mthstat/