

Policies and Procedures for the Graduate Programs in Mathematics and Statistics

Department of Mathematics and Statistics
UMBC

August 22, 2019

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0 Introduction

This document, subsequently referred to as *Policies and Procedures*, describes policies and procedures pertaining to graduate students in the Department of Mathematics and Statistics at UMBC. It either adds, expands or clarifies the requirements set forth in the *Graduate Catalog*, which is the Graduate School's official manual for UMBC's graduate students.

The Graduate Catalog describes the university's policies and procedures regarding admission, progression through the programs and graduation requirements. The Graduate Catalog is frequently revised to adjust and improve its policies. The current Graduate Catalog is available electronically at:

<http://www.umbc.edu/gradschool/gradcatalog/>

Parts of the catalog pertaining to the Department of Mathematics and Statistics can also be found at:

<http://mathstat.umbc.edu/graduate-programs-of-study/>

The Graduate Catalog is published only once every two years. The department's version, referred to above, is updated more frequently. Please consult the latter for the most up-to-date information.

Policies and Procedures does not repeat everything in the Graduate Catalog. If questions or ambiguities remain after reading this document, please consult the Graduate Catalog or talk to the Graduate Program Director.

The focus of the current *Policies and Procedures* is on full-time students who receive financial support from the department. Many, but not all, of the policies described here apply to part-time and independently-supported students as well. If in doubt, please ask the Graduate Program Director for clarification.

Full-time
vs
part-time

1 Course Requirements

1.1 Course requirements for the MS degree programs

The department awards two distinct *Master of Science* (MS) degrees: *MS in Applied Mathematics* and *MS in Statistics*. The Graduate Catalog describes the detailed requirements for obtaining these degrees. Summaries of these requirements are presented in graphical charts in the Appendix A.

As can be seen in these charts, there are several ways, or *tracks*, in which one can achieve the degree requirements of a Master's degree. The student can choose the track most appropriate with his or her educational goals.

1.2 Course requirements for the PhD programs

The department awards two distinct *Doctor of Philosophy* (PhD) degrees: *PhD in Applied Mathematics* and *PhD in Statistics*. Within the statistics PhD there are two tracks: the traditional track and the biostatistics track. There are no prescribed courses for the Statistics PhD program. The written comprehensive exams (see Section 3) in both tracks are based on Stat 601 (Applied Statistics I), Stat 602 (Applied Statistics II), Stat 651 (Basic Probability), and Stat 653 (Basic Mathematical Statistics).

There is a set of prescribed courses for the Applied Mathematics PhD program which consists of:

1. Math 600: Real Analysis

2. Math 603: Matrix Analysis

The student will be exempted from the Math 600 & 603 requirement if able to pass the Master's Written Comprehensive Examination based on prior preparation.

3. Math 611: Applied Analysis

4. Four of the six courses below, with at least one from each category:

- DE: Differential equations
 - Math 612: Ordinary Differential Equations
 - Math 614: Partial differential Equations
- NA: Numerical Analysis
 - Math 620: Numerical Analysis
 - Math 630: Matrix Analysis
- OP: Optimization
 - Math 650: Optimization
 - Math 651: Optimization

5. Math 699: Independent Study

The student is expected to take one or more Math 699 courses and make presentations to general audiences and faculty in the department based on what is learned in these studies.

The courses prescribed above are only minimal requirements. In either Applied Mathematics or Statistics PhD programs, the student will take any number of courses as necessary to carry out the dissertation research and receive a broad education at the same time.

The student is required to register for at least 18 credits of Doctoral Dissertation Research: Math/Stat 899 during the course of study.

The Graduate Catalog describes the detailed requirements and procedures for obtaining a PhD degree. Section 4 of *Policies and Procedures* (this document) has additional details.

18 credits of Math or Stat 899 are required for PhD degree programs.

2 Advising

The Graduate Program Director assigns each entering student an *academic advisor* from among the department's full-time faculty. The academic advisor is responsible for working with the student to set a reasonable path toward the student's goals, monitoring the student's performance and progress and intervening with corrective actions when necessary.

Academic Advisor

If, in due course, a student finds another faculty member's academic interests more suitable to his or her goals, the student can request a change in academic advisor by appealing to the Graduate Program Director.

Students who will write a thesis, as those in the PhD program or those in the MS program with a thesis option, often select a faculty member other than their academic advisor to guide the thesis work. The faculty member thus selected, becomes the student's *thesis advisor*. At this point, the role of the student's academic advisor ceases and the responsibilities of monitoring the student's program are transferred to the thesis advisor.

Thesis Advisor

The department does not provide a formal mechanism for identifying a thesis advisor for a student. It is up to the student to seek a thesis advisor. Faculty members are at their discretion as to whether to accept the role of the thesis advisor to a student.

3 The Written Comprehensive Examinations

The Written Comprehensive Examinations (WCEs) for the Master's and PhD programs are administered in January and August. Students can take the exam as soon as they feel ready for it.

Old comprehensive exams are available to all students for inspection.

3.1 The Master's WCE in Applied Mathematics

The syllabus of the *Master's Written Comprehensive Examination in Applied Mathematics* is based on the subjects of the courses Math 600 and Math 603.

Students receive a free attempt to pass the exam as they enter the program, and two attempts thereafter.

3.2 The Master's WCE in Statistics

The WCE requirement in the MS Statistics tracks has been removed. The students can meet their program requirements by taking sufficient course credits or by writing a thesis or capstone project in addition to taking courses. Please refer to the Graduate Catalog for the details.

3.3 The PhD WCE in Applied Mathematics

Candidates for the PhD program in Applied Mathematics should pass (a) the Master's Written Comprehensive Examination in Applied Mathematics (see Section 3.1), and (b) the PhD Written Comprehensive Examination in Applied Mathematics in one of the three possible categories:

Differential Equations (DE) based loosely on the contents of the courses

- Math 612 – Ordinary Differential Equations
- Math 614 – Partial Differential Equations

Numerical Analysis (NA) based loosely on the contents of the courses

- Math 620 – Numerical Analysis
- Math 630 – Matrix Analysis

Optimization (OP) based loosely on the contents of the courses

- Math 650 – Foundations of Optimization
- Math 651 – Optimization Algorithms

Students are allowed two attempts to pass the WCE in Applied Mathematics.

3.4 The PhD WCE in Statistics

The PhD Written Comprehensive Examination in Statistics consists of two parts. The first part is based on the content of the methodology courses Stat 601 and 602, while the second part of the WCEs is based on the content of the theoretical courses Stat 651 and 653.

In addition to the WCEs, students in the PhD biostatistics track are required to do a scientific minor. Please refer to the Graduate Catalog for more details.

Students are required to pass the comprehensive examination (all parts) in at most three attempts. In exceptional cases, the graduate program director may allow a student to take the exam for the fourth time.

3.5 The evaluation of the Written Comprehensive Examination

The evaluation method for the Written Comprehensive Examination is somewhat different from that of the traditional exams. The details of the procedure may vary, but in most cases, the faculty member who poses the exam questions makes a preliminary evaluation of the student's work. Then a second faculty member is asked to make an independent evaluation. Next, these faculty members meet with the Graduate Program Director and go over the details of the exam and discuss its strengths and weaknesses. Ultimately, they reach a recommendation that declares the outcome as a *Fail* or *Pass* in

Evaluating the Comps

the case Applied Mathematics and a *Fail*, a *MS-level pass* or a *PhD-level pass* in the case of Statistics.

The evaluators of a Written Comprehensive Examination often assign numerical grades to the exam. These are entirely for their own convenience and are not required. *There is no official grading scale or a set of cut-off points* for the Written Comprehensive Examination. The outcome of an examination is decided in a “holistic” fashion, based on the overall merits of the performance demonstrated in the exam by the student.

4 The PhD Program

An MS degree is not a requirement for admission to the PhD program—an applicant with a BS degree may apply for, and be admitted to, any of the MS or PhD programs. However, admission to the PhD program without a prior MS degree is rare. Generally, applicants without an MS degree are admitted to the MS program first. Upon successful completion of the MS degree requirements, they are evaluated and reconsidered for admission into the PhD program.

All students in the PhD program, whether or not they have the MS degree, are required to pass the department's Written Comprehensive Examination as specified in Section 3.

It is not uncommon for a student who enters the PhD program with a Master's degree from other institutions to take one or two semesters of courses in preparation for the Written Comprehensive Examination. A benefit of this is that the student gets to know the various faculty, and the faculty learn about the student's strengths and special abilities. This helps to create the student-advisor bond that is necessary for successful doctoral research. Nevertheless, the choice of a thesis advisor need not be restricted to those faculty who have served as the student's teacher. The student should consider all faculty in the department as potential thesis advisors.

There is no fixed mechanism for finding a match from among the faculty; a multitude of factors, such as research interests, goals, academic abilities and personality enter the decision. Often, a common bond develops when the student takes courses with a faculty member and finds the research orientation of the faculty member appealing.

Experience shows that almost always the student identifies a potential PhD advisor and indicates a tentative interest in working with that advisor even *before* taking the Written Comprehensive Examination. Experience also shows that the potential advisor does not make a firm commitment until the student passes the Written Comprehensive Examination with strong performance in the areas which the advisor deems most important. In any case, faculty members are at their discretion as to whether to accept the role of the thesis advisor to a student. Continued service of the faculty member as thesis advisor is predicated in the student making satisfactory progress as outlined below.

Selecting a thesis advisor

4.1 Beginning the Doctoral Research

Once an advisor-advisee commitment is made, the student begins working closely with the advisor in a targeted research area. Most commonly this is done in the form of one-on-one study and independent reading and research. The advisor may require that the student take additional courses either in the department, or outside, to establish the background necessary for carrying out the intended research.

During this exploratory period, the student acquires knowledge about the specialized field proposed and relevant background material. The student and the advisor formulate a research program and set goals for the student's doctoral dissertation.

4.2 The Doctoral Advisory Committee

As early as possible during the phase described in the previous section, the student and the advisor propose a *Doctoral Advisory Committee*, consisting of 4 or more faculty members (including the advisor) whose names will be forwarded to the Graduate Program Director. The Doctoral Advisory Committee should be formed with the view that it will stay with the student throughout the doctoral study and research and will be a part of the *Doctoral Examination Committee* that will conduct the student's doctoral defense.

Formation of the Doctoral Advisory Committee

The Doctoral Advisory Committee will provide supervision and support throughout the time the student works on the dissertation topic. It will monitor the student's activities and their relevance to the program.

Every semester the committee will submit a *Doctoral Advisory Committee's Progress Report* to the Graduate Program Director. The report will contain the committee's notes, observations and recommendations in regard to student's progress. It is recommended that the committee members meet with the student, either in one sitting or individually, to fill out the report.

Semi-annual progress reports

4.3 The Oral Qualifying Examination

It is expected that within one calendar year after passing the Written Comprehensive Examination the student shall take the *Oral Qualifying Examination*. This one-year period may be extended to three semesters upon request from the advisor but it should not be delayed beyond this three semester limit.

Exam within one year

There are two objectives to the Oral Qualifying Examination:

1. To verify that the scope and goals set for the PhD thesis are reasonable and are suitable for a PhD dissertation.
2. To verify that the student has the relevant background and knowledge necessary to work in the proposed area, including sufficient understanding of the proposed problem and some familiarity with current literature

Exam objectives

The student is expected to have prepared a written document containing a summary of the oral presentation. The document, which will be regarded as a “thesis proposal”, must be distributed to the committee members at least one week in advance of the examination date. The length of the document is up to the student, but as a reasonable guideline, it is suggested that it be 3–10 pages long. Variations in length and style of the proposal are acceptable, subject to the approval of the student’s advisor and the Doctoral Advisory Committee.

Written proposal

The examination will consist of an oral presentation by the student describing the goals of the doctoral dissertation research and an overview of the mathematical/statistical/scientific tools necessary to work toward that goal. The presentation may include new findings or exploratory computations by the student, but this is not required.

The presentation will be followed by a question-and-answer period where the committee may ask any questions it deems necessary to ascertain that the goals enumerated above are met.

Although there are no strict time limits for this examination, it is generally expected that the oral presentation will be approximately 30 minutes, while the entire examination will be no longer than 2 hours. Note, however, that these time ranges are provided as guidelines rather than strict requirements.

The committee can make suggestions to correct shortcomings or make recommendations to adjust the proposed goals. In extreme cases, the committee may declare the outcome of the examination unsatisfactory and request that it be repeated. Failing the Oral Qualifying Examination twice is sufficient cause for a student’s dismissal.

Two attempts only

If the committee deems the proposed work and the progress toward it satisfactory, the student passes the examination. An *Admission to Candidacy* form will then be signed by the student’s advisor and Graduate Program Director, who will then forward it to the Graduate School.

Admission to Candidacy

4.4 After the Oral Qualifying Examination

The Doctoral Advisory Committee continues overseeing the student’s progress through the culmination of the student’s doctoral dissertation and its defense.

Near the completion of the dissertation research, a *Doctoral Examination Committee* should be formed according to the Graduate School guidelines and timetables. It is expected that the membership of the Doctoral Examination Committee will include all of the Doctoral Advisory Committee. It will also include at least one member from outside the department according to the Graduate School rules. Consult the Graduate Catalog for further requirements pertaining the Doctoral Examination Committee and the procedures that lead to the dissertation defense and the awarding of the PhD degree.

5 Responsible Conduct of Research (RCR)

All PhD students as well as MS students pursuing a thesis option are **required** to take the online course CITI RCR. This course is free and takes about 90 minutes to complete. PhD students are required to complete this course *before* taking their Oral Qualifying Exam. MS students (pursuing the thesis option) are required to complete this before setting up their defense exam. Please see

<http://research.umbc.edu/2135-2/>

for information.

6 Supported Students

The following additional rules and regulations apply to full-time, supported students. It is important to adhere to these rules for a successful annual contract renewal review.

6.1 Financial Support

The department has funds for financial support of qualified students. A full financial support package includes an Academic Year (9 month) stipend, tuition remission for up to 10 credits per semester, and health insurance. Additional support for summer months is sometimes possible but cannot be guaranteed.

The financial support is often in the form of a Teaching Assistantship. A Teaching Assistant (TA) assists the department with the delivery of its instructional mission. TA duties vary, but the department makes an effort to distribute the workload as evenly as possible among its TAs. A TA agrees to make a commitment to devote 20 hours per week to TA-related duties.

Stipend Levels

The stipend received by supported students is determined by their status within the program.

Step I stipend applies to students in the Master's degree program. Students in the PhD degree also receive *Step I* stipend before satisfactory completion of the Written Comprehensive Examination.

Step II stipend applies to students in the PhD degree program after satisfactory completion of the Written Comprehensive Examination but before passing the Oral Qualifying Examination.

Step III stipend applies to students in the PhD after passing the Oral Qualifying Examination.

Stipend levels for the Academic Year 2018–19 are expected to be: Step I: \$17,840, Step II: \$18,197 Step III: \$19,334.01

These are 9-month (Academic Year) stipends.

Additional funding may be available for summer support in the form of supplemental Teaching or Research Assistantships within UMBC or Internships outside UMBC. The availability of such supplemental support, although quite common, fluctuates and cannot be guaranteed.

Health Insurance Benefits

As part of an assistantship award, the department provides health insurance coverage through the UMBC Health Plan. The individual insurance cost of approximately \$4,883 per year is paid entirely by the department.

Additional coverage may be purchased to cover the student's dependents at a rate established by the UMBC Health Plan. The cost of the extra coverage will be split between the department and the student, the department currently (i.e., during the academic year 2018–19) is paying 1/2 and the student is paying 1/2 of the charges. However, this arrangement may change in the future.

Coverage for dependents at additional cost

Tuition Remission

Supported students receive remission for up to 10 credit of courses per semester. Funds to cover course costs beyond those of 10 credits may be made available upon approval by the Graduate Program Director.

Student Fees

The Graduate School imposes certain fees on all graduate students. During the Academic Year 2018–19, the fee is estimated to be \$140 per credit. *It is the responsibility of the student to pay these fees.* The fees are not covered by financial assistantship awards. Additionally, the Graduate School charges a one-time *matriculation fee*, which is currently \$200. For information about current fee structures, please see

http://www.umbc.edu/gradschool/funding/tuition_fees.html

6.2 Course Requirements

The department has established a minimum number of courses that fully-supported students are expected to take each semester. This is intended to ensure a) the funds are being used appropriately, b) students receive a broad education during their residency, and c) the students complete their degree programs in a timely fashion.

Fully-supported students are required to enroll in one or more regularly scheduled courses every semester

For the purposes of this section, a “regular course” means a 3-credit graduate-level¹ classroom course either in the department or elsewhere in the university subject to the advisor’s approval. Math 614 and Stat 700 are examples of regular courses. Individual-study courses and thesis and dissertation research *are not considered* regular courses.

Students in the MS degree program shall take at least 9 credits per semester. These may be a combination of regular courses described above, individual-study courses under the direction of a faculty member, or master’s thesis research. Only one 3-credit individual-study course per semester is allowed with the same faculty member. Only six credits of master’s thesis research (Math 799 or Stat 799) are allowed during the entire course of MS degree study.

Students in the PhD degree program before passing the Written Comprehensive Examination shall take at least 9 credits per semester. These may be a combination of regular courses described above and individual-study courses under the direction of a faculty member. Only one 3-credit individual-study course per semester is allowed with the same faculty member.

Students in the PhD degree program after passing the Written Comprehensive Examination but before passing the Oral Qualifying Examination shall take at least 6 credits of regular courses per semester. Courses outside the department are acceptable subject to the advisor’s approval.

Students in the PhD degree program after passing the Oral Qualifying Examination through the end of their studies shall take at least one regular course per semester. Note that UMBC Graduate School requires students at this stage to also register for 9 credits of Math/Stat 899.

Additionally, *all students are required to enroll and participate* in the zero-credit Math/Stat 690, Graduate Student Seminar, every semester during which they receive financial support.

The Doctoral Advisory Committee’s semi-annual *Progress Report* will list the courses taken by the student during the semester in which the report is filed.

6.3 Annual Contract Renewal Review

The performance of each graduate student is reviewed annually in a meeting of all full-time faculty which takes place around mid- to late-spring. The faculty report on their experiences with the student as a teaching or research assistant, thesis advisee, or other forms of interaction. Past and current performance in courses, research, and other academic activities are also discussed.

A letter containing the summary of the discussion is mailed to the student. Problems and concerns, if any, are noted.

The continuation of a student’s financial support is contingent upon a positive recommendation in this review. In borderline cases the faculty can recommend extending

Financial support contract is reviewed for renewal at least once a year

¹Graduate-level courses are numbered 600 and above. However it is possible to count up to two 400-level courses toward the MS degree requirements subject to the advisor’s approval.

the financial support for only half a year and require a second review in the Fall to determine whether improvement has been achieved.

6.4 Time Line

This section describes the department's expectations of the rate of progress of supported students. The rate of progress depends on many factors, including the student's prior preparation and the nature of courses and research that the student undertakes, therefore deviations from the norm are inevitable. Nevertheless, it is expected that students will aim to adhere to these prescriptions to the extent possible.

Time to the MS Degree

Students in the MS degree programs are expected to complete all degree requirements and graduate in no more than two years. *Support cannot be extended beyond two years in the MS program.*

Time to the PhD Degree

Students who complete the MS degree program at UMBC and continue with the PhD program are expected to complete all the PhD degree requirements, including writing and defending a dissertation, in no more than three years after completing the MS degree.

Students who have obtained an MS degree elsewhere, are expected to complete all the PhD degree requirements, including writing and defending a dissertation, in no more than four years after entering the PhD program.

For all PhD students, number of years of support is restricted to five; an additional year of support may be made possible with the recommendation of the student's Doctoral Advisory Committee but is by no means guaranteed.

Time to the Written Comprehensive Examination

The Written Comprehensive Examination should be taken as early as possible, but no later than two years of full-time study.

Time to the Oral Qualifying Examination

The Oral Qualifying Examination should be taken within one calendar year of the satisfactory completion of the Written Comprehensive Examination. At the recommendation of the Doctoral Advisory Committee, the Graduate Program Director may extend this period by one semester.

Time to the Dissertation Defense

The dissertation defense is the culmination of the student's doctoral research. It should take place within the time limits specified under the paragraph *Time to PhD degree* above.

Application for Graduation

It is the responsibility of the student to follow the Graduate School's time tables to meet graduation deadlines. See the website

<http://www.umbc.edu/gradschool/programs/requirements.php>
for details.

6.5 English Language Testing

International students whose native language is not English, are required to take and pass the *TA Oral Proficiency Examination* administered by UMBC's Learning Resources Center. The exam is given twice a year shortly before the beginning of each semester. A student who does not receive a satisfactory rating will be required to enroll in an English language course (in addition to the normal mathematics/statistics courses) and will not be assigned classroom teaching duties for that semester, even if employed as a Teaching Assistant.

Students are expected to pass the English test at a satisfactory level within two semesters after beginning study at UMBC. Otherwise the department may withdraw its commitment to continuing financial support.

7 Appendix

Master's Degree in Applied Mathematics

Traditional Tracks

Core Curriculum

Math 600 – Real Analysis

Math 603 – Matrix Analysis

One course from each of the three categories:

DE { Math 612 – Ordinary Differential Equations
Math 614 – Partial Differential Equations

NA { Math 620 – Numerical Analysis I
Math 630 – Matrix Analysis

OP { Math 650 – Foundations of Optimization
Math 651 – Optimization Algorithms

Industrial Track

intended for students interested in a terminal MS degree and employment in industry and government

30 credit hours of courses consisting of

Math 617 – Introduction to Industrial Mathematics

5 graduate-level Math or Stat courses
(at least one of which is Stat)

2 courses in an area of application taken in another department

Math 717 – Projects in Applied Mathematics

Math 699 – Master's project (3 credits)

Comprehensive Exam Option

30 credit hours

(including the core above)

At least 18 credit hours must be in MATH courses. No more than 6 credit hours can be in STAT courses.

Comprehensive exam material based on:

Math 600, Math 603

Thesis Option

24 credit hours

(including the core above)

and

a master's thesis
(Math 799 – 6 credits)

and

Passing the oral thesis defense

Please note: This chart provides a simplified overview of program requirements. For complete details, please consult the Graduate Catalog, which is the ultimate authority in these matters.