APPLIED MATHEMATICS, PHD

Degree: Doctor of Philosophy (PhD)
Field of Study: Applied Mathematics

Program Overview

A student must satisfy all of the general requirements of the School of Graduate Studies as well as the more specific requirements of the department to earn a doctoral degree. Each graduate student is assigned an initial academic advisor upon matriculation. The academic advisor's primary responsibility is to help the student plan an appropriate and sufficiently broad program of coursework and study that will satisfy both the degree requirements and the special interests of the student. With the aid of the academic advisor, each student must present a study plan indicating how they intend to satisfy the requirements for a graduate degree. At the appropriate time, PhD students are also required to form a thesis advising committee, including a permanent research advisor, in order to draft a syllabus for and schedule an area exam.

The doctorate is conferred not merely upon completion of a stipulated course of study, but rather upon clear demonstration of scholarly attainment and capability of original research work in applied mathematics.

In addition to the doctoral coursework, all PhD students must complete the following specific requirements:

Qualifying Exams

Each student will be required to take two written qualifying exams in numerical analysis and modeling. Syllabi for the exams are available to students. Exams will be offered twice a year, usually in January and May. Students may attempt each exam up to two times. Under normal circumstances, students are expected to have passed both exams by the end of their fifth semester.

Area Exam

Each student will be required to pass an oral area examination showing knowledge of the background and literature in the chosen area of specialization. The exam will be administered by the student's advising committee, chaired by the research advisor. The exam should normally take place within one year after final passage of the qualifying examinations and at least one year before the defense takes place. A student may retake the area exam once.

A written syllabus, with a list of the papers for which the student will be responsible, should be prepared and agreed upon by the student and advising committee *at least two months before the exam takes place*, at which time a specific date and time for the exam should be decided. Both the syllabus and the scheduled date of the exam should then be reported to the graduate committee. Once the syllabus and exam date have been reported to the graduate committee, the student will advance to PhD candidacy.

Yearly Progress Reports

After passing the area exam, students will present yearly progress reports to their advising committees, usually in April.

Dissertation, Expository Talk, and Defense

Students are required to produce a written dissertation and present an oral defense. The dissertation is expected to constitute an original contribution to mathematical knowledge. It must be provided to the defense committee (the composition of which is discussed below) *at least 10 days* prior to the defense. Students are required to give a colloquium-level presentation of their thesis work, open to all students and faculty, followed by an oral defense of the thesis work to the defense committee. The committee consists of at least four faculty members, including the student's research advisor and at least one outside faculty member.

Deadlines for the thesis defense and approval of the dissertation are determined by the School of Graduate Studies. It is the student's responsibility to be aware of deadlines and make sure they are met.

Petitions

Any exceptions to departmental regulations or requirements must have the formal approval of the department's graduate committee. Such exceptions are to be sought by a written petition, approved by the student's advisory committee or research advisor, to the graduate committee.

Any exception to university rules and regulations must be approved by the dean of graduate studies. Such exceptions are to be sought by presenting a written petition to the graduate committee for departmental endorsement and approval prior to forwarding the petition to the dean.

PhD Policies

For PhD policies and procedures, please review the School of Graduate Studies section of the General Bulletin.

Program Requirements

A student in the applied mathematics program must demonstrate knowledge of scientific computing, mathematical modeling, and differential equations. Students must take 36 credit hours of approved courses with a grade average of B or better. For students entering with a master's degree in a mathematical subject compatible with our program, as determined by the graduate committee, this requirement is reduced to 18 credit hours of approved courses. This includes taking qualifying examinations in the areas of computational mathematics and mathematical modeling, and taking certain courses in these areas, as specified below.

Qualifying Examination

Students are required to take qualifying examinations in the areas of computational mathematics and mathematical modeling.

Area Examination

A doctoral student in the applied mathematics program must take an oral area examination in his or her chosen area of specialization. The subjects for the area exam will be determined by the student and their advising committee. Past topics have included fluid mechanics, statistical mechanics, epidemiology, neuroscience, inverse problems, and imaging.

Course requirements

Code	Title	Credit Hours
Required Courses:		
MATH 431	Introduction to Numerical Analysis I	3
MATH 441	Mathematical Modeling	3
Choose one of the following:		*3*
MATH 432	Numerical Differential Equations	
MATH 433	Numerical Solutions of Nonlinear Systems and Optimization	
Choose one of the following:		*3*
MATH 435	Ordinary Differential Equations	
MATH 445	Introduction to Partial Differential Equations	
Approved Courses [a]		24
Total Credit Hours		**36**

a Must include at least 9 credit hours of MATH courses and at least 9 credit hours of non-MATH courses.

Applied Mathematics PhD students are subject to the same breadth requirements as students pursuing the MS degree in Applied Mathematics (see above). For students entering with a master's degree, this can be modified, as described below.

A student with a master's degree in a mathematical subject compatible with our program, as determined by the graduate committee, must take 18 credit hours of approved courses, which must include at least 6 credit hours of courses offered outside the Department of Mathematics, Applied Mathematics, and Statistics and at least 9 credit hours offered by the Department of Mathematics, Applied Mathematics, and Statistics. The graduate committee will determine which of the specific course requirements stated above have been satisfied by the master's coursework.

Sample study plans for students with concentrations in scientific computing, imaging, mathematical biology, and stochastics follow. Alternate study plans may also be approved by the graduate committee.

Concentrations

Scientific Computing Concentration

Code	Title	Credit Hours
MATH 431	Introduction to Numerical Analysis I	3
MATH 432	Numerical Differential Equations	3
MATH 433	Numerical Solutions of Nonlinear Systems and Optimization	3
MATH 439	Bayesian Scientific Computing	3
or MATH 440	Computational Inverse Problems	
MATH 441	Mathematical Modeling	3
MATH 445	Introduction to Partial Differential Equations	3
MATH 449	Dynamical Models for Biology and Medicine	3
or MATH 478	Computational Neuroscience	
Application area		9

Imaging Concentration

Code	Title	Credit Hours
EBME 410	Medical Imaging Fundamentals	3
MATH 431	Introduction to Numerical Analysis I	3
MATH 432	Numerical Differential Equations	3
MATH 433	Numerical Solutions of Nonlinear Systems and Optimization	3
MATH 439	Bayesian Scientific Computing	3
or MATH 440	Computational Inverse Problems	
MATH 441	Mathematical Modeling	3
MATH 444	Mathematics of Data Mining and Pattern Recognition	3
MATH 445	Introduction to Partial Differential Equations	3
MATH 473	Introduction to Mathematical Image Processing and Computer Vision	3
PHYS 431	Physics of Imaging	3
PHYS 460	Advanced Topics in NMR Imaging	3

Life Science Concentration

Code	Title	Credit Hours
MATH 419	Applied Probability and Stochastic Processes for Biology	3
MATH 431	Introduction to Numerical Analysis I	3
MATH 432	Numerical Differential Equations	3
MATH 433	Numerical Solutions of Nonlinear Systems and Optimization	3
MATH 439	Bayesian Scientific Computing	3
MATH 440	Computational Inverse Problems	3
MATH 441	Mathematical Modeling	3
MATH 445	Introduction to Partial Differential Equations	3
MATH 449	Dynamical Models for Biology and Medicine	3
MATH 478	Computational Neuroscience	3
Application area		9

Stochastics Concentration

Code	Title	Credit Hours
MATH 419	Applied Probability and Stochastic Processes for Biology	3
MATH 423	Introduction to Real Analysis I	3
MATH 424	Introduction to Real Analysis II	3
MATH 431	Introduction to Numerical Analysis I	3
MATH 441	Mathematical Modeling	3
MATH 491		
MATH 492	Probability II	3
Application area		9