Mathematics, Ph.D.

Graduate courses are designed to meet the needs of students doing graduate work in mathematics and in those disciplines that require graduate-level mathematics for their study. Among the fields covered are analysis, algebra, applied and computational mathematics, mathematical biology, geometry and topology, probability, ordinary and partial differential equations, and mathematical logic.

In addition to formal courses, there are seminars for advanced study toward the Ph.D. in various fields of mathematics. Topics will vary from year to year. Each seminar is conducted by a faculty member specializing in the subject studied. Enrollment will be subject to the approval of the instructor in charge.

When accepted into the doctoral program, the student embarks on a program of formal courses, seminars, and individual study courses to prepare for the Ph.D. written examinations, Advancement to Candidacy examination, and dissertation.

Requirements

Upon entering the program, students are expected to take MATH 210A, MATH 210B, MATH 210C, MATH 220A, MATH 220B, MATH 220C, MATH 230A, MATH 230B, and MATH 230C, which must be passed with a grade of B or better. Students must complete these sequences by the end of the second year.

By the start of the second year, students must achieve at least two passes at the M.S. level among four exams in Real Analysis, Complex Analysis, Algebra, and Applied Math. By the start of the third year, students must achieve two Ph.D. level passes among four exams in Real Analysis, Complex Analysis, Algebra, and Applied Math.

To satisfy the exam requirements, students may take the Core Assessment Exams (offered in spring of every year) or the Qualifying Exams (offered before the start of the fall quarter) in these areas. Students may not attempt to take an exam in a particular subject area more than three times. A student who passes a Qualifying Examination at the Ph.D. level prior to taking the corresponding course will be exempted from taking the course.

Some students may require additional background prior to entering MATH 210A, MATH 210B, MATH 210C. This will be determined by assessment prior to the start of the students' first year by the Vice Chair for Graduate Studies, upon consultation with the Graduate Studies Committee. Such students will be directed into MATH 205, or equivalent, during their first year. These students may pass one Comprehensive Exam in the area of Analysis in lieu of achieving an M.S. pass on one Qualifying Exam that must be obtained prior to the start of the students' second year. The Comprehensive Exam in Analysis will be offered once per year in the spring quarter.

By the end of their second year, students must declare a major specialization from the following areas: Algebra, Analysis, Applied and Computational Mathematics, Geometry and Topology, Logic, or Probability. Students are required to take two series of courses from their chosen area. (Students who later decide to change their area must also take two series of courses from the new area.) Additionally, all students must take two series outside their declared major area of specialization. Special topics courses within certain areas of specialization and courses counted toward the M.S., other than MATH 205A-MATH 205B-MATH 205C, will count toward the fulfillment of the major specialization requirement.

By the beginning of their third year, students must have an advisor specializing in their major area. With the advisor's aid, the student forms a committee for the Advancement to Candidacy oral examination. This committee will be approved by the Department on behalf of the Dean of the Graduate Division and the Graduate Council and will consist of five faculty members. At least one, and at most two, of the members must be faculty from outside the Department. Before the end of the third year, students must have a written proposal, approved by their committee, for the Advancement to Candidacy examination. The proposal should explain the role of at least two series of courses from the student's major area of specialization that will be used to satisfy the Advancement to Candidacy requirements. The proposal should also explain the role of additional research reading material as well as providing a plan for investigating specific topics under the direction of the student's advisor(s). Only one of the courses MATH 210A-MATH 210B-MATH 210C, MATH 220A-MATH 220B-MATH 220C, and MATH 230A-MATH 230B-MATH 230C may count for the course requirement for Advancement to Candidacy Examinations. After the student meets the requirements, the Graduate Studies Committee recommends to the Dean of the Graduate Division the advancement to candidacy for the Ph.D. Students should advance to candidacy by the beginning of their fourth year.

After advancing to candidacy, students are expected to be fully involved in research toward writing their Ph.D. dissertation. Ideally, students should keep in steady contact/interaction with their Doctoral Committee.

Teaching experience and training is an integral part of the Ph.D. program. All doctoral students are expected to participate in the Department's teaching program.

The candidate must demonstrate independent, creative research in Mathematics by writing and defending a dissertation that makes a new and valuable contribution to mathematics in the candidate's area of concentration. Upon Advancement to Candidacy a student must form a Thesis Committee, a subcommittee of the Advancement Examination Committee, consisting of at least three faculty members and chaired by the student's advisor. The committee guides and supervises the candidate's research, study, and writing of the dissertation; conducts an oral defense of the dissertation; and recommends that the Ph.D. be conferred upon approval of the Doctoral Dissertation. The normative time for completion of the Ph.D. is six years, and the maximum time permitted is seven years. Completion of the Ph.D. degree must occur within nine quarters of Advancement to Ph.D. candidacy.

Examinations

Ph.D. examinations are given in Algebra, Complex Analysis, Applied Math, and Real Analysis. All students seeking the Ph.D. must successfully complete two examinations before the end of the third year of entering the graduate program. Only two attempts are allowed for a Ph.D. student on each exam.

Area Requirements

Ph.D. students will choose from one of six areas of specialization in the Mathematics Department, which determines course work requirements. Each area of specialization will have a core course, which the Department will do its best to offer each year. The Department will offer other courses every other year, or more frequently depending on student demands and other Department priorities.

Algebra	
MATH 230A- 230B- 230C	Algebra and Algebra and Algebra (core)
MATH 232A- 232B- 232C	Algebraic Number Theory and Algebraic Number Theory and Algebraic Number Theory
MATH 233A- 233B- 233C	Algebraic Geometry and Algebraic Geometry and Algebraic Geometry
Analysis	
MATH 210A- 210B- 210C	Real Analysis and Real Analysis and Real Analysis (core)
MATH 220A- 220B- 220C	Analytic Function Theory and Analytic Function Theory and Analytic Function Theory (core)
MATH 260A- 260B- 260C	Functional Analysis and Functional Analysis and Functional Analysis
MATH 295A- 295B- 295C	Partial Differential Equations and Partial Differential Equations and Partial Differential Equations
MATH 296	Topics in Partial Differential Equations
Applied and Computational Mathematics	
MATH 290A- 290B- 290C	Methods in Applied Mathematics and Methods in Applied Mathematics and Methods in Applied Mathematics (core)
MATH 225A- 225B- 225C	Introduction to Numerical Analysis and Scientific Computing and Introduction to Numerical Analysis and Scientific Computing and Introduction to Numerical Analysis and Scientific Computing
MATH 226A- 226B- 226C	Computational Differential Equations and Computational Differential Equations and Computational Differential Equations
MATH 227A- 227B	Mathematical and Computational Biology and Mathematical and Computational Biology
MATH 295A- 295B- 295C	Partial Differential Equations and Partial Differential Equations and Partial Differential Equations
Geometry and Topology	
MATH 218A- 218B- 218C	Introduction to Manifolds and Geometry and Introduction to Manifolds and Geometry and Introduction to Manifolds and Geometry (core)
MATH 222A	Several Complex Variables and Complex Geometry
MATH 240A- 240B- 240C	Differential Geometry and Differential Geometry and Differential Geometry

MATH 245A- 245C- 245C	Topics in Geometric Analysis and Topics in Geometric Analysis and Topics in Geometric Analysis
MATH 250A- 250B- 250C	Algebraic Topology and Algebraic Topology and Algebraic Topology
Logic	
MATH 280A- 280B- 280C	Mathematical Logic and Mathematical Logic and Mathematical Logic (core)
MATH 281A- 281B- 281C	Set Theory and Set Theory and Set Theory
MATH 282A- 282B- 282C	Model Theory and Model Theory and Model Theory
Probability	
MATH 210A- 210B- 210C	Real Analysis and Real Analysis and Real Analysis
MATH 270A- 270B- 270C	Probability and Probability and Probability (core)
MATH 271A- 271B- 271C	Stochastic Processes and Stochastic Processes and Stochastic Processes (core)
MATH 274	Topics in Probability