

Master of Science Degree (M.S.)

Candidates have six calendar years from the time of enrollment in The Graduate School to complete the Master's degree. Students who change degree programs during this six-year period may be granted an extension after review and approval by The Graduate School. In any event, courses used toward the degree must have been taken within six years of graduation.

1. Departmental Requirements.

a. Thesis Option.

i. A total of 30-credit hours in courses numbered above 400, including at least 6 credit hours of thesis (Math 500) and 15 hours in mathematics courses numbered above 500. Of the 24 nonthesis credit hours, 6 may be earned in courses approved by the Supervisory Committee in fields other than mathematics. (More than 6 hours of Math 500 may be taken, but only 6 hours will count toward the degree.)

ii. Sequence Requirement (see d.).

iii. Thesis and Oral Examination.

b. Nonthesis Option.

i. Approval of this option by the Supervisory Committee after one semester of graduate study.

ii. A total of 30 credit-hours in courses numbered above 400, including 21 credit hours (with at least 15 in mathematics) numbered above 500. A student must take the reading course, Math 598, in which a term paper or project is required. The instructor and student must agree that the term paper or project will be the student's nonthesis Master's project, and the student must make an oral presentation of the results of the project to the director and the reader of the project. Of the 30 credit hours, 9 may be earned in courses approved by the Supervisory Committee in fields other than mathematics.

iii. Sequence Requirement (see d.).

iv. A written final examination. The Ph.D. preliminary examinations in mathematics may be taken as an option instead of the Master's final examination. The successful completion of one Ph.D. preliminary examination in mathematics will constitute successful completion of a portion of the written Master's final examination. The successful completion of three Ph.D. written preliminary examinations in mathematics will constitute successful completion of the entire Master's final examination. In the case of a substitution of a passed preliminary examination in mathematics for a portion of the Master's final examination, the preliminary examination must be passed before the Master's comprehensive examination period and a faculty representative from the preliminary examination subject must participate in the determination of whether the student passes the comprehensive examination.

c. Course-work Option

(i.) A total of 30-credit hours in courses numbered above 400, including 21 credit hours (with at least 15 in mathematics) numbered above 500. Of the 30 credit hours, 9 may be earned in courses approved by the Supervisory Committee in fields other than mathematics.

(ii) Sequence requirement. (see d.)

(iii) The student must pass two PhD preliminary examinations in mathematics with a PhD level score as required in the PhD program.

d. Sequence Requirements.

A student completing the requirements of the concentration in applied mathematics must pass at least one 500-level sequence. Eligible sequences are those which (1) appear as sequences in the Graduate Catalog and (2) have at least the first semester of the sequence listed in either requirement iii or one of the program specializations of the concentration in applied mathematics.

All other M.S. degree candidates must pass three year-long sequences. Any pair of graduate-level mathematics courses appearing as a sequence in the Graduate Catalog is acceptable. One of the three sequences may be at the 400-level and may have been taken at UT or elsewhere for undergraduate or graduate credit. All pairs of 400-level mathematics courses appearing as sequences in the Graduate Catalog (available online) are acceptable and so are the following pairs of courses: 423-424, 423-425, 431-435, any two of 460-462-467, 471-472. A graduate sequence from a field other than mathematics may be used with approval of the student's supervisory committee.

e. Concentration in Applied Mathematics

For this concentration, available under all three options, the student must complete the following:

i. Required prerequisite courses:

- a. Numerical Algorithms 371 or Numerical Analysis 471 or Numerical Algebra 472,
- b. Methods in Applied Mathematics 512 or both Differential Equations II 431 and Partial Differential Equations 435,
- c. Honors Advanced Calculus I, II 447-48 or Advanced Calculus I, II 445-46, and
- d. Matrix Algebra II 453.

ii. One hour in Seminar in Applied Mathematics 519 or Seminar in Mathematical Ecology 589.

iii. One course from each of the following five areas:

- a. Foundations of Applied Mathematics - Methods in Applied Mathematics 511, Analytical Applied Mathematics I 515, Analytical Applied Mathematics II 516.

- b. Optimization - Scientific Computing: Optimization 577, Optimal Control Theory 585.
- c. Numerical Mathematics - Scientific Computing: Partial Differential Equations 578, Numerical Mathematics 571, Numerical Mathematics 572.
- d. Modeling - Mathematical Principles of Continuum Mechanics 537, Industrial Mathematics 475, Mathematical Ecology 581.
- e. Statistics - Statistics 525, Stochastic Modeling 527, Statistical Methods 571 (Department of Statistics), Biometry 560 (Department of Ecology and Evolutionary Biology).

A student who successfully completes the requirements of the concentration in applied mathematics will receive a departmental certificate signifying that fact.

For the student who is well-prepared and able to take optional coursework, there are three possible program specializations representing strengths of the department in Applied Mathematics. The courses listed here are additional to the courses in i, ii, and iii above. These lists represent the faculty consensus about which courses are appropriate choices for various student interests; a Master's degree student normally does not have time to take all the courses in a list.

Analytic Specialization. Mathematical Principles of Fluid Mechanics 513-14, Ordinary Differential Equations 531-32, Calculus of Variations 534, Partial Differential Equations 535-36, Mathematical Principles of Continuum Mechanics II 538.

Computational Specialization. Numerical Analysis 471-72, Finite Element Methods 574, Special Topics in Computer Science (Parallel Computing) CS 594.

Mathematical Ecology Specialization. Mathematical Ecology II 582, Mathematical Evolutionary Theory 583, Systems Theory 584, Ordinary Differential Equations 531-32, Partial Differential Equations 535-36, courses from the Department of Ecology and Evolutionary Biology.

2. General Comments

a. The purpose of the thesis option is to give students an opportunity to study an area of mathematics under the supervision of a faculty member and to organize and present their findings in writing. The Master's Committee for the thesis option consists of the major professor and two other faculty members. The Committee reads the thesis and administers the oral examination in which the student usually summarizes the thesis and answers any questions the Committee may ask.

b. The purpose of the nonthesis option is to give the qualified student an opportunity to take additional course work in mathematics or related areas. The written final examination consists of three two-hour tests in mathematics of which at least two are at the 500 level. Each semester the department will offer the non-thesis Master's examinations in a period consisting of the ten (10) days of classes on or before the day of The Graduate School deadline. A non-thesis Master's student must take all three of his/her examinations during the specified ten days.

After consultation with the student, the Graduate Committee specifies the three areas from which the test questions will be taken. At least two of the three areas must cover material from at least two semesters of study. The third area must cover material from at least one semester of study. The three parts of the examination are graded as a unit and, in case of failure, must be repeated as a unit. A candidate who fails the examination may not repeat the examination until the following semester. The examination may be repeated only once. In borderline cases, the Examination Committee may give a follow-up oral examination. The Department will not report the results of the written Master's Final Examination to The Graduate School until the Master's project is completed with approval indicated in writing to the Mathematics Department by the project director and the second reader. This regulation will have the effect of making the project due each semester two weeks before nonthesis examination results are due in the Graduate School.

c. The purpose of the course-work option is to give PhD students a convenient way to obtain an MS degree along the way to their PhD.

d. The concentration in applied mathematics is intended to prepare students for careers primarily in industry or government. The goal is to develop students' abilities to think mathematically, formulate and analyze mathematical models, and function as a member of a multidisciplinary team.

Toward this goal, a student should understand a wide range of mathematics and have practical experience applying analytical and computational methods to realistic problems.

Each course in this program should provide a wide background in its area and provide practical experience with applications. The emphasis should be on analytic concepts, methods, modeling, hands-on computation, data analysis, and communication.

The required prerequisite courses represent knowledge that the faculty believe every applied mathematics Master's degree student must have. The required prerequisite courses are to be taken as early as possible in one's program, but one may proceed with other courses in the program for which one has the necessary background. If a student has passed one or more of the required prerequisite courses (or their equivalents) as an undergraduate or as a graduate student elsewhere, then those courses do not have to be repeated as a graduate student at UT. However, neither undergraduate credits nor graduate credits used for a previous degree may be counted toward a Master's degree; consult the Graduate Catalog for details.

Procedures for Fulfilling Requirements

- a. Begin course work.
- b. Obtain a thesis advisor and Master's Committee, or obtain written approval of Supervisory Committee for nonthesis option (obtain appropriate form in 225A Ayres).
- c. Apply for admission to candidacy (at least one semester prior to graduation--consult Graduate Schools web site at <http://gradschool.utk.edu/forms-central/> for all forms and deadlines). Forms should be completed online, printed, and require original signatures of 3 committee members.

- d. Complete course work and write thesis, if necessary.
- e. Place name on graduation list via MyUTK.
- f. Apply for diploma.
- g. Schedule oral examination (not later than three weeks before thesis deadline), or, for nonthesis option, schedule written final examination (obtain form for departmental approval of examination plans in 225A Ayres Hall).
- h. Pass oral examination or written final examination.
- i. Submit project report approved by project supervisor and reader, if in non-thesis program.
- j. Remove all incompletes (not later than one week before commencement).
- k. Obtain approval by the Graduate School of final copy of thesis if thesis option has been elected (after oral examination and no later than two weeks before commencement).