

Mathematics

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Master of Science in Mathematical Sciences

Admission

The following are in addition to the University's graduate admission requirements:

1. Bachelor's degree in mathematics, applied mathematics or mathematical sciences from an accredited university or college.

2. A 'B' average or higher in upper division mathematics courses.

3. Graduate Record Examination taken within the past five years, with at least 650 on the quantitative portion and 500 on each of the other two parts.

4. Three letters of recommendation concerning the candidate's achievement and potential, from persons familiar with the candidate's previous academic performance.

5. International graduate student applicants whose native language is not English are required to submit a score for the Test of English as a Foreign Language (TOEFL) or for the International English Language Testing System (IELTS). A total score of 80 on the iBT TOEFL or 6.3 overall on the IELTS is required.

6. Approval of the Graduate Committee.

Core Courses

The student must complete a minimum of 24 semester hours of graduate course work. This course work must

include 5 courses from the following two lists, with at least 2 from each list.

List A:

MAA 5406	Complex Analysis	3
MAA 5616	Introduction to Real Analysis	3
MAP 5316	Ordinary Differential Equations	3
MAS 5311	Graduate Algebra	3
MAS 5312	Galois Theory	3
MHF 5107	Graduate Set Theory	3
MHF 5306	Graduate Mathematical Logic	3
MTG 5326	Introduction to Algebraic Topology	3

List B:

MAD 5405	Numerical Methods	3
MAP 5236	Mathematical Techniques of Operations Research	3
MAP 5326	Partial Differential Equations	3
MAP 5407	Methods of Applied Analysis	3
MAS 5145	Applied Linear Algebra	3

Electives

The remaining 9 hours of course work will be used to fashion a coherent program of study best suited to the student's needs and interest. This requires the prior approval of the Graduate Committee and may be done in one or a combination of the following ways: a) Further work from lists A and B. b) A maximum of 2 courses of independent study, taken with Mathematical Sciences faculty. c) Graduate level course work in Engineering, Physics or Statistics.

Master's Project

The student will complete his or her graduation requirements by writing an expository paper under the direction of a faculty member. The student may earn six credit hours (MAT 5970 Master's Research) in preparing the project. Successful completion of the Master's project requires a grade of 'B' or higher, as well as approval of a committee consisting of three mathematics faculty (including the director).

Remarks: The course work must be completed with a 3.0 GPA average or higher and a grade of 'C' or higher in each course. A maximum of six graduate semester hours may be transferred into the program from outside the University, subject to the approval of the Graduate Committee. A total of 30 credit hours is required for graduation.

Course Descriptions

Definition of Prefixes

MAA-Mathematics, Analysis; MAD-Mathematics, Discrete; MAP-Mathematics, Applied.

COT 5420 Theory of Computation I (3). Abstract models of computation; halting problem; decidability and undecidability; recursive function theory. Prerequisite: MAD 3512.

COT 6400 Analysis of Algorithms (3). Complexity behavior of algorithms is described for Set Manipulation, Graph Theory, and Matrix Manipulation problems, among others. P and NP classes of problems reveal an inherent difficulty in designing efficient algorithms. Prerequisite: COP 3530.

MAA 5406 Complex Analysis (3). Harmonic functions, normal families, Riemann mapping theorem, univalent functions, infinite products and entire functions, elliptic

functions, analytic continuation. Prerequisites: MAA 4211 and MAA 4402.

MAA 5616 Introduction to Real Analysis (3). Lebesgue Measure and Integral with applications to Integral Transforms. Prerequisites: MAS 3105, MAA 4211, MAP 4401 or MAA 4212.

MAA 5XXX Introduction to Fourier Analysis (3). Basic real analysis, and measure theory, LP spaces and convolution, the Fourier transform in L^2 , Plancherel theorem, application to differential equations and wavelets. Prerequisites: Advanced Calculus, Linear Algebra.

MAD 5405 Numerical Methods (3). Advanced ideas and techniques of numerical analysis for digital computation. Topics include: linear and non-linear systems, ordinary differential equations, continuous system modeling techniques, and languages. Prerequisites: MAS 3105 and MAP 2302.

MAP 5236 Mathematical Techniques of Operations Research (3). This course surveys the mathematical methods used in operations research. Topics will be chosen from linear programming, dynamic programming, integer programming, network analysis, classical optimization techniques, and applications such as inventory theory. Prerequisites: MAP 5117 and MAS 3105 and either CGS 3420 or COP 2210.

MAP 5316 Ordinary Differential Equations (3). Existence and Uniqueness theorem, matrix formulation, physical applications, regular singular points, autonomous systems, Laplace transform, special topics. Prerequisites: MAA 3200, MAA 4402 and MAS 3105.

MAP 5317 Advanced Differential Equations for Engineers (3). Topics may include Bessel Functions and other special functions arising from classical differential equations, Sturm-Liouville problems, partial differential equations, transform techniques. Credit may not be counted for both MAP 4401 and MAP 5317. Credit for MAP 5317 may not be applied toward the Master's degree in Mathematical Sciences. Prerequisites: MAC 2313 and MAP 2302.

MAP 5326 Partial Differential Equations (3). Basic concepts of first and second order PDE's, application to optics and wave fronts, Cauchy problem, Laplace equation, Green's function, Dirichlet problem, heat equation. Prerequisite: MAA 4211.

MAP 5407 Methods of Applied Analysis (3). Convergence, fixed point theorems, application to finding roots of equations, normed function spaces, linear operators, applications to numerical integration, differential and integral equations. Prerequisites: MAA 4211, MAP 2302, and MAS 3105.

MAP 5467 Stochastic Differential Equations and Applications (3). Review of measure theory, stochastic processes, Ito Integral and its properties, martingales and their generalisations, stochastic differential equations, diffusions. Applications to boundary value problems and finance. Prerequisites: MAS 3105, MAP 4401, MAA 4211, MAA 5616 or permission of instructor.

MAS 5145 Applied Linear Algebra (3). Vector spaces and linear maps, solutions of linear systems, orthogonal projection and QR factorization, determinant and

eigenvalues of a matrix. Prerequisites: MAS 3105 and MAA 3200.

MAS 5311 Graduate Algebra (3). A study of the basic material on groups, rings and vector spaces. Topics include the Jordan-Holder theorem, structure of modules over Euclidean domains and canonical forms of matrices. Prerequisites: MAS 4301 or equivalent.

MAS 5312 Galois Theory (3). Extension fields, ruler and compass constructions, fundamental theorem of Galois Theory, cyclotomic and cyclic extensions, solutions of equations by radicals, selected topics. Prerequisites: MAS 5311 or permission of the instructor.

MAT 5907 Independent Study (VAR). Individual conferences, assigned reading, and reports on independent investigations.

MAT 5921 Training in Mathematical Exposition (1). Students prepare and present supervised lectures on undergraduate mathematical topics to fellow students. Prerequisite: Graduate standing.

MAT 5970 Master's Research (1-6). Research toward preparation of master's project. Prerequisite: Permission of graduate committee.

MHF 5106 Graduate Set Theory (3). Zermelo-Frankel axioms, ordinals and cardinals, Godel's constructible universe, large cardinals, forcing and the independence of the Continuum Hypothesis and the Axiom of Choice. Prerequisites: MHF 4102 or MAA 4211 or permission of the instructor.

MHF 5306 Graduate Mathematical Logic (3). First order languages, construction of models from constants, advanced construction of models, non-standard models, recursion theory, RE sets, Turing degrees, oracle construction. Prerequisites: MHF 4302 or permission of the instructor.

MHF 5325 Theory of Recursive Functions (3). Turing machines, decision problems, coding, s-m-n theorem, Rice's and Myhill's theorems, oracles, degrees, finite and infinite injury constructions. Prerequisite: MHF 4302 or COT 5420.

MTG 5326 Introduction to Algebraic Topology (3). Classification of surfaces, fundamental group, homotopy type, Van Kampen theorem, simplicial complexes, introduction to homology theory. Prerequisites: MAS 4301 and MTG 4302.

STA 5446-STA 5447 Probability Theory I and II (3-3). This course is designed to acquaint the student with the basic fundamentals of probability theory. It reviews the basic foundations of probability theory, covering such topics as discrete probability spaces, random walk, Markov Chains (transition matrix and ergodic properties), strong laws of probability, convergence theorems, and law of iterated logarithm. Prerequisite: MAC 2313.

STA 6807 Queueing and Statistical Models (3). Review of probability concepts, basic probability distributions, Poisson process, queueing models, statistical models. Prerequisites: Permission of the instructor, MAC 2312 and either STA 3033 or STA 4321.