Graduate Catalog 2009-10
Department of Mathematics and Statistic
Graduate Program

Graduate Program

Students seeking an advanced degree in mathematics or statistics should consult with the Graduate Director of the department before enrolling in any courses. The department offers a number of graduate courses that are suitable for students who wish to complete a minor in mathematics or statistics. Each student must have a degree plan that has been approved by the departmental graduate advisor.

The department does not have a foreign language requirement for the master's degree. Any foreign language requirement for the Ph.D. degree will be at the discretion of the student's dissertation advisor.

Master's Programs

M.A. Degree in Mathematics. This program consists of 36 hours of graduate work, including 3 hours of credit for a departmental report. The student must complete three sequences chosen from algebra, analysis, geometry, probability and statistics, modeling and applications, and computer literacy. This degree is offered primarily for those students who wish to teach mathematics at the secondary level or at a junior/community college.

M.S. Degree in Mathematics. The M.S. program consists of 36 hours of graduate work, including 3 hours of credit for a departmental report, or 30 hours of graduate work including 6 hours of credit for the master's thesis. The student must complete at least two of the core sequences listed on the Ph.D. program for the 36-hour plan and at least one of the core sequences for the 30-hour plan. In the 36-hour plan a minor of 9 hours is permitted and in the 30-hour plan a minor of 6 hours is permitted. In each case the minor must be approved by the graduate advisor.

M.S. Degree in Mathematics with an Emphasis in Computer Science. The degree consists of 36 hours with 3 hours of credit for a departmental report. This plan calls for 18 to 21 hours of graduate coursework in mathematics and 12 to 15 hours of graduate coursework in computer science. Of the 18 to 21 hours of mathematics coursework, at least two sequences from the list in the departmental handbook must be completed. The 12 to 15 hours of computer science coursework constitute adjunct requirements and must be approved by the graduate advisor.

M.S. Degree in Statistics. An M.S. degree in statistics consists of 36 hours of graduate work including 3 hours of credit for a departmental report or 6 hours of credit for the master's thesis. Up to 3 hours of graduate work are permitted in other areas such as agriculture, biology, business, economics, engineering, psychology, sociology, or fields as approved by the graduate advisor.

Doctoral Program

Each doctoral student will undergo a preliminary examination as early as possible during graduate training. The examinations will be administered annually in May and August and the

results evaluated by the Graduate Programs and Policies Committee of the department. Details concerning the preliminary examinations can be found in the departmental handbook. Each doctoral student must also pass a qualifying examination in a specialty area

Course Descriptions

Mathematics

5101. Seminar in Algebra (1:1:0). Discussion of current research and topics of interest in algebra. Must be taken pass-fail. May be repeated for credit.

5102. Seminar in Analysis (1:1:0). Discussion of current research and topics of interest in analysis. Must be taken pass-fail. May be repeated for credit.

5103. Seminar in Control Theory (1:1:0). Discussion of current research and topics of interest in control theory. Must be taken pass-fail. May be repeated for credit.

5104. Seminar in Statistics (1:1:0). Discussion of current research and topics of interest in statistics. Must be taken pass-fail. May be repeated for credit.

5105. Seminar in Topology (1:1:0). Discussion of current research and topics of interest in topology. Must be taken pass-fail. May be repeated for credit.

5106. Seminar in Applied Mathematics (1:1:0). Discussion of current research and topics of interest in applied mathematics. Must be taken pass-fail. May be repeated for credit.

5107. Seminar in Biomathematics (1:1:0). Discussion of current research and topics of interest in biomathematics. Must be taken pass-fail. May be repeated for credit.

5310, 5311. Principles of Classical Applied Analysis I, II (3:3:0 each). Fourier series and integrals, discrete Fourier series, Laplace transforms, calculus of variations, Sturm-Louiville problems, integral equations, equations of fluids and solids, and ordinary and partial differential equations.

5312. Control Theory I (3:3:0). Prerequisite: MATH 2360, 3354, 4351, or consent of instructor. Linear dynamical systems, stability, frequency response and Laplace transform, feedback, state-space description, and geometric theory of linear systems. (M E 5312)

5313. Control Theory II (3:3:0). Prerequisite: MATH 5312, 5316, 5318, or consent of instructor. Quadratic regulator for linear systems, Kalman filtering, non-linear systems, stability, local controllability, and geometric theory of non-linear systems. (M E 5313)

5316. Applied Linear Algebra (3:3:0). Prerequisite: Consent of instructor. Solution of linear systems, matrix inversion, vector spaces, projections, determinants, eigenvalues and eigenvectors, Jordan form, computational methods, and applications.

5318, 5319. Intermediate Analysis I, II (3:3:0 each). The real number system, introduction to metric spaces, sequences, continuity, differentiation, Riemann integration, power series, functions of several variables, and differential forms.

5320, 5321. Functions of a Complex Variable I, II (3:3:0 each). Prerequisite: MATH 4350 or 4356. Analytic functions as mappings, Cauchy theorems, Laurent series, maximum modulus theorems and ramifications, normal families, Riemann mapping theorem, Weierstrass factorization theorem, Mittag-Leffler theory, analytic continuation, and harmonic functions.

5322, 5323. Functions of a Real Variable I, II (3:3:0 each). Prerequisite: MATH 5319 or equivalent. General measure and integration theory, Lp theory, differentiation theory, and basic functional analysis.

5324, 5325. Topology I, II (3:3:0 each). Prerequisite: MATH 4350 or consent of instructor. Point set theory, introduction to combinatorial topology and homology theory.

5326, 5327. Modern Algebra I, II (3:3:0 each). Prerequisite: MATH 3360 or consent of instructor. Groups, rings, fields, linear algebra, Galois theory.

5330. Theory of Ordinary Differential Equations I, II (3:3:0 each). Prerequisite: MATH 4351, 4354, or consent of instructor. Existence and uniqueness results, continuation of solutions, continuous dependence on data, linear equations, oscillation and comparison theorems, boundary value problems, and stability analysis.

5331. Theory of Ordinary Differential Equations II (3:3:0). Prerequisite: MATH 5330 or consent of instructor. Advanced existence, uniqueness, continuation, and continuity results; symmetry and variance; center manifold theorem.

5332, 5333. Partial Differential Equations I, II (3:3:0 each). Prerequisite: MATH 4351, 4354, or consent of instructor. Topics include first order equations, method of characteristics, parabolic, hyperbolic and elliptic equations, variational and Hilbert space methods.

5334, 5335. Numerical Analysis I, II (3:3:0 each). Prerequisite: MATH 5316 or equivalent. Stability and error analysis, numerical solution of ordinary and partial differential equations, integral equations.

5340, 5341. Functional Analysis I, II (3:3:0 each). Prerequisite: MATH 5322. Hilbert and Banach space theory, linear operator theory, the closed graph theorem, the open mapping theorem, the principle of uniform boundedness, linear functionals, dual spaces and weak topologies, distribution theory, topological vector spaces, spectral theory of compact and unbounded self-adjoint and unitary operators, and semigroup theory.

5342, 5343. Advanced Topics in Analysis I, II (3:3:0 each). Prerequisite: Consent of instructor. Current topics in analysis. May be repeated for credit.

5344, 5345. Topics in Numerical Analysis I, II (3:3:0 each). Prerequisite: MATH 5335. Current advanced topics in numerical analysis, research work using computers. May be repeated for credit.

5346. Advanced Topics in Applied Mathematics I (3:3:0). Prerequisite: Consent of instructor. Current topics in applied mathematics. May be repeated for credit.

5354. Biomathematics I (3:3:0). Prerequisite: Differential equations and linear algebra or consent of instructor. Qualitative and quantitative behavior of deterministic biological models are studied.

5355. Biomathematics II (3:3:0). Prerequisite: Statistics, differential equations, and linear algebra or consent of instructor. Qualitative and quantitative behavior of stochastic biological models are studied.

5356. Topics in Biomathematics (3:3:0). Prerequisite: Biomathematics II or consent of instructor. Current topics in biomathematics are studied such as biomechanics, mathematical epidemiology, mathematical neurology, mathematical opthalmology, and image processing. May be repeated for credit.

5360, 5361. Advanced Mathematics for Teachers I, II (3:3:0 each). Prerequisite: Consent of instructor. Selected topics in mathematics. May be repeated for credit.

5362. Theory of Numbers (3:3:0). Prerequisite: MATH 4362. Diophantine equations, binary quadratic forms, algebraic numbers, theory of number-theoretic functions, partitions, the prime number theorem.

5364, 5365. Computer Literacy and Programming I, II (3:3:0 each). Development of computer literacy and programming ability, algorithms and data structures, and recursion.

5382, 5383. Advanced Probability I, II (3:3:0 each). Prerequisite: MATH 5319 or consent of instructor. Measure and integration, axiomatic foundations of probability theory, random variables, distributions and their characteristic functions, stable and infinitely divisible laws, limit theorems for sums of independent random variables, conditioning, Martingales.

5399. Advanced Problems (3). Prerequisite: Graduate standing in mathematics. May be repeated for credit.

6000. Master's Thesis (V1-6).

6310. Master's Report (3).
7000. Research (V1-12).

8000. Doctor's Dissertation (V1-12).

Statistics

5302, 5303. Applied Statistics I, II (3:3:0 each). Prerequisite: Consent of instructor. Graphical presentation of data, histograms, confidence intervals for binomial probabilities, one-sample and two-sample t-test, regression and correlation with two variables, hypothesis testing and confidence intervals, multivariate regression and correlation, partial correlation coefficients, analysis of variance and covariance, multiple comparison procedures. Emphasis on analysis of research data. Not for mathematics, statistics, engineering, or physical science majors; these students should take STAT 5384, 5385.

5328, 5329. Intermediate Mathematical Statistics I, II (3:3:0 each). Prerequisite: MATH 2350 or consent of instructor. Probability space, special families of distribution functions, expectations, conditional distributions, sampling distributions, point and interval estimation, hypothesis testing, distribution of functions of random variables, regression, nonparametric techniques.

5370. Decision Theory (3:3:0). Prerequisite: MATH 4343 or STAT 5329 or consent of instructor. Game theory, statistical decision, Bayesian statistics.

5371. Regression Analysis (3:3:0). Prerequisite: STAT 5326 and 5329. Estimation and testing in linear regression, residual analysis, influence diagnostics, multicollinearity logistic regression, nonlinear regression.

5372. Nonparametric Statistical Inference (3:3:0). Prerequisite: MATH 4343 or STAT 5329 or consent of instructor. Statistical inference, rank order statistics, chi-square and slippage tests, Kolmogorov and Smirnov type tests, confidence intervals and bands, runs tests, applications.

5373. Design of Experiments (3:3:0). Prerequisite: MATH 4343 or STAT 5329 Principles of design and analysis of experiments, Latin squares, split plots, incomplete block designs, efficiency.

5374. Theory of Linear Statistical Models (3:3:0). Prerequisite: MATH 4343 or STAT 5329. Multivariate normal, convariance matrix and operations, distribution of quadratic forms, general linear hypothesis of full and non-full rank, specific linear models.

5375. Statistical Multivariate Analysis (3:3:0). Prerequisite: STAT 5329 or consent of instructor. Multivariate normal distribution, estimation of the mean vector and covariance matrix, distribution of sample correlation coefficients, the generalized T2 statistic, classification, distribution of the sample covariance matrix.

5376. Advanced Statistical Methods (3:3:0). Prerequisite: MATH 4343 or STAT 5329 or consent of instructor. Applied regression analysis, cluster analysis, factor analysis, modeling, special topics in designs, sensitivity analysis, non-linear estimation. May be repeated for credit.

5377. Statistical Sampling Theory (3:3:0). Prerequisite: MATH 4343 or STAT 5329. Theory of simple random sampling, stratified random sampling, cluster sampling, ratio estimates, regression estimates, other sampling methods.

5378. Stochastic Processes (3:3:0). Prerequisite: STAT 5329. Markov chains, Markov processes in discrete and continuous time, diffusion processes, Brownian motion and transformations of Brownian motion, non-Markovian processes.

5379. Time Series Analysis (3:3:0). Prerequisite: STAT 5329 or consent of instructor. Stationary and nonstationary time series, finite linear models, identification, filtering, and diagnostic checks of such models, spectral analysis of time series data, forecasting and control.

5380, 5381. Advanced Mathematical Statistics I, II (3:3:0 each). Prerequisite: STAT 5329; STAT 5380 is prerequisite for STAT 5381. Theory of estimation and tests of statistical hypotheses, sequential analysis.

5384. Statistics for Engineers and Scientists I (3:3:0). Prerequisite: MATH 2350 or consent of instructor. Probability, descriptive statistics, distributions, estimation, hypothesis testing, nonparametric statistics, data analysis using the computers. Not for mathematics or statistics majors.

5385. Statistics for Engineers and Scientists II (3:3:0). Prerequisite: STAT 5384 or consent of instructor. Continuation of STAT 5384; simple and multiple regression analysis, analysis of variance, nonparametric statistics, categorical data analysis, quality control, reliability, data analysis using the computer. Not for mathematics or statistics majors.

5386. Statistical Computing and Simulation (3:3:0). Prerequisite: Consent of instructor. Methods of approximating functions and probabilities, computational methods in linear algebra, introduction to theory and applications of random number generation, testing generators.

6000. Master's Thesis (V1-6).

6310. Master's Report (3).

7000. Research (V1-12).