

SPECIAL AND ADVANCED MATHEMATICS COURSES FOR Spring 2025

264. Differential Equations

An introductory course in ordinary differential equations including techniques of elementary linear algebra. Emphasis is on first-order equations, and higher-order linear equations and systems of equations. Topics include qualitative analysis of differential equations, analytical and numerical solutions, Laplace transforms, existence and uniqueness of solutions, and elemental models in science and engineering. Prerequisite: Mathematics 263. **Corvino/Lipnick**

272. Linear Algebra with Applications

An introduction to linear algebra and some of its many applications. Topics include systems of linear equations, matrix algebra, Euclidean spaces and linear transformations between them, the rank-nullity theorem, eigenvalues, diagonalization, orthogonality and least squares approximation. Not open to students who have credit for Mathematics 300. Corequisite: Mathematics 162 or permission of instructor. **Zulli**

282. Techniques of Mathematical Modeling

A course that introduces students to the fundamentals of mathematical modeling through the formulation, analysis, and testing of mathematical models in a variety of areas. Modeling techniques covered include proportionality, curve fitting, elementary linear programming, and simulation. Prerequisite: Mathematics 162. **Lewis**

286. Intro to Probability & Mathematical Statistics

This course will serve as a one-semester introduction to probability and mathematical statistics, with roughly half of the semester devoted to each. After learning basics of set theory and axiomatic probability, we review random variables, probability mass/density functions, expected value (including covariance and correlation), and expected value and variance of linear combinations. Then we begin inferential statistics (confidence intervals and hypothesis tests), correlation and simple linear regression, and, time permitting, one-way analysis of variance and/or chi-squared tests. Prerequisite: Math 263. **Hassan Balasubramanya**

290. Transition to Theoretical Math

An introduction to the concepts and techniques that permeate advanced mathematics. Topics include set theory, propositional logic, proof techniques, relations, and functions. Special emphasis on developing students' facility for reading and writing mathematical proofs. Examples and additional topics are included from various branches of mathematics, at the discretion of the instructor. Corequisite: Mathematics 263 or Mathematics 272 or permission of instructor. **Smith**

300. Vector Spaces

A first course in theoretical linear algebra, emphasizing the reading and writing of proofs. Topics include systems of linear equations, matrix algebra, vector spaces and linear transformations, eigenvectors and diagonalization, inner product spaces, and the Spectral Theorem. Prerequisite: Mathematics 290 or permission of instructor. **Gomez Lopez**

306. Operations Research

study of some mathematical methods of decision making. Topics include: linear programming (maximizing linear functions subject to linear constraints), the simplex algorithm for solving linear programming problems, sensitivity analysis, networks and inventory problems and applications. Prerequisite: Mathematics 272 or Mathematics 300 or permission of instructor. **Bloom**

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312. Partial Differential Equations

An introduction to partial differential equations and their applications. Formulation of initial and boundary value problems for these equations and methods for their solution are emphasized. Separation of variables and Fourier analysis are developed. The course includes interpretation of classical equations and their solutions in terms of applications. Prerequisite: Math 263. **Abedin**

328. Number Theory

An introduction to the theory of the integers and techniques for their study and application. Topics include primality, modular arithmetic, arithmetic functions, quadratic residues, and Diophantine equations. Prerequisite: Math 263 or permission of instructor; reading and writing proofs will be a significant part of the course, so Math 290 could be useful, though it is not a prerequisite. **Roy**

335. Probability

A development of basic probability theory including the axioms, random variables, expected value, the law of large numbers, and the central limit theorem. Additional topics include distribution functions and generating functions. Prerequisite: Math 263. **Lu**

336. Mathematical Statistics

A mathematical development of fundamental results and techniques in statistics. Topics include estimation, sampling distributions, hypothesis testing, correlation and regression. Prerequisite: Math 335. **Liebner**

356. Intro to Real Analysis

A rigorous development of the calculus of functions of one real variable including the topology of the real line, limits, uniform convergence, continuity, differentiation and integration. [W] Prerequisite: Mathematics 290. **Abedin**

371. Bayesian Statistics

The Bayesian approach offers an alternative to traditional statistics, whereby prior information is combined with data to yield a Bayesian posterior distribution. This course begins with an introduction to Bayes' Theorem, and the theory of closed-form Bayesian inference. Then we'll move to computer-based approaches, and gain experience using modern software and Markov chain Monte Carlo algorithms for analysis of real-world data. Prerequisite: Mathematics 336. **Turek**

385. *Special Topic*: Advanced Topics in Mathematical Modeling

A one semester course that surveys advanced topics in mathematical modeling. Possible topics include nonlinear optimization models, modeling with stochastic processes, agent based modeling, and sensitivity and identifiability analysis. Prerequisite: Mathematics 264 or Mathematics 272 or Mathematics 300. **Zhou**

400. Senior Seminar

A course in which each student undertakes a thorough and independent study of one or more topics in mathematics. Students are required to make oral presentations on their work and to prepare written reports on their topics. [W] Prerequisite: Senior standing and satisfactory completion of at least two 300-level courses in mathematics. **Berkove**

TENTATIVE Courses for Fall 2025:

264 Differential Equations

272 Linear Algebra with Applications

287 Introduction to Data Modeling

290 Transition to Theoretical Mathematics

301 Case Studies in Mathematical Modeling

325 Combinatorics

335 Probability

336 Mathematical Statistics

338 Advanced Regression Analysis

343 Advanced Multivariable Calculus

351 Abstract Algebra I

357 Real Analysis II

