

MATHEMATICS (MATH)

Courses

MATH 5509 Algebra I Credits: 3

This course is a first graduate algebra course, focusing on group theory. Special attention is paid to the concept of symmetry, starting with the geometry of plane and space symmetries, and culminating with the Sylow theorems and their applications.

Prerequisites: MATH 410, MATH 420.

MATH 5510 Complex Variables I Credits: 3

The group of linear fractional transformations, complex integration, Cauchy's theorem, the maximum modulus theorem, analytic continuation, Riemann surfaces. Continued in MATH 5520.

Prerequisites: MATH 402, MATH 407.

MATH 5513 Real Variables I Credits: 3

Theory of measure with applications to analysis. Riemann and Lebesgue integration. Continued in MATH 5523.

Prerequisites: MATH 402, MATH 412.

MATH 5514 Mathematics for Secondary Teachers: Algebra and Analysis Credits: 3

Designed for secondary-school teachers. Examine high school mathematics from a higher point of view. Real and complex numbers, functions, algebraic structures of equations, integers and polynomials, number system structures; analyses of alternate approaches, extensions and applications of mathematical ideas, discussion of historical contexts and connections between ideas that may have been studied separately in different courses, relationships of ideas studied in secondary-school to those students may encounter in later study. When taken for graduate credit as Math 5514, an extra project is required.

Prerequisites: MATH 300.

MATH 5517 Matrix Theory I Credits: 3

Unitary matrices, normal matrices, Jordan canonical form, nonnegative matrices and their applications, the symmetric eigenvalue problem.

Prerequisites: MATH 420.

MATH 5519 Algebra II Credits: 3

This course is a second graduate algebra course, focusing on ring and field theory. Topics include factorization, the structure theorem for abelian groups and Galois theory.

Prerequisites: MATH 5509.

MATH 5520 Complex Variables II Credits: 3

Prerequisites: MATH 5510.

MATH 5521 Differential Equations Credits: 3

This course offers an introduction to the qualitative theory and applications of ordinary differential equations (ODE). The presentation of the course will be a blend of fundamental theory and examples. The basic results will be proved rigorously and more advanced results will be only illustrated by examples that demonstrate when and how they may be applied.

Prerequisites: MATH 345, MATH 412, MATH 420.

MATH 5523 Real Variables II Credits: 3

Prerequisites: MATH 5513.

MATH 5524 Mathematics for Secondary Teachers: Geometry Credits: 3

Designed for secondary-school teachers. Examine high school mathematics from a higher point of view. Congruence, distance and similarity, trigonometry, area and volume, axiomatics and Euclidean geometry; analyses of alternate approaches, extensions, and applications of mathematical ideas, discussion of historical contexts and connections between ideas that may have been studied separately in different courses, relationships of ideas studied in secondary-school to those students may encounter in later study. When taken for graduate credit as Math 5524, an extra project is required.

MATH 5527 Matrix Theory II Credits: 3

Prerequisites: MATH 5517.

MATH 5532 Numerical Linear Algebra Credits: 3

This course covers fundamentals of numerical linear algebra. Topics include error analysis, solving systems of linear equations, solutions of nonlinear equations, the least-squares problems, and approximating functions.

Prerequisites: MATH 300.

MATH 5542 Advanced Numerical Analysis Credits: 3

This course covers advanced numerical methods applied to eigenproblems, optimization, numerical differentiation and integration, numerical solution of ordinary and partial differential equations.

Prerequisites: MATH 402 and MATH 420, or MATH 5532.

MATH 5545 Mathematical Methods in Data Science Credits: 3

This course provides a rigorous introduction to important role of mathematics in modern data science. Topics include high-dimensional space, best-fit subspaces, spectral and singular value decompositions, random graphs, and finite Markov chains.

Prerequisites: MATH 300.

MATH 5555 Optimization Credits: 3

Introduction to the analysis and applications of optimization algorithms. Students will learn various optimization problems, including their formulation, convergence analysis, implementation tools for their solutions, and engineering applications.

Prerequisites: MATH 300, and COMP-SCI 201R or ENGR 216.

MATH 5557 Functional Analysis Credits: 3

Hilbert spaces, linear operators, compact operators, Banach spaces, the Hahn-Banach theorem, the open mapping and closed graph theorems, the principle of uniform boundedness, locally convex spaces.

Prerequisites: MATH 402 and MATH 420.

MATH 5575 Stochastic Calculus for Finance Credits: 3

This course presents the basic idea and theory of stochastic calculus with the focus on the applications to finance. Topics include Brownian motion, Ito integral, Ito formula, Black-Scholes equation and formula, risk-neutral pricing, connections with partial differential equations, exotic options, American derivative securities, and term structure models for interest rates.

Prerequisites: MATH 402 and STAT 436.

MATH 5590 Special Topics Credits: 1-3

Selected topics in various fields of mathematics. May be repeated for credit when the topic varies.

MATH 5599 Mathematics Research and Thesis Credits: 1-12

Research for thesis.

Prerequisites: Students may enroll in only one section of MATH 5599 per semester. Consent number required at registration.

MATH 5699 Research And Thesis Credits: 1-16

Doctoral dissertation.

MATH 5899 Required Graduate Enrollment Credit: 1