Mathematics (MATH)

Courses

MATH 50103. Abstract Algebra with Connections to School Mathematics. 3 Hours.
Basic structures of abstract algebra (rings, fields, groups, modules and vector spaces) with emphasis on rings and fields as generalizations of the ring of integers and field of rational numbers. Graduate degree credit will not be awarded for both MATH 41103 (or MATH 51203) and MATH 50103. Prerequisite: Graduate standing or departmental consent. (Typically offered: Irregular)

MATH 50203. Geometry with Connections to School Mathematics. 3 Hours.
School geometry from an advanced perspective including conformity to the Common Core State Standards for Mathematics. Study will include historical developments and geometry based on transformations of two- and three-dimensional space. Prerequisite: Graduate standing. (Typically offered: Fall Odd Years)

MATH 50303. Advanced Calculus with Connections to School Mathematics Teaching. 3 Hours.
Rigorous development of the real numbers, continuity, differentiation, and integration. Graduate degree credit will not be awarded for both MATH 45103 (or MATH 55003) and MATH 50303. Prerequisite: Departmental consent. (Typically offered: Irregular)

MATH 5040V. Special Topics for Teachers. 1-6 Hour.
Current topics in mathematics of interest to secondary school teachers. Prerequisite: Graduate standing or departmental consent. (Typically offered: Irregular) May be repeated for degree credit.

MATH 50503. Probability & Statistics with Connections to School Mathematics. 3 Hours.
An advanced perspective of probability and statistics as contained in the high school mathematics curriculum with connections to other components of school mathematics. The content is guided by the content of the high school probability and statistics of the Common Core State Standards for Mathematics. Prerequisite: Graduate standing. (Typically offered: Spring)

MATH 5070V. Professional Development for Secondary Mathematics Teaching. 1-6 Hour.
Validated participation in professional development mathematics workshops or institutes sanctioned by national or international educational organizations such as the College Board, International Baccalaureate Program, and the National Board for Professional Teaching Standards. Prerequisite: Departmental consent. (Typically offered: Irregular) May be repeated for up to 6 hours of degree credit.

MATH 5100V. Mathematical Seminar. 1-3 Hour.
Members of the faculty and advanced students meet for presentation and discussion of topics. Prerequisite: Graduate standing in mathematics or statistics, or departmental consent. (Typically offered: Fall and Spring) May be repeated for up to 3 hours of degree credit.

MATH 51103. Introduction to Abstract Algebra II. 3 Hours.
Topics in abstract algebra including finite abelian groups, linear groups, factorization in commutative rings and Galois theory. Graduate degree credit will not be given for both MATH 41103 and MATH 51103. Prerequisite: MATH 31103. (Typically offered: Spring)

MATH 51203. Algebra I. 3 Hours.
What the beginning graduate student should know about algebra: groups, rings, fields, modules, algebras, categories, homological algebra, and Galois Theory. Prerequisite: MATH 31103, and graduate standing in mathematics or statistics, or departmental consent. (Typically offered: Fall)

MATH 51303. Algebra II. 3 Hours.
Continuation of MATH 51203. Prerequisite: MATH 51203, and graduate standing in mathematics or statistics. (Typically offered: Spring)

MATH 51503. Advanced Linear Algebra. 3 Hours.
Linear functionals, matrix representation of linear transformations, scalar product, and spectral representation of linear transformations. Graduate degree credit will not be given for both MATH 41003 and MATH 51503. Prerequisite: Graduate standing. (Typically offered: Fall)

MATH 51603. Dynamic Models in Biology. 3 Hours.
Mathematical and computational techniques for developing, executing, and analyzing dynamic models arising in the biological sciences. Both discrete and continuous time models are studied. Applications include population dynamics, cellular dynamics, and the spread of infectious diseases. Graduate degree credit will not be given for both MATH 41603 and MATH 51603. Prerequisite: MATH 24004. (Typically offered: Irregular)

MATH 52103. Advanced Calculus I. 3 Hours.
The real and complex number systems, basic set theory and topology, sequences and series, continuity, differentiation, and Taylor's theorem. Emphasis is placed on careful mathematical reasoning. Graduate degree credit will not be given for both MATH 45103 and MATH 52103. Prerequisite: Graduate standing. (Typically offered: Fall)

MATH 52203. Advanced Calculus II. 3 Hours.
The Riemann-Stieltjes integral, uniform convergence of functions, Fourier series, implicit function theorem, Jacobians, and derivatives of higher order. Graduate degree credit will not be given for both MATH 45203 and MATH 52203. Prerequisite: MATH 45103 or MATH 52103. (Typically offered: Spring)

MATH 5250V. Internship in Professional Practice. 1-3 Hour.
Professional work experience involving significant use of mathematics or statistics in business, industry or government. Graduate degree credit will not be given for both MATH 4050V and MATH 5250V. (Typically offered: Fall, Spring and Summer) May be repeated for up to 3 hours of degree credit.

MATH 52603. Symbolic Logic I. 3 Hours.
Rigorous analyses of the concepts of proof, consistency, equivalence, validity, implication, and truth. Full coverage of truth-functional logic and quantification theory (predicate calculus). Discussion of the nature and limits of mechanical procedures (algorithms) for proving theorems in logic and mathematics. Informal accounts of the basic facts about infinite sets. Graduate degree credit will not be given for both MATH 42503 and MATH 52603. Prerequisite: MATH 26103, MATH 28003, or PHIL 22003. (Typically offered: Fall)
This course is cross-listed with PHIL 52503.

MATH 53103. Partial Differential Equations. 3 Hours.
Laplace's equation, Heat equation, Wave Equation, Method of Characteristics. Prerequisite: MATH 44203, MATH 45103, and graduate standing in mathematics or statistics, or departmental consent. (Typically offered: Fall)

MATH 53203. Partial Differential Equations II. 3 Hours.
Fourier Transforms, Sobolev Spaces, Elliptic Regularity. Prerequisite: MATH 53103 and graduate standing in mathematics or statistics, or departmental consent. (Typically offered: Spring)

MATH 53603. Scientific Computation and Numerical Methods. 3 Hours.
An introduction to numerical methods used in solving various problems in engineering and the sciences. May not earn credit for this course and MATH 43503 or MATH 43603. Prerequisite: Graduate standing in mathematics or statistics, or departmental consent. (Typically offered: Fall)
This course is cross-listed with PHYS 53603.

MATH 53703. Finite Element Methods and Solution of Sparse Linear. 3 Hours.
Provides an in-depth understanding of numerical methods for the solution of partial differential equations using Finite Element Methods, Direct and Iterative Methods for the Sparse Linear Systems. Prerequisite: MATH 53903. (Typically offered: Spring)

MATH 53803. Numerical Analysis. 3 Hours.
General iterative techniques, error analysis, root finding, interpolation, approximation, numerical integration, and numerical solution of differential equations. Graduate degree credit will not be given for both MATH 43603 and MATH 53803. Prerequisite: Graduate standing. (Typically offered: Fall)

MATH 53903. Numerical Linear Algebra. 3 Hours.
Numerical methods for problems of linear algebra, including the solution of very large systems, eigenvalues, and eigenvectors. Graduate degree credit will not be given for both MATH 43503 and MATH 53903. Prerequisite: Graduate standing. (Typically offered: Spring)
This course is equivalent to MATH 43503.

MATH 54003. Numerical Linear Algebra II. 3 Hours.
Provides an in-depth understanding of numerical methods for the solution of large scale eigenvalue problems arising in science and engineering applications including theory, implementation and applications. Prerequisite: MATH 53903. (Typically offered: Fall)

MATH 54203. Introduction to Partial Differential Equations. 3 Hours.
Separation of variables, Fourier transform, and Laplace transform methods for the solution of partial differential equations. Topics include Fourier series, Fourier-Bessel series, orthogonal expansions, and the error function. Does not count towards degree credit in MATH. Prerequisite: Graduate standing. (Typically offered: Fall, Spring and Summer)

MATH 54403. Complex Variables. 3 Hours.
Complex analysis, series, and conformal mapping. Graduate degree credit will not be given for both MATH 44403 and MATH 54403. Prerequisite: MATH 26103 or MATH 28003, and MATH 25804. (Typically offered: Fall)

MATH 54503. Functional Analysis I. 3 Hours.
Banach Spaces, Hilbert Spaces, operator theory, compact operators, dual spaces and adjoints, spectral theory, Hahn-Banach, open mapping and closed graph theorems, uniform boundedness principle, weak topologies. Prerequisite: MATH 55103, and graduate standing in mathematics or statistics, or departmental consent. (Typically offered: Spring Odd Years)

MATH 55003. Theory of Functions of a Real Variable I. 3 Hours.
Real number system, Lebesque measure, Lebesque integral, convergence theorems, differentiation of monotone functions, absolute continuity and the fundamental theorem of calculus L^P spaces, Holder and Minkowski inequalities, and bounded linear functionals on the L^P spaces. Prerequisite: MATH 45203 or MATH 52203, and graduate standing in mathematics or statistics, or departmental consent. (Typically offered: Fall)

MATH 55103. Theory of Functions of a Real Variable II. 3 Hours.
Measure and integration on abstract measure spaces, signed measures, Hahn decomposition, Radon-Nikdoym theorem, Lebesque decomposition, measures on algebras and their extensions, product measures, and Fubini's theorem. Prerequisite: MATH 55003, and graduate standing in mathematics or statistics, or departmental consent. (Typically offered: Spring)

MATH 55203. Theory of Functions of a Complex Variable I. 3 Hours.
Complex numbers, analytic functions, power series, complex integration, Cauchy's Theorem and integral formula, maximum principle, singularities, Laurent series, and Mobius maps. Prerequisite: MATH 45103 or MATH 52103. (Typically offered: Fall)

MATH 55303. Theory of Functions of a Complex Variable II. 3 Hours.
Riemann Mapping Theorem, analytic continuation, harmonic functions, and entire functions. Prerequisite: MATH 55203, and graduate standing in mathematics or statistics, or departmental consent. (Typically offered: Spring)

MATH 56003. Differential Geometry. 3 Hours.
Topics include: classical differential geometry of curves and surfaces in 3-space, differential forms and vector fields. Graduate degree credit will not be given for both MATH 45003 and MATH 56003. Prerequisite: MATH 26004. (Typically offered: Irregular)

MATH 57003. Topology I. 3 Hours.
An introduction to topology. Topics include metric spaces, topological spaces and general point-set topology, homotopy and the fundamental group, covering spaces, the classification of surfaces. Prerequisite: MATH 45103 or MATH 52103, and graduate standing in mathematics or statistics, or departmental consent. (Typically offered: Fall Even Years)

MATH 57103. Topology II. 3 Hours.
The continuation of Topology I. Topics include: advanced homotopy and covering spaces, the Seifert-van Kampen theorem, homology and the Mayer-Vietoris sequence. Prerequisite: MATH 57003, and graduate standing in mathematics or statistics, or departmental consent. (Typically offered: Spring Odd Years)

MATH 57203. Differential Topology I. 3 Hours.
An introduction to the topology of smooth manifolds: applications of the inverse function theorem to smooth maps, Sard's theorem, transversality, intersection theory, degrees of maps, vector fields and differential forms on manifolds, integration on manifolds. Prerequisite: MATH 45103 or MATH 52103 and graduate standing in mathematics or statistics, or departmental consent. (Typically offered: Fall Odd Years)

MATH 57303. Differential Topology II. 3 Hours.
The continuation of Differential Topology I, with additional advanced topics. Possible advanced topics may include: Morse theory, de Rham cohomology theory, Poincare duality, Riemannian geometry, and Lie groups and Lie algebras. Prerequisite: MATH 57203 and graduate standing in mathematics or statistics, or department consent. (Typically offered: Spring Even Years)

MATH 58003. Introduction to Point-Set Topology. 3 Hours.
A study of topological spaces including continuous transformations, connectedness and compactness. Graduate degree credit will not be given for both MATH 47003 and MATH 58003. Prerequisite: MATH 45103 or MATH 52103. (Typically offered: Irregular)

MATH 5990V. Research Topics in Mathematics. 1-3 Hour.
Current research interests in mathematics. Graduate degree credit will not be given for both MATH 4990V and MATH 5990V. Prerequisite: Departmental consent. (Typically offered: Irregular) May be repeated for up to 12 hours of degree credit.

MATH 6100V. Directed Readings. 1-6 Hour.
Directed readings. Prerequisite: Departmental consent. (Typically offered: Irregular) May be repeated for up to 18 hours of degree credit.

MATH 6190V. Topics in Algebra. 1-6 Hour.
Current research interests in algebra. Prerequisite: Graduate standing in mathematics or statistics, or departmental consent. (Typically offered: Fall, Spring and Summer) May be repeated for degree credit.

MATH 62003. Theory of Probability. 3 Hours.
A rigorous mathematical treatment based on measure theory of the fundamental notions and results of the theory of probability. Topics covered include laws of large numbers, central limit theorems, conditional expectations. Additional topics that may be covered include martingales, Markov chains, Brownian motion and stochastic integration. Prerequisite: MATH 55103. (Typically offered: Fall)

MATH 62103. Mathematical Statistics. 3 Hours.
A rigorous mathematical treatment of the fundamental principles and results in the theory of Statistics. Topics include exponential families of distributions, estimation of unknown parameters, the classical theory of theory of hypothesis testing, Large sample approximations, large sample properties of estimators. Prerequisite: MATH 62003. (Typically offered: Spring)

MATH 6590V. Topics in Analysis. 1-6 Hour.
Current research interests in analysis. Prerequisite: Graduate standing in mathematics or statistics, or departmental consent. (Typically offered: Fall, Spring and Summer) May be repeated for degree credit.

MATH 6790V. Topics in Topology. 1-6 Hour.
Current research interest in topology. Prerequisite: Graduate standing in mathematics or statistics, or departmental consent. (Typically offered: Fall, Spring and Summer) May be repeated for degree credit.

MATH 7000V. Doctoral Dissertation. 1-18 Hour.
Doctoral Dissertation. Prerequisite: Doctoral candidacy in mathematics. (Typically offered: Fall, Spring and Summer) May be repeated for degree credit.