Mathematics

Phone: 314-935-6760

Website: https://math.wustl.edu/graduate

Courses

Visit online course listings to view semester offerings for L24 Math.

L24 Math 501C Theoretical Physics
The first part of a two-semester course reviewing the mathematical methods essential for the study of physics. Theory of functions of a complex variable, residue theory; review of ordinary differential equations; introduction to partial differential equations; integral transforms. Prerequisite: undergraduate differential equations (Math 217), or permission of instructor.
Same as L31 Physics 501
Credit 3 units.

L24 Math 5021 Complex Analysis I
An intensive course in complex analysis at the introductory graduate level. Math 5021 and Math 5022 form the basis for the Ph.D. qualifying exam in complex analysis. Prerequisite: Math 4111, 4171 and 4181, or permission of the instructor.
Credit 3 units.

L24 Math 5022 Complex Analysis II
Continuation of Math 5021. Prerequisite, Math 5021 or permission of intstructor.
Credit 3 units.

L24 Math 502C Methods of Theoretical Physics II
Continuation of Phys 501. Introduction to function spaces; self-adjoint and unitary operators; eigenvalue problems, partial differential equations, special functions; integral equations; introduction to group theory. Prerequisite: Phys 501, or permission of instructor.
Same as L31 Physics 502
Credit 3 units.

L24 Math 5031 Algebra I
An introductory graduate level course on the basic structures and methods of algebra. Detailed survey of group theory including the Sylow theorems and the structure of finitely generated Abelian groups, followed by a study of basic ring theory and the Galois theory of fields. Math 5031 and Math 5032 form the basis for the Ph.D. qualifying exam in algebra. Prerequisite: Math 430 or the equivalent, or permission of the instructor.
Credit 3 units.

L24 Math 5032 Algebra II
Continuation of Math 5031. Prerequisite: Math 5031 or permission of instructor.
Credit 3 units.

L24 Math 5041 Geometry I
Introductory graduate level course including differential calculus in n-space; differentiable manifolds; vector fields and flows; differential forms and calculus on manifolds; elements of Lie groups and Lie algebras; Frobenius theorem; elements of Riemannian geometry. Math 5041 and Math 5042 (or 5043) form the basis for the Ph.D. qualifying exam in geometry / topology. Prerequisites: Math 4121, 429, and 4181, or permission of the instructor.
Credit 3 units.

L24 Math 5042 Geometry II
Continuation of Math 5041. Math 5042 and Math 5043 are offered in alternate spring semesters as a sequel to Math 5041. Prerequisite: Math 5041 or permission of instructor.
Credit 3 units.

L24 Math 5045 Geometry/Topology I: Algebraic Topology
An introductory graduate-level course in algebraic topology, including fundamental groups, covering spaces, homology, and cohomology. Prerequisites: undergraduate courses in abstract algebra and point-set topology or permission from the instructor. Replaces 5043.
Credit 3 units.

L24 Math 5046 Geometry/Topology II: Differential Topology
An introductory graduate-level course in the topology of smooth manifolds and vector bundles. Prerequisites: Math 5045 (GT I: Algebraic Topology) or permission from the instructor. Replaces 5041.
Credit 3 units.

L24 Math 5047 Geometry/Topology III: Differential Geometry
An introductory graduate-level course in the geometry of smooth manifolds and vector bundles. Prerequisites: Math 5046 (Geometry/Topology II: Differntial Topology) or permission from the instructor. Replaces 5042.
Credit 3 units.

L24 Math 5051 Measure Theory and Functional Analysis I
Introductory graduate level course including the theory of integration in Euclidean and abstract spaces, and an introduction to the basic ideas of functional analysis. Math 5051 and Math 5052 form the basis for the Ph.D. qualifying exam in real analysis. Prerequisites: Math 4111, 4171, and 4181, or permission of the instructor.
Credit 3 units.

L24 Math 5052 Measure Theory and Functional Analysis II
Continuation of Math 5051. Prerequisite: Math 5051 or permission of instructor.
Credit 3 units.

L24 Math 510 Introduction to Fourier Series and Integrals
The basic theory of Fourier series and Fourier integrals including different types of convergence. Applications to certain differential equations. Prerequisites: Math 4111 or permission of instructor.
Same as L24 Math 410
Credit 3 units. A&S IQ: NSM

L24 Math 5101 Introduction to Analysis
The real number system and the least upper bound property; metric spaces (completeness, compactness, and connectedness); continuous functions (in R^n; on compact spaces; on connected spaces); C(X) (pointwise and uniform convergence; Weierstrass approximation theorem); differentiation (mean value theorem; Taylor's theorem); the contraction mapping theorem; the inverse and implicit function theorems. Prerequisite: Math 310 or permission of instructor.
Same as L24 Math 4111
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM

L24 Math 5102 Introduction to Lebesgue Integration
Riemann integration; measurable functions; measures; Lebesgue measure; the Lebesgue integral; integrable functions; L^p spaces; modes of convergence; decomposition of measures; product measures. Prerequisite: Math 4111 or permission of the instructor.
Same as L24 Math 4121
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM

L24 Math 515 Theory of Partial Differential Equations I
A rigorous mathematical study of topics in partial differential equations. Prerequisites: Math 5051 and Math 5052 or equivalent. Some knowledge of complex analysis will also be useful. No prior knowledge of partial differential equations is required.
Credit 3 units.

L24 Math 516 Theory of Partial Differential Equations II
Credit 3 units.

L24 Math 5160 Complex Variables
Analytic functions, elementary functions and their properties, line integrals, the Cauchy integral formula, power series, residues, poles, conformal mapping and applications. Prereq: Math 310 and (Math 318 or Math 4111), or permission of instructor.
Same as L24 Math 416
Credit 3 units. A&S IQ: NSM Art: NSM

L24 Math 517 Hilbert Spaces I
Credit 3 units.

L24 Math 518 Hilbert Spaces II
Credit 3 units.

L24 Math 519 Harmonic Analysis I
Credit 3 units.

L24 Math 520 Harmonic Analysis II
Credit 3 units.

L24 Math 5201 Topology I
An introduction to the most important ideas of topology. Course includes necessary ideas from set theory, topological spaces, subspaces, products and quotients, compactness and connectedness. Some time is also devoted to the particular case of metric spaces (including topics such as separability, completeness, completions, the Baire Caregory Theorem, and equivalents of compactness in metric spaces). Prerequisite: Math 4111 or permission of instructor.
Same as L24 Math 4171
Credit 3 units. A&S IQ: NSM Art: NSM

L24 Math 5202 Topology II
A continuation of Math 4171 featuring more advanced topics in topology. The content may with each offering. Prerequisite: Math 4171, or permission of instructor.
Same as L24 Math 4181
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM

L24 Math 521 Topics in Complex Variables I
Credit 3 units.

L24 Math 522 Topics in Complex Variables II
Credit 3 units.

L24 Math 523 Topics in Analysis
Analytic Combinatiorics
Credit 3 units.

L24 Math 523C Information Theory
Discrete source and channel model, definition of information rate and channel capacity, coding theorems for sources and channels, encoding and decoding of data for transmission over noisy channels. Corequisite: ESE 520.
Same as E35 ESE 523
Credit 3 units. EN: BME T, TU

L24 Math 527 Functional Analysis I
Credit 3 units.

L24 Math 528 Topics in Functional Analysis II
Credit 3 units.

L24 Math 5301 Linear Algebra
This course is an introduction to the linear algebra of finite-dimensional vector spaces. It includes systems of equations, matrices, determinants, inner product spaces, and spectral theory. Prerequisite: Math 310 or permission of instructor. Math 309 is not an explicit prerequisite, but students should already be familiar with such basic topics from matrix theory as matrix operations, linear systems, row reduction, and Gaussian elimination. (Material on these topics in early chapters of the text will be covered very quickly.)
Same as L24 Math 429
Credit 3 units. A&S IQ: NSM Art: NSM

L24 Math 5302 Modern Algebra
Introduction to groups, rings, and fields. Includes permutation groups, group and ring homomorphisms, field extensions, connections with linear algebra. Prerequisite: Math 310, Math 429 or permission of the instructor.
Same as L24 Math 430
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM

L24 Math 535 Topics in Combinatorics
Credit 3 units.

L24 Math 537 Topics in Algebra I
Credit 3 units.

L24 Math 538 Topics in Algebra II
Credit 3 units.

L24 Math 539 Topics in Algebraic Geometry
Selected topics in algebraic geometry.
Credit 3 units.

L24 Math 5392 Topics in Algebraic Geometry II
Credit 3 units.

L24 Math 541 Topics in Applied Mathematics
Topic and prerequisites vary with each offering of the course.
Credit 3 units.

L24 Math 543 Geometry and Manifold Theory I
Credit 3 units.

L24 Math 544 Topics in Geometry and Manifold Theory II
Credit 3 units.

L24 Math 545 Topics in Riemannian Geometry I
Credit 3 units.

L24 Math 546 Topics in Riemannian Geometry II
Credit 3 units.

L24 Math 547 Topics in Geometry
An introduction to Geometric Group Theory, concentrating on the theory of hyperbolic groups and group boundaries.
Credit 3 units.

L24 Math 550 Topics in Number Theory: Analytic Number Theory
The course will develop analytic methods for problems which occur in algebraic number theory and algebraic geometry. We will consider Riemann zeta function, Dirichlet L-functions, multiple zeta functions, multiple DirichetL-functions (according to Manin), polylogarithms, reciprocity laws on curves and surfaces and multiple Dedekind zeta functions. Prerequisite: Permission of Instructor
Credit 3 units.

L24 Math 5501 Numerical Applied Mathematics
Computer arithmetic, error propagation, condition number and stability; mathematical modeling, approximation and convergence; roots of functions; calculus of finite differences; implicit and explicit methods for initial value and boundary value problems; numerical integration; numerical solution of linear systems, matrix equations, and eigensystems; Fourier transforms; optimization. Various software packages may be introduced and used. Prerequisites: Math 217 or 312, Math 309, Math 310 and CSE 131 (or other computer background with permission of the instructor).
Same as L24 Math 449
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM

L24 Math 5502 Topics in Applied Mathematics
Topic may vary with each offering of the course. Prerequisite: CSE 131 and, Math 449, or permission of the instructor.
Same as L24 Math 450
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM

L24 Math 5560 Topics in Financial Mathematics
An introduction to the principles and methods of financial mathematics, with a focus on discrete-time stochastic models. Topics include no-arbitrage pricing of financial derivatives, risk-neutral probability measures, the Cox-Ross-Rubenstein and Black-Scholes-Merton options pricing models, and implied volatility. Prerequisites: Math 233, Math 3200, Math 310 or permission of instructor.
Same as L24 Math 456
Credit 3 units. A&S IQ: NSM Arch: NSM Art: NSM

L24 Math 560 Topics in Topology
Credit 3 units.

L24 Math 563 Topics in Lie Groups and Algebras I
Credit 3 units.

L24 Math 564 Topics in Lie Groups and Algebras II
Credit 3 units.

L24 Math 565 Algebraic Topology I
Credit 3 units.

L24 Math 566 Algebraic Topology II
Credit 3 units.

L24 Math 567 Several Complex Variables I
Credit 3 units.

L24 Math 568 Several Complex Variables II
Credit 3 units.

L24 Math 569 Topics in Homological Algebra
Credit 3 units.

L24 Math 571 Topics in Combinatorics: Spectral Graph Theory
Credit 3 units.

L24 Math 572 Topics in Set Theory and Logic
Credit 3 units.

L24 Math 581 Introduction to Computational Analysis
Credit 3 units.

L24 Math 583 Higher Methods of Computational Analysis
Credit 3 units.

L24 Math 590 Research
Credit variable, maximum 3 units.

L24 Math 595 Seminar
Credit variable, maximum 3 units.

L24 Math 596 Seminar
Credit variable, maximum 3 units.

L24 Math 597 Teaching Seminar

Principles and practice in the teaching of mathematics at the college and university level. Prerequisite: graduate standing, or permission of instructor.

Credit 1 unit.

L24 Math 598 Mathematical Professional Development

This course includes topics on professional development and responsible conduct of research. Prerequisites: none.

Credit 1 unit.

L24 Math 883 Master's Continuing Student Status