Applied Mathematics

The Department of Mathematics offers both a PhD program in Mathematics and Applied Mathematics.

Students are admitted for specific degree programs: the PhD in Mathematics or PhD in Applied Mathematics. Requirements for the Mathematics and Applied Mathematics PhDs differ only in minor respects, and no distinction is made between the two in day-to-day matters. Graduate students typically take 5-6 years to complete the doctorate.

Continuing students wishing to transfer from one program to another should consult the graduate advisor in 910 Evans Hall. Transfers between the two PhD programs are fairly routine but must be done prior to taking the qualifying examination. It is a formal policy of the department that an applicant to the PhD program who has previous graduate work in mathematics must present very strong evidence of capability for mathematical research.

Students seeking to transfer to the department's PhD programs from other campus programs, including the Group in Logic and the Methodology of Science, must formally apply and should consult the Vice Chair for Graduate Studies.

Admission to the University

Applying for Graduate Admission

Thank you for considering UC Berkeley for graduate study! UC Berkeley offers more than 120 graduate programs representing the breadth and depth of interdisciplinary scholarship. The Graduate Division hosts a complete list (https://grad.berkeley.edu/admissions/choosing-your-program/list/) of graduate academic programs, departments, degrees offered, and application deadlines can be found on the Graduate Division website.

Prospective students must submit an online application to be considered for admission, in addition to any supplemental materials specific to the program for which they are applying. The online application and steps to take to apply can be found on the Graduate Division website (https://grad.berkeley.edu/admissions/steps-to-apply/).

Admission Requirements

The minimum graduate admission requirements are:

1. A bachelor's degree or recognized equivalent from an accredited institution;
2. A satisfactory scholastic average, usually a minimum grade-point average (GPA) of 3.0 (B) on a 4.0 scale; and
3. Enough undergraduate training to do graduate work in your chosen field.

For a list of requirements to complete your graduate application, please see the Graduate Division's Admissions Requirements page (https://grad.berkeley.edu/admissions/steps-to-apply/requirements/). It is also important to check with the program or department of interest, as they may have additional requirements specific to their program of study and degree. Department contact information can be found here (https://guide.berkeley.edu/graduate/degree-programs/).

Where to apply?

Visit the Berkeley Graduate Division application page (http://grad.berkeley.edu/admissions/apply/).

Admission to the Program

Undergraduate students also often take one or more of the following introductory mathematics graduate courses:

MATH 202A	Introduction to Topology and Analysis	4
MATH 202B	Introduction to Topology and Analysis	4
MATH 214	Differential Topology	4
MATH 225A	Metamathematics	4
MATH 225B	Metamathematics	4
MATH 228A	Numerical Solution of Differential Equations	4
MATH 228B	Numerical Solution of Differential Equations	4
MATH 250A	Groups, Rings, and Fields	4
MATH 250B	Commutative Algebra	4

The Math Department admits new graduate students to the fall semester only. The Graduate Division's Online Application will be available in early September at: http://grad.berkeley.edu/admissions/index.shtml (http://grad.berkeley.edu/admissions/index.shtml/). Please read the information on Graduate Division requirements and information required to complete the application.

Copies of official or unofficial transcripts may be uploaded to your application. Please do **not** mail original transcripts for the review process.

We require three letters of recommendation, which should be submitted online. Please do **not** mail letters of recommendation for the review process.

For more information, please review the department's graduate admissions webpage at: https://math.berkeley.edu/programs/graduate/admissions (https://math.berkeley.edu/programs/graduate/admissions/). We also recommend reviewing our admissions FAQs page at: https://math.berkeley.edu/programs/graduate/faqs (https://math.berkeley.edu/programs/graduate/faqs/).

Curriculum

Prerequisites

The Department of Mathematics offers two PhD degrees, one in Mathematics and one in Applied Mathematics. Applicants for admission to either PhD program are expected to have preparation comparable to the undergraduate major at Berkeley in Mathematics or in Applied Mathematics. These majors consist of two full years of lower division work (covering calculus, linear algebra, differential equations, and multivariable calculus), followed by eight one-semester courses including real analysis, complex analysis, abstract algebra, and linear algebra. These eight courses may include some mathematically based courses in other departments, like physics, engineering, computer science, or economics.

Applicants for admission are considered by the department's Graduate Admissions and M.O.C. Committees. The number of students that can be admitted each year is determined by the Graduate Division and by departmental resources. In making admissions decisions, the committee conducts a comprehensive review of applicants considering broader community impacts, academic performance in mathematics courses,

level of mathematical preparation, letters of recommendation, and GRE scores.

Degree Requirements

In outline, to qualify for the PhD in either Mathematics or Applied Mathematics, the candidate must meet the following requirements.

1. During the first year in the PhD program:
   a. take at least four courses, two or more of which are graduate courses in mathematics;
   b. and pass the six-hour written preliminary examination covering primarily undergraduate material. (The exam is given just before the beginning of each semester, and the student must pass it within their first three semesters.)
2. Pass a three-hour, oral qualifying examination emphasizing, but not exclusively restricted to, the area of specialization. The qualifying examination must be attempted *within two years* of entering the program.
3. Complete a seminar offered by the Math department, giving a talk of at least one hour duration. Research presentations held at Mathematical Sciences Research Institute (MSRI), or Lawrence Berkeley National Lab (LBNL) are also acceptable. A Math Department faculty member must be present at the talk and sign the seminar form confirming.
4. Write a dissertation embodying the results of original research and acceptable to a properly constituted dissertation committee.
5. Meet the University residence requirement of two years or four semesters.

The detailed regulations of the PhD program are as follows:

Course Requirements
Students must take and pass at least four 4-unit courses during the first year of the Ph.D. program; at least two courses per semester. At minimum, two of these courses must be graduate courses (200-level) offered by the Department of Mathematics. Two upper division (100-level) undergraduate courses offered by the Department of Mathematics may also be used toward this requirement. Exceptions may also be considered and must be reviewed by the Head Graduate Advisor for approval.

Preliminary Examination
The preliminary examination consists of six hours of written work given over a two-day period. Most of the examination covers material, mainly in analysis and algebra, and helps to identify gaps in preparation. The preliminary examination is offered twice a year—during the week before classes start in both the fall and spring semesters. A student may repeat the examination twice. A student who does not pass the preliminary examination within 13 months of the date of entry into the PhD program will not be permitted to remain in the program past the third semester. In exceptional cases, a fourth try may be granted upon appeal to committee omega.

Qualifying Examination
To arrange for the qualifying examination, a student must first settle on an area of concentration, and a prospective dissertation supervisor, someone who agrees to supervise the dissertation if the examination is passed. With the aid of the prospective supervisor, the student forms an examination committee of four members. Committee members must be members of Berkeley's Academic Senate and the Chair must be a faculty member in the Mathematics Department. The syllabus of the examination is to be worked out jointly by the committee and the student, but before final approval it is to be circulated to all faculty members of the appropriate sections. The qualifying examination must cover material falling in at least three subject areas and these must be listed on the application to take the examination. Moreover, the material covered must fall within more than one section of the department. Sample syllabi can be seen on the Qualifying Examination page (https://math.berkeley.edu/programs/graduate/qualifying-examination/) on the department website.

The student must attempt the qualifying examination within twenty-five months of entering the PhD program. If a student does not pass on the first attempt, then, on the recommendation of the student's examining committee, and subject to the approval of the Graduate Division, the student may repeat the examination once. The examining committee must be the same, and the re-examination must be held within thirty months of the student's entrance into the PhD program.

For a student to pass the qualifying examination, at least one identified member of the subject area group must be willing to accept the candidate as a dissertation student, if asked. The student must obtain an official dissertation supervisor within one semester after passing the qualifying examination or leave the PhD program. For more detailed rules and advice concerning the qualifying examination, consult the graduate advisor in 910 Evans Hall.

Applied Mathematics

MATH 202A Introduction to Topology and Analysis 4 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022
Metric spaces and general topological spaces. Compactness and connectedness. Characterization of compact metric spaces. Theorems of Tychonoff, Urysohn, Tietze. Complete spaces and the Baire category theorem. Function spaces; Arzela-Ascoli and Stone-Weierstrass theorems. Partitions of unity. Locally compact spaces; one-point compactification. Introduction to measure and integration. Sigma algebras of sets. Measures and outer measures. Lebesgue measure on the line and Rn. Construction of the integral. Dominated convergence theorem.

Rules & Requirements

Prerequisites: 104

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 202B Introduction to Topology and Analysis 4 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
Measure and integration. Product measures and Fubini-type theorems. Signed measures; Hahn and Jordan decompositions. Radon-Nikodym theorem. Integration on the line and in Rn. Differentiation of the integral. Hausdorff measures. Fourier transform. Introduction to linear topological spaces, Banach spaces and Hilbert spaces. Banach-Steinhaus theorem; closed graph theorem. Hahn-Banach theorem. Duality; the dual of LP. Measures on locally compact spaces; the dual of C(X). Weak and weak-* topologies; Banach-Alaoglu theorem. Convexity and the Krein-Milman theorem. Additional topics chosen may include compact operators, spectral theory of compact operators, and applications to integral equations.

Rules & Requirements

Prerequisites: 202A and 110

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 204 Ordinary Differential Equations 4 Units

Terms offered: Fall 2022, Fall 2016, Spring 2016
Rigorous theory of ordinary differential equations. Fundamental existence theorems for initial and boundary value problems, variational equilibria, periodic coefficients and Floquet Theory, Green's functions, eigenvalue problems, Sturm-Liouville theory, phase plane analysis, Poincare-Bendixon Theorem, bifurcation, chaos.

Rules & Requirements

Prerequisites: 104

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 205 Theory of Functions of a Complex Variable 4 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
Normal families. Riemann Mapping Theorem. Picard's theorem and related theorems. Multiple-valued analytic functions and Riemann surfaces. Further topics selected by the instructor may include: harmonic functions, elliptic and algebraic functions, boundary behavior of analytic functions and HP spaces, the Riemann zeta functions, prime number theorem.

Rules & Requirements

Prerequisites: 185

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 206 Functional Analysis 4 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022
Spectrum of an operator. Analytic functional calculus. Compact operators. Hilbert-Schmidt operators. Spectral theorem for bounded self-adjoint and normal operators. Unbounded self-adjoint operators. Banach algebras. Commutative Gelfand-Naimark theorem. Selected additional topics such as Fredholm operators and Fredholm index, Calkin algebra, Toeplitz operators, semigroups of operators, interpolation spaces, group algebras.

Rules & Requirements

Prerequisites: 202A-202B

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 208 C*-algebras 4 Units

Terms offered: Spring 2023, Spring 2022, Spring 2021
Basic theory of C*-algebras. Positivity, spectrum, GNS construction. Group C*-algebras and connection with group representations. Additional topics, for example, C*-dynamical systems, K-theory.

Rules & Requirements

Prerequisites: 206

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 209 Von Neumann Algebras 4 Units

Terms offered: Spring 2024, Spring 2017, Spring 2014
Basic theory of von Neumann algebras. Density theorems, topologies and normal maps, traces, comparison of projections, type classification, examples of factors. Additional topics, for example, Tomita Takasaki theory, subfactors, group actions, and noncommutative probability.
Rules & Requirements

Prerequisites: 206

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 212 Several Complex Variables 4 Units

Terms offered: Fall 2023, Fall 2021, Fall 2019
Power series developments, domains of holomorphy, Hartogs' phenomenon, pseudo convexity and plurisubharmonicity. The remainder of the course may treat either sheaf cohomology and Stein manifolds, or the theory of analytic subvarieties and spaces.
Rules & Requirements

Prerequisites: 185 and 202A-202B or their equivalents

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 214 Differential Topology 4 Units

Terms offered: Fall 2024, Spring 2024, Fall 2022
This is an introduction to abstract differential topology based on rigorous mathematical proofs. The topics include Smooth manifolds and maps, tangent and normal bundles. Sard's theorem and transversality, Whitney embedding theorem. differential forms, Stokes' theorem, Frobenius theorem. Basic degree theory. Flows, Lie derivative, Lie groups and algebras. Additional topics selected by instructor.
Rules & Requirements

Prerequisites: 202A

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 215A Algebraic Topology 4 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022
Fundamental group and covering spaces, simplicial and singular homology theory with applications, cohomology theory, duality theorem. Homotopy theory, fibrations, relations between homotopy and homology, obstruction theory, and topics from spectral sequences, cohomology operations, and characteristic classes. Sequence begins fall.
Rules & Requirements

Prerequisites: 113 and point-set topology (e.g. 202A)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

Instructors: 113C, 202A, and 214

MATH 215B Algebraic Topology 4 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
Fundamental group and covering spaces, simplicial and singular homology theory with applications, cohomology theory, duality theorem. Homotopy theory, fibrations, relations between homotopy and homology, obstruction theory, and topics from spectral sequences, cohomology operations, and characteristic classes. Sequence begins fall.
Rules & Requirements

Prerequisites: 215A, 214 recommended (can be taken concurrently)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

Instructors: 113C, 202A, and 214

MATH C218A Probability Theory 4 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022
The course is designed as a sequence with Statistics C205B/ Mathematics C218B with the following combined syllabus. Measure theory concepts needed for probability. Expection, distributions. Laws of large numbers and central limit theorems for independent random variables. Characteristic function methods. Conditional expectations, martingales and martingale convergence theorems. Markov chains. Stationary processes. Brownian motion.
Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

Also listed as: STAT C205A

MATH C218B Probability Theory 4 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
The course is designed as a sequence with with Statistics C205A/ Mathematics C218A with the following combined syllabus. Measure theory concepts needed for probability. Expection, distributions. Laws of large numbers and central limit theorems for independent random variables. Characteristic function methods. Conditional expectations, martingales and martingale convergence theorems. Markov chains. Stationary processes. Brownian motion.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

Also listed as: STAT C205B

MATH 219 Dynamical Systems 4 Units

Terms offered: Fall 2024, Fall 2023, Spring 2022
Diffeomorphisms and flows on manifolds. Ergodic theory. Stable manifolds, generic properties, structural stability. Additional topics selected by the instructor.

Rules & Requirements

Prerequisites: 214

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 220 Introduction to Probabilistic Methods in Mathematics and the Sciences 4 Units

Terms offered: Spring 2012, Spring 2011, Spring 2010
Brownian motion, Langevin and Fokker-Planck equations, path integrals and Feynman diagrams, time series, an introduction to statistical mechanics, Monte Carlo methods, selected applications.

Rules & Requirements

Prerequisites: Some familiarity with differential equations and their applications

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 221 Advanced Matrix Computations 4 Units

Terms offered: Fall 2024, Fall 2023, Spring 2022
Direct solution of linear systems, including large sparse systems: error bounds, iteration methods, least square approximation, eigenvalues and eigenvectors of matrices, nonlinear equations, and minimization of functions.

Rules & Requirements

Prerequisites: Consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Summer: 8 weeks - 6 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 222A Partial Differential Equations 4 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022
The theory of boundary value and initial value problems for partial differential equations, with emphasis on nonlinear equations. Laplace's equation, heat equation, wave equation, nonlinear first-order equations, conservation laws, Hamilton-Jacobi equations, Fourier transform, Sobolev spaces.

Rules & Requirements

Prerequisites: 105 or 202A

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 222B Partial Differential Equations 4 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
The theory of boundary value and initial value problems for partial differential equations, with emphasis on nonlinear equations. Second-order elliptic equations, parabolic and hyperbolic equations, calculus of variations methods, additional topics selected by instructor.

Rules & Requirements

Prerequisites: 105 or 202A

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH C223A Advanced Topics in Probability and Stochastic Process 3 Units

Terms offered: Fall 2024, Fall 2020, Fall 2016
The topics of this course change each semester, and multiple sections may be offered. Advanced topics in probability offered according to students demand and faculty availability.
Rules & Requirements

Prerequisites: Statistics C205A-C205B or consent of instructor

Repeat rules: Course may be repeated for credit with instructor consent.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

Also listed as: STAT C206A

MATH C223B Advanced Topics in Probability and Stochastic Processes 3 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
The topics of this course change each semester, and multiple sections may be offered. Advanced topics in probability offered according to students demand and faculty availability.
Rules & Requirements

Repeat rules: Course may be repeated for credit with instructor consent.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

Also listed as: STAT C206B

MATH 224A Mathematical Methods for the Physical Sciences 4 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022
Introduction to the theory of distributions. Fourier and Laplace transforms. Partial differential equations. Green's function. Operator theory, with applications to eigenfunction expansions, perturbation theory and linear and non-linear waves. Sequence begins fall.
Rules & Requirements

Prerequisites: Graduate status or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

Instructors: 112 or 113C; 104A and 185, or 121A-121B-121C, or 120A-120B-120C.

MATH 224B Mathematical Methods for the Physical Sciences 4 Units

Terms offered: Spring 2015, Spring 2014, Spring 2013
Introduction to the theory of distributions. Fourier and Laplace transforms. Partial differential equations. Green's function. Operator theory, with applications to eigenfunction expansions, perturbation theory and linear and non-linear waves. Sequence begins fall.
Rules & Requirements

Prerequisites: Graduate status or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 225A Metamathematics 4 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022
Metamathematics of predicate logic. Completeness and compactness theorems. Interpolation theorem, definability, theory of models. Metamathematics of number theory, recursive functions, applications to truth and provability. Undecidable theories. Sequence begins fall.
Rules & Requirements

Prerequisites: 125A and (135 or 136)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 225B Metamathematics 4 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
Metamathematics of predicate logic. Completeness and compactness theorems. Interpolation theorem, definability, theory of models. Metamathematics of number theory, recursive functions, applications to truth and provability. Undecidable theories. Sequence begins fall.

Rules & Requirements

Prerequisites: 125A and (135 or 136)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 227A Theory of Recursive Functions 4 Units

Terms offered: Spring 2021, Fall 2015, Fall 2013
Recursive and recursively enumerable sets of natural numbers; characterizations, significance, and classification. Relativization, degrees of unsolvability. The recursion theorem. Constructive ordinals, the hyperarithmetical and analytical hierarchies. Recursive objects of higher type. Sequence begins fall.

Rules & Requirements

Prerequisites: Mathematics 225B

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

Instructor: 225C.

MATH 228A Numerical Solution of Differential Equations 4 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022
Ordinary differential equations: Runge-Kutta and predictor-corrector methods; stability theory, Richardson extrapolation, stiff equations, boundary value problems. Partial differential equations: stability, accuracy and convergence, Von Neumann and CFL conditions, finite difference solutions of hyperbolic and parabolic equations. Finite differences and finite element solution of elliptic equations.

Rules & Requirements

Prerequisites: 128A

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

Instructor: 128A-128B.

MATH 228B Numerical Solution of Differential Equations 4 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
Ordinary differential equations: Runge-Kutta and predictor-corrector methods; stability theory, Richardson extrapolation, stiff equations, boundary value problems. Partial differential equations: stability, accuracy and convergence, Von Neumann and CFL conditions, finite difference solutions of hyperbolic and parabolic equations. Finite differences and finite element solution of elliptic equations.

Rules & Requirements

Prerequisites: 128A

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

Instructor: 128A-128B.

MATH 229 Theory of Models 4 Units

Terms offered: Spring 2019, Spring 2015, Spring 2013
Syntactical characterization of classes closed under algebraic operations. Ultraproducts and ultralimits, saturated models. Methods for establishing decidability and completeness. Model theory of various languages richer than first-order.

Rules & Requirements

Prerequisites: 225B

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 235A Theory of Sets 4 Units

Terms offered: Fall 2024, Spring 2024, Fall 2018
Axiomatic foundations. Operations on sets and relations. Images and set functions. Ordering, well-ordering, and well-founded relations; general principles of induction and recursion. Ranks of sets, ordinals and their arithmetic. Set-theoretical equivalence, similarity of relations; definitions by abstraction. Arithmetic of cardinals. Axiom of choice, equivalent forms, and consequences. Sequence begins fall.

Rules & Requirements

Prerequisites: 125A and 135

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

Instructor: 125A and 135.

MATH 236 Metamathematics of Set Theory 4 Units

Terms offered: Fall 2021, Fall 2014, Fall 2010
Various set theories: comparison of strength, transitive, and natural models, finite axiomatizability. Independence and consistency of axiom of choice, continuum hypothesis, etc. The measure problem and axioms of strong infinity.

Rules & Requirements

Prerequisites: 225B and 235A

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 239 Discrete Mathematics for the Life Sciences 4 Units

Terms offered: Spring 2011, Fall 2008, Spring 2008
Introduction to algebraic statistics and probability, optimization, phylogenetic combinatorics, graphs and networks, polyhedral and metric geometry.

Rules & Requirements

Prerequisites: Statistics 134 or equivalent introductory probability theory course, or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH C239 Discrete Mathematics for the Life Sciences 4 Units

Terms offered: Spring 2013
Introduction to algebraic statistics and probability, optimization, phylogenetic combinatorics, graphs and networks, polyhedral and metric geometry.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

Also listed as: MCELLBI C244

MATH 240 Riemannian Geometry 4 Units

Terms offered: Spring 2025, Fall 2022, Fall 2021
Riemannian metric and Levi-Civita connection, geodesics and completeness, curvature, first and second variations of arc length. Additional topics such as the theorems of Myers, Synge, and Cartan-Hadamard, the second fundamental form, convexity and rigidity of hypersurfaces in Euclidean space, homogeneous manifolds, the Gauss-Bonnet theorem, and characteristic classes.

Rules & Requirements

Prerequisites: 214

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 241 Complex Manifolds 4 Units

Terms offered: Spring 2024, Spring 2023, Spring 2021
Riemann surfaces, divisors and line bundles on Riemann surfaces, sheaves and the Dolbeault theorem on Riemann surfaces, the classical Riemann-Roch theorem, theorem of Abel-Jacobi. Complex manifolds, Kahler metrics. Summary of Hodge theory, groups of line bundles, additional topics such as Kodaira's vanishing theorem, Lefschetz hyperplane theorem.

Rules & Requirements

Prerequisites: 214 and 215A

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 242 Symplectic Geometry 4 Units

Terms offered: Fall 2024, Fall 2023, Fall 2021
Basic topics: symplectic linear algebra, symplectic manifolds, Darboux theorem, cotangent bundles, variational problems and Legendre transform, hamiltonian systems, Lagrangian submanifolds, Poisson brackets, symmetry groups and momentum mappings, coadjoint orbits, Kahler manifolds.

Rules & Requirements

Prerequisites: 214

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH C243 Seq: Methods and Applications 3 Units

Terms offered: Spring 2015, Spring 2014
A graduate seminar class in which a group of students will closely examine recent computational methods in high-throughput sequencing followed by directly examining interesting biological applications thereof.

Rules & Requirements

Prerequisites: Graduate standing in Math, MCB, and Computational Biology; or consent of the instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

Instructor: Pachter

Also listed as: MCELLBI C243

MATH 245A General Theory of Algebraic Structures 4 Units

Terms offered: Fall 2017, Fall 2015, Spring 2014
Structures defined by operations and/or relations, and their homomorphisms. Classes of structures determined by identities. Constructions such as free objects, objects presented by generators and relations, ultraproducts, direct limits. Applications of general results to groups, rings, lattices, etc. Course may emphasize study of congruence- and subalgebra-lattices, or category-theory and adjoint functors, or other aspects.

Rules & Requirements

Prerequisites: Math 113

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 249 Algebraic Combinatorics 4 Units

Terms offered: Fall 2024, Spring 2024, Spring 2023
(I) Enumeration, generating functions and exponential structures, (II) Posets and lattices, (III) Geometric combinatorics, (IV) Symmetric functions, Young tableaux, and connections with representation theory. Further study of applications of the core material and/or additional topics, chosen by instructor.

Rules & Requirements

Prerequisites: 250A or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 250A Groups, Rings, and Fields 4 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022
Group theory, including the Jordan-Holder theorem and the Sylow theorems. Basic theory of rings and their ideals. Unique factorization domains and principal ideal domains. Modules. Chain conditions. Fields, including fundamental theorem of Galois theory, theory of finite fields, and transcendence degree.

Rules & Requirements

Prerequisites: 114 or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 250B Commutative Algebra 4 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
Development of the main tools of commutative and homological algebra applicable to algebraic geometry, number theory and combinatorics.

Rules & Requirements

Prerequisites: 250A

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 251 Ring Theory 4 Units

Terms offered: Fall 2021, Fall 2016, Spring 2013
Topics such as: Noetherian rings, rings with descending chain condition, theory of the radical, homological methods.

Rules & Requirements

Prerequisites: 250A

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 252 Representation Theory 4 Units

Terms offered: Spring 2025, Fall 2021, Fall 2020
Structure of finite dimensional algebras, applications to representations of finite groups, the classical linear groups.

Rules & Requirements

Prerequisites: 250A

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 253 Homological Algebra 4 Units

Terms offered: Spring 2023, Fall 2016, Fall 2014
Modules over a ring, homomorphisms and tensor products of modules, functors and derived functors, homological dimension of rings and modules.

Rules & Requirements

Prerequisites: 250A

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 254A Number Theory 4 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022
Valuations, units, and ideals in number fields, ramification theory, quadratic and cyclotomic fields, topics from class field theory, zeta-functions and L-series, distribution of primes, modular forms, quadratic forms, diophantine equations, P-adic analysis, and transcendental numbers. Sequence begins fall.

Rules & Requirements

Prerequisites: 250A for 254A; 254A for 254B

Repeat rules: Course may be repeated for credit with instructor consent.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

Instructor: 250A.

MATH 254B Number Theory 4 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
Valuations, units, and ideals in number fields, ramification theory, quadratic and cyclotomic fields, topics from class field theory, zeta-functions and L-series, distribution of primes, modular forms, quadratic forms, diophantine equations, P-adic analysis, and transcendental numbers. Sequence begins fall.

Rules & Requirements

Prerequisites: 254A

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

Instructor: 250A.

MATH 255 Algebraic Curves 4 Units

Terms offered: Fall 2022, Spring 2019, Fall 2014
Elliptic curves. Algebraic curves, Riemann surfaces, and function fields. Singularities. Riemann-Roch theorem, Hurwitz's theorem, projective embeddings and the canonical curve. Zeta functions of curves over finite fields. Additional topics such as Jacobians or the Riemann hypothesis.

Rules & Requirements

Prerequisites: 250A-250B or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 256A Algebraic Geometry 4 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022
Affine and projective algebraic varieties. Theory of schemes and morphisms of schemes. Smoothness and differentials in algebraic geometry. Coherent sheaves and their cohomology. Riemann-Roch theorem and selected applications. Sequence begins fall.

Rules & Requirements

Prerequisites: 250A-250B for 256A; 256A for 256B

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

Instructor: 250A.

MATH 256B Algebraic Geometry 4 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
Affine and projective algebraic varieties. Theory of schemes and morphisms of schemes. Smoothness and differentials in algebraic geometry. Coherent sheaves and their cohomology. Riemann-Roch theorem and selected applications. Sequence begins fall.

Rules & Requirements

Prerequisites: 256A

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

Instructor: 250A.

MATH 257 Group Theory 4 Units

Terms offered: Spring 2021, Spring 2018, Spring 2014
Topics such as: generators and relations, infinite discrete groups, groups of Lie type, permutation groups, character theory, solvable groups, simple groups, transfer and cohomological methods.
Rules & Requirements

Prerequisites: 250A

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 258 Harmonic Analysis 4 Units

Terms offered: Fall 2023, Fall 2021, Fall 2020
Basic properties of Fourier series, convergence and summability, conjugate functions, Hardy spaces, boundary behavior of analytic and harmonic functions. Additional topics at the discretion of the instructor.
Rules & Requirements

Prerequisites: 206 or a basic knowledge of real, complex, and linear analysis

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 261A Lie Groups 4 Units

Terms offered: Fall 2024, Fall 2023, Fall 2022
Lie groups and Lie algebras, fundamental theorems of Lie, general structure theory; compact, nilpotent, solvable, semi-simple Lie groups; classification theory and representation theory of semi-simple Lie algebras and Lie groups, further topics such as symmetric spaces, Lie transformation groups, etc., if time permits. In view of its simplicity and its wide range of applications, it is preferable to cover compact Lie groups and their representations in 261A. Sequence begins Fall.
Rules & Requirements

Prerequisites: 214

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

Instructor: 214.

MATH 261B Lie Groups 4 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
Lie groups and Lie algebras, fundamental theorems of Lie, general structure theory; compact, nilpotent, solvable, semi-simple Lie groups; classification theory and representation theory of semi-simple Lie algebras and Lie groups, further topics such as symmetric spaces, Lie transformation groups, etc., if time permits. In view of its simplicity and its wide range of applications, it is preferable to cover compact Lie groups and their representations in 261A. Sequence begins Fall.
Rules & Requirements

Prerequisites: 214

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

Instructor: 214.

MATH 270 Advanced Topics Course in Mathematics 2 Units

Terms offered: Spring 2024, Fall 2023, Spring 2023
This course will give introductions to research-related topics in mathematics. The topics will vary from semester to semester.
Rules & Requirements

Repeat rules: Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1.5 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

MATH 272 Interdisciplinary Topics in Mathematics 1 - 4 Units

Terms offered: Fall 2023, Spring 2019
Advanced topics chosen by the instructor. The content of this course changes, as in the case of seminars.
Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 3-3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 273 Topics in Numerical Analysis 4 Units

Terms offered: Spring 2022, Spring 2016, Spring 2014
Advanced topics chosen by the instructor. The content of this course changes, as in the case of seminars.

Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 274 Topics in Algebra 4 Units

Terms offered: Spring 2025, Fall 2024, Fall 2023
Advanced topics chosen by the instructor. The content of this course changes, as in the case of seminars.

Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 275 Topics in Applied Mathematics 4 Units

Terms offered: Spring 2024, Spring 2023, Fall 2021
Advanced topics chosen by the instructor. The content of this course changes, as in the case of seminars.

Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 276 Topics in Topology 4 Units

Terms offered: Spring 2021, Fall 2017, Spring 2016
Advanced topics chosen by the instructor. The content of this course changes, as in the case of seminars.

Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 277 Topics in Differential Geometry 4 Units

Terms offered: Spring 2025, Spring 2023, Fall 2022
Advanced topics chosen by the instructor. The content of this course changes, as in the case of seminars.

Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 278 Topics in Analysis 4 Units

Terms offered: Fall 2024, Spring 2024, Fall 2021
Advanced topics chosen by the instructor. The content of this course changes, as in the case of seminars.

Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 279 Topics in Partial Differential Equations 4 Units

Terms offered: Fall 2023, Spring 2023, Fall 2022
Advanced topics chosen by the instructor. The content of this course changes, as in the case of seminars.

Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 290 Seminars 1 - 6 Units

Terms offered: Spring 2017, Spring 2015, Fall 2014
Topics in foundations of mathematics, theory of numbers, numerical calculations, analysis, geometry, topology, algebra, and their applications, by means of lectures and informal conferences; work based largely on original memoirs.

Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of seminar per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Letter grade.

MATH 295 Individual Research 1 - 12 Units

Terms offered: Summer 2016 10 Week Session, Spring 2016, Fall 2015
Intended for candidates for the Ph.D. degree.

Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-12 hours of independent study per week

Summer:
3 weeks - 5 hours of independent study per week
6 weeks - 2.5-30 hours of independent study per week
8 weeks - 1.5-60 hours of independent study per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: The grading option will be decided by the instructor when the class is offered.

MATH N295 Individual Research 0.5 - 5 Units

Terms offered: Summer 2022 8 Week Session, Summer 2021 8 Week Session, Summer 2006 10 Week Session
Intended for candidates for the Ph.D. degree.

Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Summer: 8 weeks - 1-5 hours of independent study per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: The grading option will be decided by the instructor when the class is offered.

MATH N297 General Academic Internship 0.5 Units

Terms offered: Prior to 2007
This is an independent study course designed to provide structure for graduate students engaging in summer internship opportunities. Requires a paper exploring how the theoretical constructs learned in academic courses were applied during the internship.

Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Summer: 8 weeks - 2.5 hours of independent study per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

MATH 299 Reading Course for Graduate Students 1 - 6 Units

Terms offered: Fall 2018, Fall 2017, Fall 2016
Investigation of special problems under the direction of members of the department.

Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of independent study per week

Summer:
6 weeks - 1-5 hours of independent study per week
8 weeks - 1-4 hours of independent study per week

Additional Details

Subject/Course Level: Mathematics/Graduate

Grading: The grading option will be decided by the instructor when the class is offered.

MATH 301 Undergraduate Mathematics Instruction 1 - 2 Units

Terms offered: Fall 2018, Spring 2018, Fall 2017
May be taken for one unit by special permission of instructor. Tutoring at the Student Learning Center or for the Professional Development Program.

Rules & Requirements

Prerequisites: Permission of SLC instructor, as well as sophomore standing and at least a B average in two semesters of calculus. Apply at Student Learning Center

Repeat rules: Course may be repeated for credit up to a total of 4 units.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of seminar and 4 hours of tutorial per week

Additional Details

Subject/Course Level: Mathematics/Professional course for teachers or prospective teachers

Grading: Offered for pass/not pass grade only.

MATH 302 Teaching Workshop 1 Unit

Terms offered: Summer 2002 10 Week Session, Summer 2001 10 Week Session
Mandatory for all graduate student instructors teaching summer course for the first time in the Department. The course consists of practice teaching, alternatives to standard classroom methods, guided group and self-analysis, classroom visitations by senior faculty member.

Hours & Format

Summer: 8 weeks - 1 hour of lecture per week

Additional Details

Subject/Course Level: Mathematics/Professional course for teachers or prospective teachers

Grading: Offered for satisfactory/unsatisfactory grade only.

MATH 303 Professional Preparation: Supervised Teaching of Mathematics 2 - 4 Units

Terms offered: Spring 2017, Spring 2016, Fall 2015
Meeting with supervising faculty and with discussion sections. Experience in teaching under the supervision of Mathematics faculty.

Rules & Requirements

Prerequisites: 300, graduate standing and appointment as a Graduate Student Instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 2-4 hours of independent study per week

Additional Details

Subject/Course Level: Mathematics/Professional course for teachers or prospective teachers

Grading: Offered for satisfactory/unsatisfactory grade only.

MATH 600 Individual Study for Master's Students 1 - 6 Units

Terms offered: Summer 2006 10 Week Session, Fall 2005, Spring 2005
Individual study for the comprehensive or language requirements in consultation with the field adviser.

Rules & Requirements

Prerequisites: For candidates for master's degree

Credit Restrictions: Course does not satisfy unit or residence requirements for master's degree.

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-6 hours of independent study per week

Summer: 8 weeks - 1.5-10 hours of independent study per week

Additional Details

Subject/Course Level: Mathematics/Graduate examination preparation

Grading: Offered for satisfactory/unsatisfactory grade only.

MATH 602 Individual Study for Doctoral Students 1 - 8 Units

Terms offered: Fall 2019, Fall 2018, Fall 2016

Individual study in consultation with the major field adviser intended to provide an opportunity for qualified students to prepare themselves for the various examinations required for candidates for the Ph.D. Course does not satisfy unit or residence requirements for doctoral degree.

Rules & Requirements

Prerequisites: For qualified graduate students

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-8 hours of independent study per week

Additional Details

Subject/Course Level: Mathematics/Graduate examination preparation

Grading: Offered for satisfactory/unsatisfactory grade only.