APPLIED MATHEMATICS (GRADUATE GROUP)

College of Letters & Science

Group Office

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Faculty

The Group includes approximately 90 faculty members, of whom about one-third are in the Department of Mathematics. Membership comprises chemists, biologists, physicists, geologists, statisticians, computer scientists, and engineers. Research interests include biology, atmospheric sciences, mechanics, solid and fluid dynamics, optimization and control, theoretical chemistry, computer and engineering sciences, mathematical physics, signal and image processing, harmonic analysis, numerical analysis and nonlinear partial differential equations. A complete list of faculty and their research areas are available at Applied Mathematics People (http://appliedmath.ucdavis.edu/people/).

- Applied Mathematics, Master of Science (https://catalog.ucdavis.edu/departments-programs-degrees/applied-mathematics-graduate-group/applied-mathematics-ms/)
- Applied Mathematics, Doctor of Philosophy (https://catalog.ucdavis.edu/departments-programs-degrees/applied-mathematics-graduate-group/applied-mathematics-phd/)

Mathematics (MAT)

MAT 200 — Problem-Solving in Analysis (3 units)

Course Description: Problem-solving in graduate analysis: continuous functions, metric spaces, Banach & Hilbert spaces, bounded linear operators, the spectral theorem, distributions, Fourier series & transforms, Lp spaces, Sobolev spaces.
Prerequisite(s): MAT 201A (can be concurrent); MAT 201B (can be concurrent).
Learning Activities: Lecture 1 hour(s), Extensive Problem Solving.
Grade Mode: Satisfactory/Unsatisfactory only.

MAT 201A — Analysis (4 units)

Course Description: Metric and normed spaces. Continuous functions. Topological, Hilbert, and Banach spaces. Fourier series. Spectrum of bounded and compact linear operators. Linear differential operators and Green's functions. Distributions. Fourier transform. Measure theory. Lp and Sobolev spaces. Differential calculus and variational methods.
Prerequisite(s): Graduate standing in Mathematics or Applied Mathematics, or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 201B — Analysis (4 units)

Course Description: Metric and normed spaces. Continuous functions. Topological, Hilbert, and Banach spaces. Fourier series. Spectrum of bounded and compact linear operators. Linear differential operators and Green's functions. Distributions. Fourier transform. Measure theory. Lp and Sobolev spaces. Differential calculus and variational methods.
Prerequisite(s): Graduate standing in Mathematics or Applied Mathematics, or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 201C — Analysis (4 units)

Course Description: Metric and normed spaces. Continuous functions. Topological, Hilbert, and Banach spaces. Fourier series. Spectrum of bounded and compact linear operators. Linear differential operators and Green's functions. Distributions. Fourier transform. Measure theory. Lp and Sobolev spaces. Differential calculus and variational methods.
Prerequisite(s): Graduate standing in Mathematics or Applied Mathematics, or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 202 — Functional Analysis (4 units)

Course Description: Hahn-Banach, Open mapping, Closed graph, Banach-Steinhaus, and Krein-Milman. Subspaces and quotient spaces. Projections. Weak and weak-star topologies. Compact and adjoint operators in Banach spaces. Fredholm theory. Functions of operators. Spectral theory of self-adjoint operators.
Prerequisite(s): MAT 201A; MAT 201B.
Learning Activities: Lecture 3 hour(s), Term Paper.
Grade Mode: Letter.

MAT 205 — Complex Analysis (4 units)

Course Description: Analytic continuation, Riemann surfaces, conformal mappings, Riemann mapping theorem, entire functions, special functions, elliptic functions.
Prerequisite(s): MAT 185A; or equivalent to MAT 185A, or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 205A — Complex Analysis (4 units)

Course Description: Cauchy's theorem, Cauchy's integral formulas, meromorphic functions, complex logarithm, entire functions, Weierstrass infinite product formula, the gamma and zeta functions, and prime number theorem.
Prerequisite(s): MAT 185A; or equivalent to MAT 185A, or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Credit Limitation(s): No credit given to students who have completed MAT 205.
Grade Mode: Letter.

MAT 205B — Complex Analysis (4 units)

Course Description: Conformal mappings, the Schwarz lemma, analytic automorphisms, the Riemann mapping theorem, elliptic functions, Eisenstein series, the Jacobi theta functions, asymptotics, Bessel functions, the Airy function, topics on special functions and Riemann surfaces.
Prerequisite(s): MAT 205A; or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Repeat Credit: May be repeated 2 time(s) when topic differs.
Grade Mode: Letter.

MAT 206 — Measure Theory (4 units)

Course Description: Introduction to measure theory. The study of lengths, surface areas, and volumes in general spaces, as related to integration theory.
Prerequisite(s): MAT 125B.
Learning Activities: Lecture 3 hour(s), Extensive Problem Solving.
Grade Mode: Letter.

MAT 207A — Methods of Applied Mathematics (4 units)

Course Description: Ordinary differential equations and dynamical systems. Variational principles. Eigenfunctions, integral equations and Green's functions. Complex analysis and contour integration. Laplace's equation. Diffusion equations. Wave phenomena. Dimensional analysis and scaling. Asymptotic expansions and perturbation theory. Stochastic processes and Brownian motion.
Prerequisite(s): Graduate standing or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 207B — Methods of Applied Mathematics (4 units)

Course Description: Ordinary differential equations and dynamical systems. Variational principles. Eigenfunctions, integral equations and Green's functions. Complex analysis and contour integration. Laplace's equation. Diffusion equations. Wave phenomena. Dimensional analysis and scaling. Asymptotic expansions and perturbation theory. Stochastic processes and Brownian motion.
Prerequisite(s): Graduate standing or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 207C — Methods of Applied Mathematics (4 units)

Course Description: Ordinary differential equations and dynamical systems. Variational principles. Eigenfunctions, integral equations and Green's functions. Complex analysis and contour integration. Laplace's equation. Diffusion equations. Wave phenomena. Dimensional analysis and scaling. Asymptotic expansions and perturbation theory. Stochastic processes and Brownian motion.
Prerequisite(s): Graduate standing or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 215A — Topology (4 units)

Course Description: Fundamental group and covering space theory. Homology and cohomology. Manifolds and duality. CW complexes. Fixed point theorems.
Prerequisite(s): Graduate standing or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 215B — Topology (4 units)

Course Description: Fundamental group and covering space theory. Homology and cohomology. Manifolds and duality. CW complexes. Fixed point theorems.
Prerequisite(s): Graduate standing or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 215C — Topology (4 units)

Course Description: Fundamental group and covering space theory. Homology and cohomology. Manifolds and duality. CW complexes. Fixed point theorems.
Prerequisite(s): Graduate standing or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 216 — Geometric Topology (4 units)

Course Description: Topology of two- and three-dimensional manifolds. Surfaces and their diffeomorphisms. Dehn twists. Heegaard surfaces. Theory of 3-dimensional manifolds. Knots and knot theory. Hyperbolic manifolds and geometric structures.
Prerequisite(s): MAT 215A.
Learning Activities: Lecture 3 hour(s), Extensive Problem Solving 1 hour(s).
Repeat Credit: May be repeated 1 time(s).
Grade Mode: Letter.

MAT 218A — Partial Differential Equations (4 units)

Course Description: Year-long sequence on PDEs which covers linear transport, Laplace, heat, and wave equations, maximum principles, method of characteristics, Sobelev and Hölder space theory, weak derivatives, semilinear, quasilinear, and fully nonlinear elliptic/parabolic equations, nonlinear hyperbolic equations, and compensated compactness.
Prerequisite(s): MAT 201A; MAT 201B; MAT 201C; or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 218B — Partial Differential Equations (4 units)

Course Description: Year-long sequence on PDEs which covers linear transport, Laplace, heat, and wave equations, maximum principles, method of characteristics, Sobelev and Hölder space theory, weak derivatives, semilinear, quasilinear, and fully nonlinear elliptic/parabolic equations, nonlinear hyperbolic equations, and compensated compactness.
Prerequisite(s): MAT 218A; or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 218C — Partial Differential Equations (4 units)

Course Description: Year-long sequence on PDEs which covers linear transport, Laplace, heat, and wave equations, maximum principles, method of characteristics, Sobelev and Hölder space theory, weak derivatives, semilinear, quasilinear, and fully nonlinear elliptic/parabolic equations, nonlinear hyperbolic equations, and compensated compactness.
Prerequisite(s): MAT 218B; or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 221A — Mathematical Fluid Dynamics (4 units)

Course Description: Kinematics and dynamics of fluids. The Euler and Navier-Stokes equations. Vorticity dynamics. Irrotational flow. Low Reynolds number flows and the Stokes equations. High Reynolds number flows and boundary layers. Compressible fluids. Shock waves.
Prerequisite(s): MAT 118B; or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 221B — Mathematical Fluid Dynamics (4 units)

Course Description: Kinematics and dynamics of fluids. The Euler and Navier-Stokes equations. Vorticity dynamics. Irrotational flow. Low Reynolds number flows and the Stokes equations. High Reynolds number flows and boundary layers. Compressible fluids. Shock waves.
Prerequisite(s): MAT 118B; or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 226A — Numerical Methods: Fundamentals (4 units)

Course Description: Fundamental principles and methods in numerical analysis, including the concepts of stability of algorithms and conditioning of numerical problems, numerical methods for interpolation and integration, eigenvalue problems, singular value decomposition and its applications.
Prerequisite(s): MAT 128A; MAT 128B; or equivalent, or consent of instructor; familiarity with some programming language.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 226B — Numerical Methods: Large-Scale Matrix Computations (4 units)

Course Description: Numerical methods for large-scale matrix computations, including direct and iterative methods for the solution of linear systems, the computation of eigenvalues and singular values, the solution of least-squares problems, matrix compression, methods for the solution of linear programs.
Prerequisite(s): MAT 167; or equivalent, or consent of instructor; familiarity with some programming language.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 226C — Numerical Methods: Ordinary Differential Equations (4 units)

Course Description: Numerical methods for the solution of ordinary differential equations, including methods for initial-value problems and two-point boundary-value problems, theory of and methods for differential algebraic equations, dimension reduction of large-scale dynamical systems.
Prerequisite(s): MAT 022B; or equivalent, or consent of instructor; familiarity with some programming language.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 227 — Mathematical Biology (4 units)

Course Description: Nonlinear ordinary and partial differential equations and stochastic processes of cell and molecular biology. Scaling, qualitative, and numerical analysis of mathematical models. Applications to nerve impulse, chemotaxis, muscle contraction, and morphogenesis.
Prerequisite(s): Graduate standing or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 228A — Numerical Solution of Differential Equations (4 units)

Course Description: Numerical solutions of initial-value, eigenvalue and boundary-value problems for ordinary differential equations. Numerical solution of parabolic and hyperbolic partial differential equations.
Prerequisite(s): MAT 128C.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s), Discussion.
Grade Mode: Letter.

MAT 228B — Numerical Solution of Differential Equations (4 units)

Course Description: Numerical solutions of initial-value, eigenvalue and boundary-value problems for ordinary differential equations. Numerical solution of parabolic and hyperbolic partial differential equations.
Prerequisite(s): MAT 128C.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s), Discussion.
Grade Mode: Letter.

MAT 228C — Numerical Solution of Differential Equations (4 units)

Course Description: Numerical solutions of initial-value, eigenvalue and boundary-value problems for ordinary differential equations. Numerical solution of parabolic and hyperbolic partial differential equations.
Prerequisite(s): MAT 128C.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s), Discussion.
Grade Mode: Letter.

MAT 235A — Probability Theory (4 units)

Course Description: Measure-theoretic foundations, abstract integration, independence, laws of large numbers, characteristic functions, central limit theorems. Weak convergence in metric spaces, Brownian motion, invariance principle. Conditional expectation. Topics selected from: martingales, Markov chains, ergodic theory.
Prerequisite(s): MAT 125B; (MAT 135A or STA 131A); or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Cross Listing: STA 235A.
Grade Mode: Letter.

MAT 235B — Probability Theory (4 units)

Course Description: Measure-theoretic foundations, abstract integration, independence, laws of large numbers, characteristic functions, central limit theorems. Weak convergence in metric spaces, Brownian motion, invariance principle. Conditional expectation. Topics selected from: martingales, Markov chains, ergodic theory.
Prerequisite(s): MAT 235A or STA 235A; or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Cross Listing: STA 235B.
Grade Mode: Letter.

MAT 235C — Probability Theory (4 units)

Course Description: Measure-theoretic foundations, abstract integration, independence, laws of large numbers, characteristic functions, central limit theorems. Weak convergence in metric spaces, Brownian motion, invariance principle. Conditional expectation. Topics selected from: martingales, Markov chains, ergodic theory.
Prerequisite(s): MAT 235B or STA 235B; or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Cross Listing: STA 235C.
Grade Mode: Letter.

MAT 236A — Stochastic Dynamics & Applications (4 units)

Course Description: Stochastic processes, Brownian motion, Stochastic integration, martingales, stochastic differential equations. Diffusions, connections with partial differential equations, mathematical finance.
Prerequisite(s): MAT 201C or (MAT 235B or STA 235B); MAT 235A, MAT 235B, MAT 235C/STA 235A, STA 235B, STA 235C recommended.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 236B — Stochastic Dynamics & Applications (4 units)

Course Description: Stochastic processes, Brownian motion, Stochastic integration, martingales, stochastic differential equations. Diffusions, connections with partial differential equations, mathematical finance.
Prerequisite(s): MAT 201C or (MAT 235B or STA 235B); MAT 235A, MAT 235B, MAT 235C/STA 235A, STA 235B, STA 235C recommended.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 239 — Differential Topology (4 units)

Course Description: Differentiable manifolds, vector fields, transverse intersections, Sard's Theorem, orientations, intersection theory, the index of a vector field, differential forms, integration on manifolds, Stokes' Theorem, deRham cohomology, Morse functions, the Morse lemma, and the index of critical points.
Prerequisite(s): MAT 201A; or consent of instructor; Vector calculus, point-set topology; MAT 250A MAT 250B highly recommended.
Learning Activities: Lecture 3 hour(s), Discussion 1 hour(s).
Grade Mode: Letter.

MAT 240A — Differential Geometry (4 units)

Course Description: Riemannian metrics, connections, geodesics, Gauss lemma, convex neighborhoods, curvature tensor, Ricci and scalar curvature, connections and curvature on vector bundles.
Prerequisite(s): MAT 201A; MAT 239; MAT 250A MAT 250B highly recommended; intended primarily for second-year graduate students.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 240B — Differential Geometry (4 units)

Course Description: Jacobi fields, conjugate points, completeness, Hopf-Rinow theorem, Cartan-Hadamard theorem, energy, variation theorems and their applications, Rauch comparison theorem and its applications.
Prerequisite(s): MAT 240A; Intended primarily for second-year graduate students.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 245 — Enumerative Combinatorics (4 units)

Course Description: Introduction to modern combinatorics and its applications. Emphasis on enumerative aspects of combinatorial theory.
Prerequisite(s): MAT 145; MAT 150; or the equivalent, or consent of instructor.
Learning Activities: Lecture 3 hour(s), Extensive Problem Solving.
Grade Mode: Letter.

MAT 246 — Algebraic Combinatorics (4 units)

Course Description: Algebraic and geometric aspects of combinatorics. The use of structures such as groups, polytopes, rings, and simplicial complexes to solve combinatorial problems.
Prerequisite(s): MAT 245; or consent of instructor.
Learning Activities: Lecture 3 hour(s), Extensive Problem Solving.
Grade Mode: Letter.

MAT 248A — Algebraic Geometry (4 units)

Course Description: Affine varieties and radical ideals. Projective varieties. Abstract varieties. Morphisms and rational maps. Smoothness. Algebraic curves and the Riemann-Roch theorem. Special topics.
Prerequisite(s): MAT 250A; MAT 250B; MAT 250C.
Learning Activities: Lecture 3 hour(s), Extensive Problem Solving.
Grade Mode: Letter.

MAT 248B — Algebraic Geometry (4 units)

Course Description: Complex varieties and the analytic topology. Sheaves and schemes. Fiber products. Separatedness and properness. Applications of scheme theory.
Prerequisite(s): MAT 248A.
Learning Activities: Lecture 3 hour(s), Extensive Problem Solving.
Grade Mode: Letter.

MAT 249 — Problem-Solving in Algebra (3 units)

Course Description: Problem-solving in graduate algebra: groups, rings, modules, matrices, tensor products, representations, Galois theory, ring extensions, commutative algebra and homological algebra.
Prerequisite(s): MAT 250A (can be concurrent); MAT 250B (can be concurrent).
Learning Activities: Lecture 1 hour(s), Extensive Problem Solving.
Grade Mode: Satisfactory/Unsatisfactory only.

MAT 250A — Algebra (4 units)

Course Description: Group and rings. Sylow theorems, abelian groups, Jordan-Holder theorem. Rings, unique factorization. Algebras, and modules. Fields and vector spaces over fields. Field extensions. Commutative rings. Representation theory and its applications.
Prerequisite(s): Graduate standing in mathematics or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 250B — Algebra (4 units)

Course Description: Group and rings. Sylow theorems, abelian groups, Jordan-Holder theorem. Rings, unique factorization. Algebras, and modules. Fields and vector spaces over fields. Field extensions. Commutative rings. Representation theory and its applications.
Prerequisite(s): Graduate standing in mathematics or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 250C — Algebra (4 units)

Course Description: Group and rings. Sylow theorems, abelian groups, Jordan-Holder theorem. Rings, unique factorization. Algebras, and modules. Fields and vector spaces over fields. Field extensions. Commutative rings. Representation theory and its applications.
Prerequisite(s): Graduate standing in mathematics or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 258A — Numerical Optimization (4 units)

Course Description: Numerical methods for infinite dimensional optimization problems. Newton and Quasi-Newton methods, linear and sequential quadratic programming, barrier methods; large-scale optimization; theory of approximations; infinite and semi-infinite programming; applications to optimal control, stochastic optimization and distributed systems.
Prerequisite(s): MAT 025; MAT 167.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 258B — Discrete & Mixed-Integer Optimization (4 units)

Course Description: Combinatorial, integer, and mixed-integer linear optimization problems. Ideal and strong formulations, cutting planes, branch and cut, decomposition methods.
Prerequisite(s): MAT 025; MAT 167; or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 261 — Lie Groups & Lie Algebras (4 units)

Course Description: Lie groups, examples and topological properties. Lie algebras and representation theory, and semisimple Lie algebras.
Prerequisite(s): MAT 147 and MAT 150A strongly encouraged; or equivalent; MAT 250A and MAT 215A and MAT 239 (can be concurrent) recommended.
Learning Activities: Lecture 3 hour(s); Extensive Problem Solving.
Enrollment Restriction(s): Open to graduate students only; or consent of instructor.
Grade Mode: Letter.

MAT 265 — Mathematical Quantum Mechanics (4 units)

Course Description: Mathematical foundations of quantum mechanics: the Hilbert space and Operator Algebra formulations; the Schrödinger and Heisenberg equations, symmetry in quantum mechanics, basics of spectral theory and perturbation theory. Applications to atoms and molecules. The Dirac equation.
Prerequisite(s): MAT 201; or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Grade Mode: Letter.

MAT 266 — Mathematical Statistical Mechanics & Quantum Field Theory (4 units)

Course Description: Mathematical principles of statistical mechanics and quantum field theory. Topics include classical and quantum lattice systems, variational principles, spontaneous symmetry breaking and phase transitions, second quantization and Fock space, and fundamentals of quantum field theory.
Prerequisite(s): MAT 265; or consent of instructor.
Learning Activities: Lecture 3 hour(s), Term Paper/Discussion 1 hour(s).
Repeat Credit: May be repeated 1 time(s).
Grade Mode: Letter.

MAT 270 — Mathematics of Data Science (4 units)

Course Description: Mathematical methods and algorithms that are fundamental to a variety of data science applications. Theoretical foundations and inner workings of popular algorithms used in data science, machine learning, and artificial intelligence. Implementation and application of these algorithms to real-world data sets.
Prerequisite(s): MAT 127A; MAT 167; MAT 135A.
Learning Activities: Lecture 3 hour(s), Extensive Problem Solving.
Enrollment Restriction(s): Open to Graduate Students; undergraduate students obtain consent of instructor.
Grade Mode: Letter.

MAT 271 — Applied & Computational Harmonic Analysis (4 units)

Course Description: Introduction to mathematical basic building blocks (wavelets, local Fourier basis, and their relatives) useful for diverse fields (signal and image processing, numerical analysis, and statistics). Emphasis on the connection between the continuum and the discrete worlds.
Prerequisite(s): (MAT 125B or MAT 201C); (MAT 128B or MAT 167); MAT 129; or the equivalent, or consent of instructor.
Learning Activities: Lecture 3 hour(s), Extensive Problem Solving.
Grade Mode: Letter.

MAT 280 — Topics in Pure & Applied Mathematics (3 units)

Course Description: Special topics in various fields of pure and applied mathematics. Topics selected based on the mutual interests of students and faculty.
Prerequisite(s): Graduate standing.
Learning Activities: Lecture 3 hour(s).
Repeat Credit: May be repeated when topic differs.
Grade Mode: Letter.

MAT 290 — Seminar (1-6 units)

Course Description: Advanced study in various fields of mathematics, including analysis, applied mathematics, discrete mathematics, geometry, mathematical biology, mathematical physics, optimization, partial differential equations, probability, and topology.
Learning Activities: Seminar 1-6 hour(s).
Repeat Credit: May be repeated.
Grade Mode: Satisfactory/Unsatisfactory only.

MAT 298 — Group Study (1-5 units)

Course Description: Group study.
Learning Activities: Variable.
Grade Mode: Letter.

MAT 299 — Individual Study (1-12 units)

Course Description: Individual study.
Learning Activities: Variable.
Grade Mode: Satisfactory/Unsatisfactory only.

MAT 299D — Dissertation Research (1-12 units)

Course Description: Dissertation research.
Learning Activities: Variable.
Repeat Credit: May be repeated.
Grade Mode: Satisfactory/Unsatisfactory only.