

# MATHEMATICS (MATH)

## MATH 405G Numerical Analysis I 3 Hours

Computer arithmetic, roots of equations, polynomial approximation and interpolation, numerical differentiation and integration. Computer solutions of problems will be required.

**Prerequisite(s):** (MATH 307 or MATH 310 or MATH 237) and (CS 180 or CS 146) or permission of instructor

**Equivalent(s):** CS 405G

*Recent Term(s) Offered:* fall 2022; fall 2023; fall 2024

## MATH 406G Numerical Analysis II 3 Hours

The solution of linear systems by direct and iterative methods, matrix inversion, the calculation of eigenvalues and eigenvectors of matrices. Initial and boundary value problems in ordinary differential equations. Computer solution of problems will be required.

*Recent Term(s) Offered:* spring 2022; spring 2023; spring 2024

## MATH 409G History of Mathematics 3 Hours

History of mathematics from ancient times through the development of calculus with emphasis on famous problems. Provides knowledge and appreciation useful in the classroom. Term papers will be required. Note: 6 hours of undergraduate mathematics required.

**Prerequisite(s):** permission of instructor

**Restriction(s):** Students cannot enroll who are in Mathematics (085)

*Recent Term(s) Offered:* None

## MATH 411G Problem Solving for Elementary and Middle Grades Teachers 3 Hours

Integrates concepts developed in algebra, geometry, logic, statistics, probability, and elementary number theory. Students are encouraged to use problem-solving strategies, models, and technologies, and to create problems of their own. This course is only for students enrolled in the MAE in Elementary Mathematics Specialist P-5 degree.

**Restriction(s):** Students cannot enroll who are in Secondary Ed Teacher Leader (0435) or Mathematics (085)

*Recent Term(s) Offered:* fall 2022; fall 2023; fall 2024

## MATH 415G Algebra and Number Theory 3 Hours

Survey of modern algebra and number theory. Includes number systems, divisibility, congruences, groups and their application to number theory.

*Recent Term(s) Offered:* spring 2023

## MATH 417G Algebraic Systems 3 Hours

The theory of finite groups and related algebraic systems. Lagrange's Theorem, Sylow Theorems, and the structure of finite groups are studied. Applications of group theory to the study of algebraic problems and symmetry.

*Recent Term(s) Offered:* spring 2022; spring 2023

## MATH 431G Intermediate Analysis I 3 Hours

Topics in analysis chosen from inverse and implicit function theorems, differentiation, integration, infinite series, series of functions, and introductory functional analysis.

*Recent Term(s) Offered:* fall 2022; fall 2023; fall 2024

## MATH 435G Partial Differential Equations 3 Hours

Equations of first and second order; elliptic, hyperbolic and parabolic equations of mathematical physics using separation of variables and Fourier series.

*Recent Term(s) Offered:* spring 2024

## MATH 439G Topology I 3 Hours

Introduction to topology including topics selected from: topological spaces, mappings, homeomorphisms, metric spaces, surfaces, knots, manifolds, separation properties, compactness and connectedness.

*Recent Term(s) Offered:* fall 2022; fall 2024

## MATH 450G Complex Variables 3 Hours

Complex number plane, analytic functions of a complex variable, integration, power series, calculus of residues, conformal representation, applications of analytic function theory.

*Recent Term(s) Offered:* spring 2023; spring 2024

## MATH 470G Introduction to Operations Research 3 Hours

Principles and techniques of operations research including linear programming, integer programming, quality theory, sensitivity analysis, and dynamic programming.

*Recent Term(s) Offered:* None

## MATH 482G Probability & Statistics II 3 Hours

Multivariate probability distributions; sampling distributions, statistical inference; point and interval estimation, properties of estimators; hypothesis testing; regression and correlation; analysis of variance; non-parametric methods.

*Recent Term(s) Offered:* None

## MATH 500 Readings in Mathematics 1-3 Hours (repeatable max of 6 hrs)

Students read and present papers that have appeared in (or have been accepted by) mathematical journals. Topics covered are determined by areas of interest. Note: Undergraduate major in mathematics required.

**Prerequisite(s):** permission of instructor

*Recent Term(s) Offered:* summer 2022; summer 2023; fall 2023; summer 2024

## MATH 501 Introduction to Probability and Statistics I 3 Hours

Interpreting, analyzing, and simulating univariate and bivariate data; probability and sampling distributions; regression and chi-squared procedures from traditional and randomization approaches.

**Restriction(s):** Enrollment is limited to students in Mathematics (049)

*Recent Term(s) Offered:* spring 2022; spring 2023; spring 2024

## MATH 503 Introduction to Analysis 3 Hours

Theoretical examination of selected topics in real analysis including sequences, series, limits, continuity, derivatives, and integration.

**Restriction(s):** Enrollment is limited to students in Mathematics (049)

*Recent Term(s) Offered:* fall 2022; spring 2023; fall 2023; fall 2024

## MATH 504 Application of Technology to Problems in Mathematics 3 Hours

Problem solving via non-routine problems from various branches of mathematics, including, but not limited to number theory, discrete math, linear algebra, calculus, probability, and statistics.

**Restriction(s):** Enrollment is limited to students in Mathematics (049)

*Recent Term(s) Offered:* summer 2022; summer 2024

## MATH 506 Mathematical Applications for Middle Grades Teachers 3 Hours

Advanced study in logic, discrete mathematics, functions, and modeling, as appropriate for middle grades mathematics teachers.

**Prerequisite(s):** permission of instructor

**Restriction(s):** Students cannot enroll who are in Mathematics (049) or Mathematics (085)

*Recent Term(s) Offered:* None

**MATH 507 Number Systems for Elementary and Middle Grades****Teachers 3 Hours**

Conceptual development of numeration systems and structures, set and number theory, and sequences. This course is only for students enrolled in the MAE in Middle Grades Math or Elementary Mathematics Specialist P-5 degrees; or permission of instructor.

*Recent Term(s) Offered: summer 2023*

**MATH 508 Rational Number Concepts for Elementary and Middle Grades Teachers 3 Hours**

Conceptual development of rational number representations, ratios, and proportional reasoning. This course is only for students enrolled in the MAE in Middle Grades Math or Elementary Mathematics Specialist P-5 degrees.

**Restriction(s):** Students cannot enroll who are in Secondary Ed Teacher Leader (0435) or Mathematics (085)

*Recent Term(s) Offered: summer 2022; summer 2024*

**MATH 510 Intermediate Statistics 3 Hours**

Extended coverage of experimental design and data collection, statistical inference including confidence intervals, estimation, tests of significance, comparison of population parameters, and multiple regression.

**Prerequisite(s):** MATH 501

*Recent Term(s) Offered: summer 2022; summer 2023; summer 2024*

**MATH 511 Algebra from an Advanced Perspective 3 Hours**

Topics in algebra from an advanced perspective including analysis of functions and polynomials, number theory, and fields.

**Restriction(s):** Enrollment is limited to students in Mathematics (049)

*Recent Term(s) Offered: fall 2022; summer 2023; fall 2023; fall 2024*

**MATH 512 Geometry from an Advanced Perspective 3 Hours**

Topics in geometry from an advanced perspective including a theoretical examination of transformations in real and complex plane; distance congruence, and similarity in a variety of contexts; connections and applications between geometry, trigonometry, and calculus.

*Recent Term(s) Offered: spring 2022; spring 2023; spring 2024*

**MATH 514 Mathematical Modeling and Applications 3 Hours**

Uses mathematical modeling to describe and explore real world problems using algebraic, geometric, and statistical approaches.

**Restriction(s):** Enrollment is limited to students in Mathematics (049)

*Recent Term(s) Offered: spring 2022; summer 2023; spring 2024; fall 2024*

**MATH 515 Introduction to Number Theory 3 Hours**

An introduction to number theory, including, but not limited to, divisibility, congruences, quadratic reciprocity, theory of primes, Fermat's Theorem, Euler's Theorem, application problems

**Restriction(s):** Enrollment is limited to students in Mathematics (049)

*Recent Term(s) Offered: spring 2023; spring 2024*

**MATH 517 Topics from Algebra 3 Hours**

Theory of rings, fields, and vector spaces. Topics include: polynomial rings, principal ideal domains, unique factorization domains, field extensions, Galois theory.

*Recent Term(s) Offered: None*

**MATH 529 Applied Probability 3 Hours**

Axiomatic development of the theory of probability. Introduction to Markov chains, random variables, distributions, transformations. Limit theorems and various modes of convergence.

*Recent Term(s) Offered: None*

**MATH 531 Advanced Differential Equations 3 Hours**

Power series solutions, existence and uniqueness theorems, stability and Liapunov's method, regular singular points, perturbations of periodic solutions.

*Recent Term(s) Offered: None*

**MATH 532 Real Analysis 3 Hours**

Function spaces, additive set functions, outer measure; measurable functions, integration.

*Recent Term(s) Offered: spring 2022*

**MATH 535 Advanced Applied Mathematics- I 3 Hours**

Eigenvalue and boundary value problems, orthogonal expressions in function spaces, classic polynomials, Sturm-Liouville theory, Fourier and Laplace transforms.

*Recent Term(s) Offered: fall 2023*

**MATH 536 Advanced Applied Mathematics- II 3 Hours**

Integral equations, calculus of variations, maximization of linear functionals, gradient methods.

**Prerequisite(s):** MATH 535

*Recent Term(s) Offered: None*

**MATH 539 Topology II 3 Hours**

Homotopy, homology theory.

*Recent Term(s) Offered: None*

**MATH 540 Stochastic Processes 3 Hours**

Theory and application of stochastic processes; random walks; Markov chains; Poisson processes; birth and death processes; queues; renewal and branching processes; computer simulations.

*Recent Term(s) Offered: None*

**MATH 541 Graph Theory 3 Hours**

Introduction to the basic concepts of graph theory. Topics include Eulerian circuits, Hamiltonian cycles, coloring problems and planar graphs. Note: Undergraduate major in mathematics required.

**Prerequisite(s):** permission of instructor

*Recent Term(s) Offered: spring 2023*

**MATH 542 Advanced Topics in Discrete Mathematics 3 Hours**

Combinatorics, ordered sets and lattice theory, modeling with difference equations, discrete calculus, dynamic equations on time scales.

*Recent Term(s) Offered: None*

**MATH 550 Complex Analysis 3 Hours**

Analytic continuation, conformal mapping, Riemann surfaces, and univalent functions.

*Recent Term(s) Offered: None*

**MATH 570 Topics in Operations Research 3 Hours**

Specific area(s) of operations research.

*Recent Term(s) Offered: None*

**MATH 585 Advanced Mathematical Thinking I 3 Hours**

Students will explore and identify connections between research in mathematics education and the mathematics content, from an advanced perspective, they are teaching in their courses.

**Prerequisite(s):** (MATH 501 and MATH 503 and MATH 511) and (MATH 512 or MATH 515 (may be taken concurrently))

**Restriction(s):** Enrollment is limited to students in Mathematics (049)

*Recent Term(s) Offered: summer 2023; summer 2024*

**MATH 590 Special Topics in Mathematics 3 Hours** (repeatable max of 6 hrs)

No course description is available.

**Prerequisite(s):** permission of instructor

*Recent Term(s) Offered: fall 2022; fall 2023; spring 2024*

**MATH 595 Advanced Mathematical Thinking II 3 Hours**

Students will conduct their own research project regarding secondary students' mathematical thinking, applying what was learned in MATH 585 (Adv Mathematical Thinking I).

**Prerequisite(s):** MATH 585

**Restriction(s):** Enrollment is limited to students in Mathematics (049)

*Recent Term(s) Offered: fall 2023; fall 2024*

**MATH 598 Graduate Seminar: Communicating Mathematics and Technical Writing 3 Hours**

This course will familiarize graduate students in mathematics with the many different areas of mathematics and active research topics in the field as well as give them an opportunity to practice effective oral presentation skills. Students will also learn mathematical typesetting with LaTeX.

*Recent Term(s) Offered: spring 2022; spring 2023; fall 2023; spring 2024; fall 2024*

**MATH 599 Thesis/Research 1-6 Hours** (repeatable max of 6 hrs)

Thesis research and writing directed by faculty committee.

*Recent Term(s) Offered: spring 2022; fall 2022; spring 2023; fall 2023; spring 2024; fall 2024*

**MATH 600 Maintaining Matriculation 1-6 Hours** (repeatable max of 6 hrs)

Continued enrollment for thesis completion.

*Recent Term(s) Offered: fall 2022*