MAT: MATHEMATICS

Courses

MAT 500. Fundamentals of Applied Mathematics. 3 Credits.
This course is designed to provide an intense review of the core concepts essential to the study of applied mathematics. Topics include the main theorems of differential and integral calculus; techniques and theorems of vector analysis; sequences and power series; complex arithmetic and elementary complex-valued functions; first-order, second-order, and systems of linear differential equations; matrix algebra and vector spaces. The computer algebra systems Matlab and Mathematica will be introduced as computational tools for these topics.

MAT 503. History Of Mathematics. 3 Credits.
This course will cover selected topics from the history of mathematics. Many great mathematicians will be studied including Hippocrates, Euclid, Archimedes, Heron, Cardano, Newton, the Bernoulli Brothers, Euler, Gauss, and others. Mathematics problems will be approached using the methods and knowledge of the era studied. A solid background in undergraduate mathematics is required.

MAT 513. Linear Algebra. 3 Credits.
Vectors, vector spaces, determinants, linear transformations, matrices, and bilinear and quadratic forms.
MAT 513 Prerequisite: Successful completion of MAT 512, with a minimum grade of C-.

MAT 514. Theory of Numbers. 3 Credits.
This course covers divisibility, linear congruence, the Chinese Remainder Theorem, Euler's phi function, primitive roots, and quadratic reciprocity. Additional topics may include public-key cryptography, Diophantine equations, continued fractions, and the distribution of primes.
MAT 514 Prerequisite: Successful completion of MAT 200, with a minimum grade of C-.

MAT 515. Algebra I. 3 Credits.
Elements of abstract algebra, groups, commutative ring theory, modules, and associative algebras over commutative rings. Offered in fall of odd-numbered years.

MAT 516. Algebra II. 3 Credits.
A continuation of MAT 515. Vector spaces, representation theory, and Galois theory.
MAT 516 Prerequisite: Successful completion of MAT 515, with a minimum grade of C-.

MAT 517. Topics in Algebra. 3 Credits.
In this topics course students explore the details surrounding James Tanton's Exploding Dots concept. Specifically they (1) introduce the concept as a generalization of place value; (2) then generalize this notion to polynomials to investigate operations on polynomials, including polynomial long-division; (3) they go on to take a quick look at the arithmetic of infinite series; (4) then take a slight detour to look at more general "machines" (this leads them to exotic number representations such as base -3/2); (5) finally they conclude the exploration with a quick investigation of complex numbers (using the exploding dots concept).

MAT 521. Discrete Mathematics & Graph Theory. 3 Credits.
Topics from Discrete Mathematics including the study of logic, sets, relations, and counting will be introduced. Graphs and Graph Theory will be discussed, including Eulerian and Hamiltonian Graphs, Digraphs, Trees, Algorithms, Paths, Planarity, and Chromatic Numbers. Applications such as Social Network Analysis will be stressed.

MAT 532. Geometry I. 3 Credits.
This course is a rigorous introduction to geometry from a transformational point of view, emphasizing Euclidean, hyperbolic, and/or projective geometry. Other topics such as Spherical geometry, symplectic geometry, or Affine geometry may be included if time permits.

MAT 533. Geometry II. 3 Credits.
A study of geometry using calculus as our main tool. The course covers the basics of differential geometry: parametrizations, tengent spaces, curvature, geodesics; leading to Stokes theorem and the Gauss-Bonnett theorem. Several examples will be studied in depth, including the sphere and the projective plane.

MAT 535. Topology. 3 Credits.
This course is a rigorous introduction to point-set topology. Topics covered include topological spaces and continuous functions, connectedness, compactness, separation axioms, metrization theorems, and function spaces.

MAT 536. Algebraic Topology. 3 Credits.
This course is an introduction to the fundamental techniques of algebraic topology. Topics covered include fundamental groups and covering spaces, basic homological algebra, simplicial homology, singular homology, and cohomology.

MAT 543. Topics in Differential Equations. 3 Credits.
An advanced topics course. Existence and uniqueness theorems, stability theory, singular points, regular singular points, Sturm separation theorem, and the "method of Liapunov."

MAT 545. Real Analysis I. 3 Credits.
A rigorous study of real-valued functions of real variables.

MAT 546. Real Analysis II. 3 Credits.
Continuation of MAT 545.
MAT 546 Prerequisite: Successful completion of MAT 545, with a minimum grade of C-.

MAT 548. Industrial Mathematics - Continuous Models. 3 Credits.
This course is designed to provide a survey of mathematical concepts, techniques, and numerical algorithms used to study real-world continuous mathematical models. Application areas include population dynamics, climatology, feedback and control systems, traffic flow, diffusion, fluids and transport, and epidemiology. Computer software packages such as Matlab, Mathematica, and Maple will be used in the analysis of the problems.
MAT 548 Prerequisite: Successful completion of MAT 500, with a minimum grade of C-.

MAT 549. Industrial Mathematics - Discrete Models. 3 Credits.
This course is designed to provide a survey of mathematical concepts, techniques, and numerical algorithms used to study real-world discrete mathematical models. Application areas include forestation, particle dynamics, image processing, genetics, queues, efficient call and traffic routing, and optimal scheduling. Computer software packages such as Matlab, Mathematica, and Maple will be used in the analysis of the problems.
MAT 549 Prerequisite: Successful completion of MAT 500, with a minimum grade of C-.

MAT 552. Operations Research. 3 Credits.
This course provides an overview of deterministic operations research methodology including linear, integer, nonlinear, and dynamic programming, and classical optimization problems. The computer algebra system MATLAB and other software will be used as an investigative tool in analyzing the problems that arise.
MAT 552 Prerequisite: Successful completion of MAT 500, with a minimum grade of C-.

MAT 553. Stochastic Modeling. 3 Credits.
This course introduces topics in stochastic optimization and control (including Markov chains, queueing theory, reliability theory, inventory theory, and forecasting), discrete-event and Monte Carlo simulation, and stochastic differential equations. Applications are drawn from manufacturing, finance, logistics, and service systems. The computer algebra system MATLAB and other software will be used as an investigative tool in analyzing these models.
MAT 553 Prerequisite: Successful completion of MAT 500, with a minimum grade of C-.

MAT 554. Scientific Computing. 3 Credits.
This case-study driven course will illustrate the use of computational tools in multiple science and engineering domains. The focus is on using MATLAB and appropriate numerical methods (including solutions of linear and nonlinear algebraic equations, solutions of ordinary and partial differential equations, finite elements, linear programming, optimization algorithms, and fast-Fourier transforms) to assist in investigating mathematical models of phenomena in the physical, ecological, and financial realms.
MAT 554 Prerequisite: Successful completion of MAT 500, with a minimum grade of C-.

MAT 555. Industrial Practicum - Continuous Models. 3 Credits.
This is a case study, team problem-solving based course focused on solving real-world problems that can be modeled using continuous mathematics techniques and that emanate from industry. Ideally, the problems would be obtained from partnerships with local industry and they will ordinarily focus on topics arising in optimization, financial mathematics, and other stochastic models.
MAT 555 Prerequisite: Successful completion of MAT 548, MAT 549; and MAT 552, MAT 553, or MAT 554, with minimum grades of C-.

MAT 556. Industrial Practicum - Discrete Models. 3 Credits.
This is a case study, team problem-solving based course focused on solving real-world problems that can be modeled using discrete mathematics techniques and that emanate from industry. Ideally, the problems would be obtained from partnerships with local industry and they will ordinarily focus on topics arising in the biological, natural, and physical sciences.
MAT 556 Prerequisite: Successful completion of MAT 548, MAT 549; and MAT 552, MAT 553, or MAT 554, with minimum grades of C-.

MAT 575. Complex Analysis I. 3 Credits.
This course covers basic properties of functions of a single complex variable. Topics include complex arithmetic, analytic functions and mappings, contour integrals, Cauchy's Theorem, Taylor and Laurent series, and the theory and application of residues.
MAT 575 Prerequisite: Successful completion of MAT 261, with a minimum grade of C-.

MAT 595. Topics in Mathematics. 1-3 Credits.
Topics announced at time of offering.
Repeatable for credit.

MAT 599. Independent Study. 3 Credits.
Students will work independently on a mathematics topic of their choice under the aegis of a Mathematics Department faculty member.

MAT 609. Thesis I. 3 Credits.
Conduct literature search, develop thesis proposal and begin research under the guidance of a mathematics department faculty member.

MAT 610. Thesis II. 3 Credits.
This course is a continuation of MAT 609. The student will continue research under the guidance of a Mathematics Department faculty member and prepare their thesis for submission.