MATHEMATICS (MATH)

MATH 112. Introduction to Mathematical Modeling. 1 Credit.
Offered Spring Semester Only; Lecture hours:3
Introduction for the non-specialist to mathematical modeling of real-world phenomena such as voting and networks, using graph theory, probability, and other accessible tools.

MATH 117. Introduction to Mathematical Thought. 1 Credit.
Offered Spring Semester Only; Lecture hours:3,Lab:1.5
An investigation of number, numeration, and operations from the perspective of elementary school teachers and pupils. Open only to B.S. in Education Early Childhood Pre-K to 4 students. Required fieldwork.

MATH 118. Elementary Geometry and Statistics. 1 Credit.
Offered Fall Semester Only; Lecture hours:3
Investigation of geometric, probabilistic, and statistical concepts related to Pre-K to 4 mathematics and how children learn and make sense of these concepts. Prerequisite: permission of the instructor. Prerequisite: MATH 117 or permission of the instructor.

MATH 192. Topics in Calculus. 1 Credit.
Offered Spring Semester Only; Lecture hours:3
Elementary calculus and applications taken primarily from economics. Topics include algebraic, exponential, and logarithmic functions, graphs, limits, derivatives and integration. Not open to students who have taken MATH 201.

MATH 201. Calculus I. 1 Credit.
Offered Both Fall and Spring; Lecture hours:4
An introduction to the calculus of algebraic, trigonometric and transcendental functions. Interpretation, significance and calculations of a derivative. Applications to geometry, biology, physics, economics, and other subjects. Introduction to the definite integral, including the Fundamental Theorem of Calculus. Not open to students who have taken MATH 192.

MATH 202. Calculus II. 1 Credit.
Offered Both Fall and Spring; Lecture hours:4
Methods of integration including substitution, integration by parts, numerical approximations, and improper integrals. Series, including Taylor series. Complex numbers, polar coordinates, differential equations, and applications. Prerequisite: MATH 201.

MATH 207. The Teaching of Mathematics in Secondary Schools. 1 Credit.
Offered Fall Semester Only; Lecture hours:3,Other:.5
Investigation into the components of effective secondary school mathematics instruction, including lesson design/ implementation (curriculum, tasks, discourse, and assessment). Required fieldwork. Prerequisite: EDUC 201 or permission of the instructor.

MATH 208. Mathematical Explorations. .5 Credits.
Offered Fall Semester Only; Lecture hours:1.5
An exploration of topics from pure mathematics, applied mathematics and statistics, illustrating the power and beauty of mathematical reasoning. For students considering a major in mathematics. Corequisites: MATH 201 or MATH 202 or MATH 211 or MATH 212 or MATH 216. Open to first-year students only.

MATH 209. Mathematical Problem Solving. .5 Credits.
Offered Fall Semester Only; Lecture hours:Varies; Repeatable
Mathematical problem solving, with an emphasis on problems and topics that appear in contests such as the Putnam Competition. Prerequisite: permission of the instructor.

MATH 211. Calculus III. 1 Credit.
Offered Both Fall and Spring; Lecture hours:4
Calculus of vector-valued functions and functions of several variables. Multiple, line, and surface integrals; applications, and extrema. Green's, Stokes' and Divergence Theorems. Prerequisite: MATH 202.

MATH 212. Differential Equations. 1 Credit.
Offered Both Fall and Spring; Lecture hours:3
Basic methods of solving ordinary differential equations. Systems of linear differential equations, Laplace transform, applications and selected topics. Prerequisite: MATH 211. Not open to students who have taken MATH 222.

MATH 216. Statistics I. 1 Credit.
Offered Both Fall and Spring; Lecture hours:3,Other:1
Exploratory data analysis, sampling distributions, regression, sampling designs, confidence intervals, hypothesis testing, ANOVA. Statistical software is used and applications, including projects, are undertaken. Not open to students who have taken MATH 226 or PSYC 215.

MATH 217. Statistics II. 1 Credit.
Offered Fall Semester Only; Lecture hours:3,Other:1
Exploratory data analysis, design of experiments and inference emphasizing applications to a range of disciplines. Includes multiple linear regression, analysis of variance, categorical data analysis, nonparametric statistics. Prerequisite: MATH 216 or equivalent. Crosslisted as MATH 617.

MATH 219. Topics in Applied Mathematics. 1 Credit.
Offered Occasionally; Lecture hours:3; Repeatable
Topics such as financial mathematics, mathematical biology, cryptography, social networks, etc. Topic varies by semester. Prerequisite: varies by topic.

MATH 222. Differential Equations for Engineers. .5 Credits.
Offered Spring Semester Only; Lecture hours:3
First order differential equations, second order linear equations, higher order linear equations, numerical approximations. Prerequisite: MATH 211. Open only to civil engineering and computer science engineering students. Not open to students who have taken MATH 212.

MATH 226. Probability and Statistics for Engineers. .5 Credits.
Offered Fall Semester Only; Lecture hours:3
Descriptive modeling and statistics, sampling and experimental design, discrete and continuous random variables, central limit theorem, and elementary inference. Prerequisite: MATH 202. Open only to engineering students and students in computer science. Not open to students who have taken MATH 216.

MATH 240. Combinatorics and Graph Theory. .5 Credits.
Offered Spring Semester Only; Lecture hours:3
Counting techniques and traversal problems. Does not count toward the major. Students join MATH 241 mid-semester. Corequisite: MATH 280. Only for computer science students or students seeking secondary certification.

MATH 241. Discrete Structures. 1 Credit.
Offered Spring Semester Only; Lecture hours:3
Logic, sets; mathematical induction; relations, functions; combinatorics and graph theory. Does not count toward the mathematics major. Prerequisite: MATH 202.

MATH 245. Linear Algebra. 1 Credit.
Offered Both Fall and Spring; Lecture hours:3
Linear equations, matrices, vector spaces, linear transformations, determinants, eigenvalues. Prerequisite: MATH 202.

MATH 260. Applications of Calculus to Medicine and Biology. 1 Credit.
Offered Occasionally; Lecture hours:3
Biology has been described as the most mathematical science. Researchers in biology use mathematical models to design strategies for controlling epidemics, administering drugs, and managing ecosystems. In this class you will learn how to develop your own models, approximate solutions to your models, and compare these solutions to real data. Crosslisted as BIOL 360 or BIOL 662.

MATH 280. Logic, Sets, and Proofs. 1 Credit.
Offered Both Fall and Spring; Lecture hours:3
Logic, sets; proof techniques; relations, functions, sequences and convergence; cardinality. Skills and tools for independent reading, problem solving and exploration. Prerequisite: MATH 211 or MATH 245.

MATH 291. Undergraduate Readings. .5-2 Credits.
Offered Either Fall or Spring; Lecture hours:Varies; Repeatable
Readings and research in special topics at an intermediate level. Prerequisites: permission of the instructor, adviser, and department chair.

MATH 303. Probability. 1 Credit.
Offered Both Fall and Spring; Lecture hours:3
Elementary probability, random variables, moments, central limit theorem, conditional expectation, statistical distributions derived from the normal distribution. Probability simulations and applications from various fields. Prerequisite: MATH 211. Crosslisted as MATH 603.

MATH 304. Statistical Inference Theory. 1 Credit.
Offered Both Fall and Spring; Lecture hours:3
Point and interval estimation, hypothesis testing, Fisher's likelihood theory, frequentist versus Bayesian approach, computational statistics. Crosslisted as MATH 604.

MATH 308. Real Analysis I. 1 Credit.
Offered Both Fall and Spring; Lecture hours:3
Real numbers and elementary topology of Cartesian spaces, convergence, continuity, differentiation, and history of the development of analysis. Prerequisites: MATH 211, MATH 245, and MATH 280.

MATH 311. Theory of Numbers. 1 Credit.
Offered Alternate Fall or Spring; Lecture hours:3
Classical number theory in an algebraic setting. Topics include unique factorization, diophantine equations, and linear and quadratic congruences. Advanced topics from algebraic or analytic number theory. Prerequisites: MATH 245 and MATH 280 and permission of the instructor. Crosslisted as MATH 611.

MATH 319. Topics in Advanced Mathematics. 1 Credit.
Offered Alternate Fall or Spring; Lecture hours:3; Repeatable
Special topics, to be selected from algebra, analysis, geometry, statistics, applied mathematics, etc. Crosslisted as MATH 619.

MATH 320. Abstract Algebra I. 1 Credit.
Offered Both Fall and Spring; Lecture hours:3
Groups and rings; homomorphisms and isomorphism theorems; history of the development of algebra. Additional selected topics. Prerequisites: MATH 245 and MATH 280.

MATH 333. Topology. 1 Credit.
Offered Alternate Fall or Spring; Lecture hours:3
Topological spaces, connectedness, compactness, continuity, separation, and countability axioms. Metric, product, function, and uniform spaces. Prerequisites: MATH 211 and MATH 280, or permission of the instructor. Crosslisted as MATH 633.

MATH 335. Geometry. 1 Credit.
Offered Fall Semester Only; Lecture hours:3
Historical and axiomatic foundations of geometry. Euclidean and non-Euclidean geometries. Prerequisite: MATH 280 or permission of the instructor. Crosslisted as MATH 635.

MATH 343. Numerical Analysis. 1 Credit.
Offered Fall Semester Only; Lecture hours:3,Lab:2
Floating point arithmetic, development of computational algorithms and error estimates for root approximation, interpolation and approximation by polynomials, numerical differentiation and integration, cubic splines, least-squares, linear systems, lab component. Prerequisites: MATH 211, CSCI 203, and one of MATH 241, MATH 245, or MATH 280; or permission of the instructor. Crosslisted as MATH 643.

MATH 345. Advanced Linear Algebra. 1 Credit.
Offered Alternate Fall or Spring; Lecture hours:3
Systems of linear equations, determinants, vector spaces, canonical forms for linear transformations and matrices, bilinear forms, inner product spaces, applications to such other areas as geometry, differential equations, linear programming. Prerequisites: MATH 245 and either MATH 280 or permission of the instructor. Crosslisted as MATH 645.

MATH 350. Methods in Applied Mathematics. 1 Credit.
Offered Alternate Fall or Spring; Lecture hours:3
Techniques drawn from partial differential equations, transform methods, Fourier and complex analysis, and variational calculus. Prerequisite: junior or senior status; MATH 212 or MATH 222 or permission of the instructor. Crosslisted as MATH 650.

MATH 358. Topics in Operations Research. 1 Credit.
Offered Spring Semester Only; Lecture hours:3
Mathematical and statistical techniques in operations research. Queueing theory. Additional topics may include simulation, forecasting, non-linear programming, inventory models. Methods and applications drawn from various fields. Prerequisite: MATH 303 or permission of the instructor. Crosslisted as MATH 658.

MATH 362. Complex Analysis. 1 Credit.
Offered Alternate Fall or Spring; Lecture hours:3
Limits, analytic functions, integrals including contour integrals. Cauchy's Integral Theorem, entire functions and singularities. Prerequisites: MATH 211 and MATH 280, or permission of the instructor. Crosslisted as MATH 662.

MATH 378. Seminar. .5 Credits.
Offered Either Fall or Spring; Lecture hours:2; Repeatable
Seminar based on topics from algebra, analysis, topology, differential equations, statistics, or applied mathematics; topics selected according to demand or interest. Prerequisite: permission of the instructor. Crosslisted as MATH 678.

MATH 391. Reading and Research. .5-2 Credits.
Offered Either Fall or Spring; Lecture hours:Varies; Repeatable
Reading and research in various topics for qualified undergraduate students. Prerequisite: permission of the instructor.

MATH 405. Statistical Modeling. 1 Credit.
Offered Fall Semester Only; Lecture hours:3
Regression and analysis of (co)variance. Model diagnosis and remediation. Model selection, multicollinearity, logistic regression. R or SAS will be used. Prerequisites: MATH 245 and MATH 304. Crosslisted as MATH 605.

MATH 407. Statistical Design of Scientific Studies. 1 Credit.
Offered Spring Semester Only; Lecture hours:3
Experiments, observational studies. Completely randomized, block, mixed models, crossed, nested design. Simple random, stratified, cluster sampling. Estimation procedures, sample size calculations. Uses R or SAS. Prerequisite: MATH 304.

MATH 409. Real Analysis II. 1 Credit.
Offered Alternate Fall or Spring; Lecture hours:3
Continuation of MATH 308. Integration theory and advanced topics in analysis. Prerequisite: MATH 308. Crosslisted as MATH 609.

MATH 416. Modern Applied Mathematics. 1 Credit.
Lecture hours:3
Possible topics include wavelets, harmonic analysis, computational mathematics, nonlinear dynamics, dynamical systems, scientific computing, or cryptography. Prerequisites: MATH 212 and MATH 308, or permission of the instructor.

MATH 446. Abstract Algebra II. 1 Credit.
Offered Alternate Fall or Spring; Lecture hours:3
Advanced topics in group theory including solvable groups, field theory and Galois theory. Prerequisite: MATH 320. Crosslisted as MATH 646.

MATH 491. Reading and Research. .5-2 Credits.
Offered Either Fall or Spring; Lecture hours:Varies; Repeatable
Reading and research in various topics for qualified undergraduates or graduate students at a level appropriate for a Culminating Experience. Prerequisite: permission of the instructor, adviser, and department chair.