Department of Mathematical Sciences

The Department of Mathematical Sciences offers programs of study for students interested in mathematics, mathematics education or statistics. The department is dedicated to providing students with excellent instruction that incorporates innovative instructional techniques and technologies. In their roles as teacher-scholars, the faculty maintains consistent and significant productivity, recognized at regional, national, and international levels, in basic research, applications, and pedagogy. The department is strengthened by the extensive service activities of the faculty on campus and in the community as well as through high-profile service to the profession. In addition, the department provides many areas for student involvement, including an active student organization and student competition teams.

Mathematical Sciences Majors


Mathematical Sciences Minor


MATH 0991 Algebra Lab
1 Credit Hour. 1 Lecture Hour. 0 Lab Hours.
Provides additional instruction on selected topics from MATH 1111 and is open to all students. MATH 0991 is a required course for any student who makes below a C in MATH 1111. Students required to take MATH 0991 must take it concurrently with MATH 1111 until they make at least a C in MATH 1111. Topics covered include a study of functions, equations, graphing, and operations with polynomial, rational, and radical expressions. Also included are appropriate study skills and the use of technology.

MATH 0999 Foundations for College Algebra
4 Credit Hours. 4 Lecture Hours. 0 Lab Hours.
This course is designed for students who are not prepared to enter a college core curriculum mathematics course. MATH 0999 consists of a study of exponents, polynomials, equations, inequalities, functions and graphs, rational expressions, and radicals. Students will be placed in MATH 0999 based on their Mathematics Placement Index (MPI) score. Students will be allowed a maximum of 2 semesters to meet exit requirements for MATH 0999. Audit or institutional credit only.

MATH 0998 Support for Mathematical Modeling
1 Credit Hour. 0 Lecture Hours. 2 Lab Hours.
This course is designed to provide students with mathematics deficiencies “just-in-time” support while they take MATH 1101-Mathematical Modeling. This course will supplement the content of MATH 1101 with the intent of filling the gaps in the students’ mathematical knowledge that is necessary to be successful in the course. Students will be placed in MATH 0998 based on their Mathematics Placement Index (MPI) score. Audit or institutional credit only.

Corequisite(s): MATH 1101.

MATH 0999 Support for College Algebra
1 Credit Hour. 0 Lecture Hours. 2 Lab Hours.
This course is designed to provide students with mathematics deficiencies “just-in-time” support while they take MATH 1111-College Algebra. This course will supplement the content of MATH 1111 with the intent of filling the gaps in the students’ mathematical knowledge that is necessary to be successful in the course. Students will be placed in MATH 0999 based on their Mathematics Placement Index (MPI) score. Audit or institutional credit only.

Corequisite(s): MATH 1111.

MATH 1101 Introduction to Mathematical Modeling
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Mathematical modeling using graphical, numerical, symbolic, and verbal techniques to describe and explore real-world data and phenomena. The investigation and analysis of applied problems and questions, and effective communication of quantitative concepts and results. Topics include linear, quadratic, polynomial, exponential and logarithmic models of real-world phenomena. Credit cannot be earned toward graduation for MATH 1111 if credit is earned for MATH 1101.

Prerequisite(s): Two years of high school algebra or equivalent.

MATH 1111 College Algebra
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
This course provides an in-depth study of the properties of algebraic, exponential and logarithmic functions as needed for calculus. Emphasis is on using algebraic and graphical techniques for solving problems involving linear, quadratic, piecewise defined, rational, polynomial, exponential, and logarithmic functions. Credit cannot be earned toward graduation for MATH 1101 if credit is earned for MATH 1111.

Prerequisite(s): Two years of high school algebra or equivalent.

MATH 1112 Trigonometry
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Circular functions, solutions of triangles, trigonometric identities and equations, graphs of trigonometric functions, Law of Sines, Law of Cosines, applications, vectors, matrices, complex numbers, Euler’s formula, DeMoivre’s theorem. Appropriate technology will be used. Credit may not be received for both MATH 1112 and MATH 1113.

Prerequisite(s): A minimum grade of “C” in MATH 1111.

MATH 1113 Pre-Calculus
3,4 Credit Hours. 3,4 Lecture Hours. 0 Lab Hours.
This course is an intensive study of the basic functions needed for the study of calculus. Topics include algebraic, functional, and graphical techniques for solving problems involving linear, quadratic, piecewise defined, rational, polynomial, exponential, and trigonometric functions and their inverses. Credit cannot be earned toward graduation for MATH 1112 if credit is earned for MATH 1113.

Prerequisite(s): MATH 1111 with a minimum grade of “C”.

MATH 1232 Survey of Calculus
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Covers the fundamental elements of differential and integral calculus of algebraic, logarithmic and exponential functions. Topics include a brief review of algebraic principles, limits, derivatives and integrals. Appropriate technology will be incorporated throughout the course.

Prerequisite(s): A minimum grade of “C” in MATH 1101 or MATH 1111 or MATH 1113 or MATH 1112.

MATH 1401 Intro to Statistics
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
The course is a course in basic statistics. Topics include descriptive statistics, probability, distributions, hypothesis testing, inferences, correlation, and regression.
MATH 1441 Calculus I
4 Credit Hours. 4 Lecture Hours. 0 Lab Hours.
This is the first of a sequence of courses which present a unified treatment of the differential and integral calculus. Topics include: limits, continuity, differentiation and integration, applications of the derivative and the integral.
Prerequisite(s): A minimum grade of "C" in MATH 1112 or MATH 1113.
Cross Listing(s): MATH 1441H.

MATH 1441H Calculus I
4 Credit Hours. 4 Lecture Hours. 1 Lab Hour.
This is the first of a sequence of courses which presents a unified treatment of the differential and integral calculus. Topics include: limits, continuity, differentiation and integration, applications of the derivative and the integral.
Prerequisite(s): A minimum grade of "C" in MATH 1112 or MATH 1113.
Cross Listing(s): MATH 1441H.

MATH 1501 Calculus I
4 Credit Hours. 4 Lecture Hours. 0 Lab Hours.
Topics include functions, limits, continuity, the derivative, antifirrerentiation, the definite integral, and applications.

MATH 2008 Foundations of Numbers and Operations
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
This course is an Area F introductory course for early childhood education majors. This course will emphasize the understanding and use of the major concepts of numbers and operations. As a general theme, strategies of problem solving will be used and discussed in the context of various topics. This course is also part of the program of study for middle grade majors.
Prerequisite(s): A minimum grade of "C" in MATH 1111 or MATH 1101.

MATH 2008H Found of Num and Operations
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
This course is an Area F introductory course for early childhood education majors. This course will emphasize the understanding and use of the major concepts of numbers and operations. As a general theme, strategies of problem solving will be used and discussed in the context of various topics. This course is also part of the program of study for middle grade majors.
Prerequisite(s): MATH 3032 with a minimum grade of "C".

MATH 2130 Discrete Mathematics
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Covers important discrete mathematical objects such as sets, relations and functions, graphs and trees. An introduction to mathematical logic and reasoning, and the concept of an algorithm and its complexity will be covered.
Prerequisite(s): MATH 1111 or MATH 1113 or MATH 1232 or MATH 1441 or MATH 1112 or MATH 2242, with a minimum grade of "C".

MATH 2242 Calculus II
4 Credit Hours. 4 Lecture Hours. 1 Lab Hour.
Includes an introduction to transcendental functions, techniques of integration, improper integrals, infinite series and conics.
Prerequisite(s): MATH 1441, with a minimum grade of "C".
Cross Listing(s): MATH 2242H.

MATH 2242H Calculus II
4 Credit Hours. 4 Lecture Hours. 1 Lab Hour.
Includes an introduction to transcendental functions, techniques of integration, improper integrals, infinite series and conics.
Prerequisite(s): MATH 1441, with a minimum grade of "C".
Cross Listing(s): MATH 2242.

MATH 2243 Calculus III
4 Credit Hours. 4 Lecture Hours. 0 Lab Hours.
Topics in real valued functions of several variables. Topics include polar coordinates, parametric equations, vectors in two and three dimensions, quadric surfaces, partial derivatives and applications, multiple integrals and applications, line integrals and Stoke's and Green's theorem.
Prerequisite(s): A minimum grade of "C" in MATH 2242.
Cross Listing(s): MATH 2243H.

MATH 2243H Calculus III
4 Credit Hours. 4 Lecture Hours. 0 Lab Hours.
Topics in real valued functions of several variables. Topics include polar coordinates, parametric equations, vectors in two and three dimensions, quadric surfaces, partial derivatives and applications, multiple integrals and applications, line integrals and Stoke's and Green's theorem.
Prerequisite(s): A minimum grade of "C" in MATH 2242.
Cross Listing(s): MATH 2243.

MATH 2330 Discrete Mathematics
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Covers important discrete mathematical objects such as sets, relations and functions, graphs and trees. An introduction to mathematical logic and reasoning, and the concept of an algorithm and its complexity will be covered.
Prerequisite(s): MATH 1111 or MATH 1113 or MATH 1232 or MATH 1441 or MATH 1112 or MATH 2242, with a minimum grade of "C".

MATH 2331 Elementary Linear Algebra
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Matrices, solutions of linear systems, vector spaces and subspaces, orthogonality, determinants, eigenvalues and eigenvectors, linear transformation, diagonalization, and applications.
Prerequisite(s): A minimum grade of "C" in MATH 1441.

MATH 2332 Mathematical Structures
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Topics include mathematical logic, methods of proofs, induction, set theory, relations, and functions. The course is primarily intended for mathematics and mathematics education majors as a first course in studying proof techniques and foundations of mathematics.
Prerequisite(s): MATH 1441, with a minimum grade of "C".

MATH 2430 Computing Techniques
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Fundamentals of numerical methods and development of programming techniques with implementation in the computer solution of problems in engineering.
Prerequisite(s): CSCI 1301 or ENGR 1731 and MATH 2242 and PHYS 2211.
Corequisite(s): MATH 3230.

MATH 2302 Foundations of Data Analysis and Geometry
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
A study of basic probability, statistics and geometry, including two and three dimensional shapes and triangle congruenced similarity. For Early Childhood and Middle Grade majors only.
Prerequisite(s): MATH 2008 with a minimum grade of "C".

MATH 3130 College Geometry
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
A study of absolute and Euclidean geometry.
Prerequisite(s): MATH 2332 with a minimum grade of "C".

MATH 3230 Ordinary Differential Equations
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
The study of differential equations involving functions of one variable. Topics include: linear and non-linear differential equations, initial value problems, existence and uniqueness theorems, systems of differential equations, stability, computational methods and Laplace transform methods.
Prerequisite(s): A minimum grade of "C" in MATH 2242.
Cross Listing(s): MATH 3230H.
MATH 3230H Ordinary Differential Equations
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
The study of differential equations involving functions of one variable. Topics include: linear and non-linear differential equations, initial value problems, existence and uniqueness theorems, systems of differential equations, stability, computational methods and Laplace transform methods.
Prerequisite(s): A minimum grade of "C" in MATH 2242.
Cross Listing(s): MATH 3230.

MATH 3337 Probability
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
An introduction to probability, random variables and discrete and continuous probability distributions for students in mathematics, engineering and the sciences including the social sciences and management science.
Prerequisite(s): MATH 2242, with a minimum grade of "C".

MATH 4630 Game Theory
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
This course is designed to introduce students to the foundations of game theory and its applications. Students will use reasoning skills to deal with concepts of games, networks, economic development, and warfare.
Prerequisite(s): MATH 2331 and MATH 2130 or MATH 2332, with a minimum grade of "C".

MATH 4825H Honors Research
2 Credit Hours. 2 Lecture Hours. 0 Lab Hours.
Independent research under the guidance of a faculty member in the Department of Mathematical Sciences for mathematics majors in the University Honors Program. Students must complete four credit hours over two semesters to complete the honors requirements.
Prerequisite(s): Requires Junior status in Mathematics Program and good standing in the University Honors Program.

MATH 4890 Directed Study in Mathematics
1-3 Credit Hours. 0 Lecture Hours. 0 Lab Hours.
Directed study under faculty supervision. Well prepared math majors may be permitted to enroll in an independent study upon the recommendation of a Mathematics faculty member.
Prerequisite(s): Permission of instructor and Department Chair required.

MATH 4920 Undergraduate Seminar
2 Credit Hours. 2 Lecture Hours. 0 Lab Hours.
A specialized study of various topics in mathematics with the intention to engage students in independent reading, writing and presentation of these topics under the supervision of mathematics faculty.
Prerequisite(s): MATH 2332 and MATH 2243, with a minimum grade of "C".

MATH 4929H Honors Thesis
2 Credit Hours. 0 Lecture Hours. 0 Lab Hours.
Written and oral presentation of results of research conducted in MATH 4825H (Honors Research). Honors thesis must follow the guidelines adopted by the University Honors Program. This course is required for mathematics majors in the University Honors Program.
Prerequisite(s): A minimum grade of "C" in MATH 4825H; Junior level or above, and good standing in the University Honors Program.

MATH 4930 Senior Research Project
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Main objective of this course is to engage senior undergraduate students in mathematical, statistical or computer science research and writing. Students will select advisors to work with on their projects. At least one oral presentation on the progress of their research during the semester is required. Also, a final written report on the project as well as a final oral presentation is required.
Prerequisite(s): Students must have at least 15 credit hours of upper level mathematics, statistics and/or computer science.

MATH 5090 Selected Topics in Mathematics
1-3 Credit Hours. 1-3 Lecture Hours. 0-2 Lab Hours.
Specialized study in a selected area of Mathematics. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.
Prerequisite(s): Permission of instructor required.
Cross Listing(s): MATH 5090G.

MATH 5130 Statistics and Probability for K-8 Teachers
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
An in-depth study of topics in statistics, such as sampling and data analysis, and probability, such as counting methods, odds, and expected value. For Early Childhood and Middle Grade majors only.
Prerequisite(s): A minimum grade of "C" in MATH 3032.
Cross Listing(s): MATH 5130G.

MATH 5135 Algebraic Connections for K-8 Teachers
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
The evolution of algebraic concepts through the curriculum will be followed by how algebra is related to other areas of mathematics and real-world applications. For Early Childhood and Middle Grade majors only.
Prerequisite(s): A minimum grade of "C" in MATH 3032.
Cross Listing(s): MATH 5135G.

MATH 5136 History of Mathematics
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
A survey of the historical development of mathematics. The emphasis will be on mathematical concepts, problem solving, and pedagogy from a historical perspective. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.
Prerequisite(s): A minimum grade of "C" in MATH 2242.
Cross Listing(s): MATH 5136G.

MATH 5137 Geometry for K-8 Teachers
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
A continuation of the study of geometry from MATH 3032. Focus will be on two and three dimensional geometry. Motion geometry and tessellations will also be covered. For Early Childhood and Middle Grade majors only.
Prerequisite(s): A minimum grade of "C" in MATH 3032.
Cross Listing(s): MATH 5137G.

MATH 5180 Math for Middle School Teacher
3 Credit Hours. 0 Lecture Hours. 0 Lab Hours.
A continuation of the study of geometry from MATH 3032. Focus will be on two and three dimensional geometry. Motion geometry and tessellations will also be covered. For Early Childhood and Middle Grade majors only.
Prerequisite(s): A minimum grade of "C" in MATH 3032.
Cross Listing(s): MATH 5137G.

MATH 5190 Algebra and Geometry Teach
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Selected topics from Euclidean and Non-Euclidean Geometry. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.
Prerequisite(s): A minimum grade of "C" in MATH 3130 or one year of teaching high school mathematics.
Cross Listing(s): MATH 5230G.

MATH 5232 Mathematical Applications Using Technology
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Selected mathematical topics used in research, problem solving, and demonstrations will be investigated with the use of current technologies. Intended for mathematics education majors. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.
Prerequisite(s): A minimum grade of "C" in MATH 2243 and 3 hours of mathematics in the junior level or above.
Cross Listing(s): MATH 5232G.
MATH 5234 Number Theory
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Introduction to the principal ideas of elementary number theory: Divisibility, congruencies, linear Diophantine Equations, Fermat's Theorem, Pythagorean triples and the distribution of primes. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.
Prerequisite(s): A minimum grade of "C" in MATH 2332.
Cross Listing(s): MATH 5234G, MATH 5234H.

MATH 5234H Number Theory (Honors)
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Introduction to the principal ideas of elementary number theory: Divisibility, congruencies, linear Diophantine Equations, Fermat's Theorem, Pythagorean triples and the distribution of primes. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.
Prerequisite(s): MATH 2332 with a minimum grade of "C".
Cross Listing(s): MATH 5234.

MATH 5236 Patterns of Problem Solving
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
A study of patterns involved in solving problems. Particular attention is paid to Polya's heuristics and his characterization of the problem solving process. The student will also solve many problems. The application of these techniques by mathematics teachers will be stressed. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.
Prerequisite(s): A minimum grade of "C" in MATH 1441 or permission of instructor.
Cross Listing(s): MATH 5236G.

MATH 5300 Operations Research
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Introduction to basic deterministic and probabilistic operations research models of decision problems. Mathematical methods of optimization for these models will be analyzed both analytically and numerically. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.
Prerequisite(s): A minimum grade of "C" in MATH 2331 and MATH 3337.
Cross Listing(s): MATH 5300G.

MATH 5331 Analysis I
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Provides a transition from calculus to real analysis. Emphasis will be placed on understanding and constructing mathematical proofs. Rigorous development of fundamental concepts in analysis, including topics such as relations, functions, limits of functions, cardinality, topology of the reals, completeness axiom, compact sets, sequences, subsquence, continuity and differentiability. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.
Prerequisite(s): A minimum grade of "C" in MATH 2243 and MATH 2332.
Cross Listing(s): MATH 5331G.

MATH 5332 Analysis II
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
A continuation of Analysis I, including topics such as Riemann integration, infinite series, sequences and series of functions, metric spaces, and normed spaces. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.
Prerequisite(s): A minimum grade of "C" in MATH 5331 or MATH 5331G.
Cross Listing(s): MATH 5332G.

MATH 5333 Modern Algebra I
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
This course is an introduction to the fundamental algebraic structures: groups, rings and fields. Topics covered include: binary operations, groups (permutation groups, subgroups, cyclic groups, group homomorphisms, factor groups), rings (integral domains, ring homomorphisms) and fields. The historical and mathematical connections to the secondary mathematics curriculum will be incorporated as appropriate. Graduate students will be given an extra assignment not required of undergraduate students.
Prerequisite(s): A minimum grade of "C" in MATH 2332.
Cross Listing(s): MATH 5333G.

MATH 5334 Modern Algebra II
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
A continuation of the study of the fundamental algebraic structures. Topics to be covered include: isomorphism of groups, rings, fields, a deeper study of quotient structures and the isomorphism theorems, field of quotients, factorization of polynomials over a field, arithmetic properties of rings of polynomials over fields, extension fields, algebraic extensions, geometric constructions and the classic problems. Graduate students will be given an extra assignment not required of undergraduate students.
Prerequisite(s): A minimum grade of "C" in MATH 5333 or MATH 5333G.
Cross Listing(s): MATH 5334G.

MATH 5335 Intermediate Linear Algebra
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
General vector spaces and bases, linear operators, least squares problems, eigenvalue problems, and applications of these concepts. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.
Prerequisite(s): A minimum grade of "C" in MATH 2331 and MATH 2332.
Cross Listing(s): MATH 5335G.

MATH 5336 Applied Numerical Methods
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Introduction to scientific computation. Solutions of linear and nonlinear equations, polynomial interpolation, numerical differentiation and integration, data fitting, and other numerical methods. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.
Prerequisite(s): A minimum grade of "C" in MATH 2331 and prior knowledge of a programming language.
Cross Listing(s): MATH 5336G.

MATH 5337 Difference Equations
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
This course is an introduction to the theory and applications of difference equations. Topics include the difference calculus, first order linear difference equations, results and solutions of linear equations, applications, equations with variable coefficients and nonlinear equations that can be linearized. Graduate students will be given an extra assignment not required of undergraduate students.
Prerequisite(s): A minimum grade of "C" in MATH 2242 and MATH 2331.
Cross Listing(s): MATH 5337G.

MATH 5338 Methods of Applied Mathematics
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Methods of applied mathematics concentrating on techniques for the analysis of differential and integral equations. Topics include: integral equations, differential operators, Fredholm alternative, distribution theory and Green's function methods. Graduate students will be given an extra assignment not required of undergraduate students.
Prerequisite(s): A minimum grade of "C" in MATH 2331 and MATH 3230.
Cross Listing(s): MATH 5338G.
MATH 5339 Partial Differential Equations
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
The study of differential equations involving functions of more than one variable. Topics include: Laplace, heat and wave equations, boundary value problems, methods of separation of variables and eigenfunction expansions, Fourier series, Green's functions, maximum principle and computational methods. Graduate students will be given an extra assignment not required of undergraduate students.
Prerequisite(s): A minimum grade of "C" in MATH 2243 and MATH 3230.
Cross Listing(s): MATH 5339G.

MATH 5430 Introduction to Mathematical Biology
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
An introduction to applications of mathematics to various biological, ecological, physiological, and medical problems, which will be analyzed both analytically and numerically. Graduate students will be given additional assignments that will not be completed by undergraduate students.
Prerequisite(s): A minimum grade of "C" in MATH 3230.
Cross Listing(s): MATH 5430G.

MATH 5431 Combinatorics and Graph Theory
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
The course covers basic theory and applications of combinatorics and graph theory. Combinatorics is a study of different enumeration techniques of finite but large sets. Topics that will be studied include principle of inclusion and exclusion, generating functions and methods to solve difference equations. Graph theory is a study of graphs, trees and networks. Topics that will be discussed include Euler formula, Hamilton paths, planar graphs and coloring problem; the use of trees in sorting and prefix codes; and useful algorithms on networks such as shortest path algorithm, minimal spanning tree algorithm and min-max flow cut algorithm. Graduate students will be given extra assignments determined by the instructor that undergraduates will not be required to do.
Prerequisite(s): A minimum grade of "C" in MATH 2332 and MATH 3337.
Cross Listing(s): MATH 5431G.

MATH 5432 Differential Geometry of Curves and Surfaces
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Differential geometry uses tools from calculus and linear algebra to study the geometric properties of smooth curves and surfaces in Euclidean spaces. Topics include: arc length surface area, geodesics, curvature, first and second fundamental forms, Gauss-Bonnett formula. Graduate students will be assigned additional assignments and/or project.
Prerequisite(s): A minimum grade of "C" in MATH 2243 and MATH 3337.
Cross Listing(s): MATH 5432G.

MATH 5433 Functions of a Complex Variable
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Topics in complex variables including functions, limits, derivatives, integrals, the Cauchy-Riemann conditions, series representation of functions, Cauchy Integral formula, and elementary conformal mappings. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.
Prerequisite(s): A minimum grade of "C" in MATH 2243.
Cross Listing(s): MATH 5433G.

MATH 5434 Introduction to Topology
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
An introduction to metric spaces, topological spaces, connectedness and compactness of topological spaces, and continuous functions on topological spaces. Graduate students enrolled in this course will complete one or more assignments that the undergraduate students will not be required to complete.
Prerequisite(s): A minimum grade of "C" in MATH 2332.
Cross Listing(s): MATH 5434G.

MATH 5435 Introduction to Topology
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
An introduction to metric spaces, topological spaces, connectedness and self-similarity. Fractal dimensions. Encoding of fractals. Decoding of fractals. Iterated function systems. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.
Prerequisite(s): A minimum grade of "C" in MATH 5331 or MATH 5331G.
Cross Listing(s): MATH 5435G.

MATH 5436 Introduction to Fractals
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Fractals as nonlinear systems involving feedback and iteration. Classical fractals, limits and self-similarity. Fractal dimensions. Encoding of fractals. Decoding of fractals. Iterated function systems. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.
Prerequisite(s): A minimum grade of "C" in MATH 5331 or MATH 5331G.
Cross Listing(s): MATH 5436G.

MATH 5437 Mathematics and Computation of Curves and Surfaces
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
This course is a study of the mathematical and computational techniques used for the computer generation of curves and surfaces. The primary representations for the curves and surfaces are univariate and multivariate polynomials and splines in the Bernstein/Bezier and B-spline bases. These curves and surfaces are used for data fitting (interpolation and smoothing) and approximation. Topics include: recursion, smoothness, surfaces over grids, surfaces over triangulations, simplex and box splines, variational curves and surfaces, transformations and projections. Graduate students will be given an extra assignment not required of undergraduate students.
Prerequisite(s): A minimum grade of "C" in MATH 2243 and MATH 2331.
Cross Listing(s): MATH 5437G.

MATH 5530 Mathematics for Scientists and Engineers
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
A survey of mathematical topics useful in the study of areas of applied sciences such as physics, engineering and computer science. Topics include: linear algebra and matrices, ordinary differential equations, partial differential equations, Fourier series, vector calculus, complex variables, numerical methods, probability and graph theory. For non-math majors only. Graduate students will be given an extra assignment not required of undergraduate students.
Prerequisite(s): A minimum grade of "C" in MATH 2242.
Cross Listing(s): MATH 5530G.

MATH 5531 Mathematical Models
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
This course introduces students to a variety of mathematical tools used for solving real world problems, with the focus on identifying the problem, constructing an appropriate model, and finding the best available method to solve it. Graduate students will be given an extra assignment not required of undergraduate students.
Prerequisite(s): A minimum grade of "C" in MATH 2331 and MATH 3230.
Cross Listing(s): MATH 5531G.

STAT 2231 Introduction to Statistics I
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
An introductory statistics course which covers descriptive statistics, probability, random variables and selected probability distributions, statistical inference including confidence intervals and hypothesis tests. Appropriate technology will be used for simulation and to solve statistical problems. Neither a background in calculus nor experience with computers is required.
Prerequisite(s): A minimum grade of "C" in MATH 1101, MATH 1111, MATH 1112, MATH 1113, MATH 1232, MATH 1441.
Cross Listing(s): STAT 2231H.

STAT 2231H Introduction to Statistics I
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
An introductory statistics course which covers descriptive statistics, probability, random variables and selected probability distributions, statistical inference including confidence intervals and hypothesis tests. Appropriate technology will be used for simulation and to solve statistical problems. Neither a background in calculus nor experience with computers is required.
Prerequisite(s): A minimum grade of "C" in MATH 1101, MATH 1111, MATH 1112, MATH 1113, MATH 1232, MATH 1441, MATH 1441H.
Cross Listing(s): STAT 2231.
STAT 2232 Introduction to Statistics II
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
A continuation of STAT 2231. The focus is on inferential procedures to compare the same characteristic between two or more populations and inferential procedures to investigate the relationship between two or more variables from the same population. Topics include tests of association, regression, correlation, and analysis of variance. The statistical software package SPSS is used.
Prerequisite(s): STAT 2231 with a minimum grade of "C".

STAT 3130 Applied Statistics
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
An introductory course in applied statistics for students in the natural sciences, social sciences, health and professional studies, technology, and business. The material covered will provide an introduction to statistical concepts and terminology while focusing on descriptive and inferential methods of data analysis. Both parametric and nonparametric methods are presented for the analysis of central tendency, variability, proportions, and categorical data. Topics covered also include regression and correlation.
Prerequisite(s): MATH 1111.

STAT 4090 Selected Topics in Statistics
1-3 Credit Hours. 1-3 Lecture Hours. 0-2 Lab Hours.
Specialized study in a selected area of Statistics.
Prerequisite(s): Permission of instructor required.

STAT 4890 Directed Study in Statistics
1-3 Credit Hours. 1-3 Lecture Hours. 0-2 Lab Hours.
Directed study under faculty supervision. Well-prepared statistics students may be permitted to enroll in an independent study upon the recommendation of a Statistics faculty member.
Prerequisite(s): Permission of instructor and Department Chair required.

STAT 5130 Sampling and Survey Methods
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
An introduction to the design and analysis of sample surveys suitable for students in business, social sciences, and biological sciences in addition to the mathematical sciences. Comparison of simple random sampling, stratified, systemic, cluster and multistage sampling. Emphasis on appropriate sample type and estimation of parameters. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.
Prerequisite(s): STAT 2231 with a minimum grade of "C". Cross Listing(s): STAT 5130G.

STAT 5330 Introduction to Mathematical Statistics
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
An introductory course intended to present a solid foundation in statistical theory, and, at the same time, to provide an indication of the relevance and importance of the theory in solving practical problems in the real world. Topics include, moments and moment-generating functions, point and interval estimation, test of statistical hypothesis, contingency tables and goodness-of-fit, nonparametric methods, and introduction to linear models. This course covers part of the material outlined in the Society of Actuaries' course 110. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.
Prerequisite(s): MATH 3337 with a minimum grade of "C". Cross Listing(s): STAT 5330G.