MATHEMATICS (MATH)

MATH 105 - Introduction to Finite Math (3 Hours)
The course provides an introduction to several areas of finite mathematics which have numerous applications, particularly in the social sciences. Topics will include mathematics of finance, discrete probability, linear programming, matrices, and linear systems.
Curriculum: NS,QS

MATH 106 - Introduction to Optimization (3 Hours)
Optimization is the search for efficient solutions to real-world problems. For example, a designer might seek a lowest-cost construction, or a manufacturer might seek a maximum-profit production schedule. This course introduces the mathematics of optimization. Topics include linear programming and unconstrained nonlinear optimization. Numerical and symbolic methods are applied where appropriate.
Curriculum: NS,QS

MATH 107 - Introduction to Math Modeling (3 Hours)
An introduction to techniques for constructing mathematical models of real-world phenomena, primarily through the study of discrete dynamical systems. Topics include recurrence relations; stable and unstable equilibria; and systems of linked recurrences. Basic growth patterns will be examined, including linear, power, exponential, and periodic. Applications include financial mathematics, biological systems, and population dynamics. Satisfies CAR Computing.
Curriculum: NS,QS

MATH 111 - Introduction to Statistics (3 Hours)
An introduction to statistical inference and sufficient probability theory for such an introduction. Topics include elementary data analysis, elementary probability, discrete and continuous random variables, distributions (including the normal distribution), correlation and regression, sampling distributions, point and interval estimation, confidence levels, and tests of significance. Students may not receive credit for successful completion of MATH 111 and MATH 113. They may receive a total of seven hours of credit for successful completion of a combination of MATH 111 and BIOL 350, or MATH 113 and BIOL 350. However, the two statistics courses may not be used together to fulfill the collegiate requirement in mathematics.
Curriculum: NS,QS

MATH 113 - Introduction to Statistics (3 Hours)
A computer-intensive version of MATH 111. Students may not receive credit for successful completion of MATH 111 and MATH113. They may receive a total of seven hours of credit for successful completion of a combination of MATH 111 and BIOL 350, or MATH 113 and BIOL 350. However, the two statistics courses may not be used together to fulfill the collegiate requirement in mathematics.
Curriculum: NS,QS

MATH 120 - Introductory Logic (3 Hours)
This course serves as an overview of the basic elements of logic and a deeper treatment of logic as a deductive science. Students are expected to analyze statements and arguments in ordinary language and symbolic form, translate statements and arguments from ordinary language into symbolic form, use truth tables in the analysis of arguments and the classification of statements, and use techniques of natural deduction to construct proofs of arguments in propositional and predicate logic.
Curriculum: NS,QS

MATH 131 - Calculus I (4 Hours)
This is a course in differential calculus. Topics to be covered will include: functions; limits and continuity; the definition of the derivative; techniques of differentiation; and applications of the derivative. Note: A working knowledge of high school algebra, geometry, and trigonometry is required for this course.
Curriculum: NS,QS

MATH 132 - Calculus II (4 Hours)
This course is a continuation of MATH 131. Topics to be covered will include: the Fundamental Theorem of Calculus; techniques of integration; applications of the definite integral; and sequences and series.
Prerequisite(s): MATH 131 or permission of instructor

Curriculum: NS,QS

MATH 203 - Multivariable Calculus (4 Hours)
This course is a continuation of MATH 132. Topics to be covered will include: vectors; vector valued functions; functions of two or more variables; partial derivatives; multiple integrals; vector fields; and Green's Theorem.
Prerequisite(s): MATH 132

Curriculum: NS,QS

MATH 213 - Elementary Linear Algebra (3 Hours)
An introduction to the algebra and geometry of three-dimensional Euclidean space and its extension to n-space. Topics include vector algebra and geometry; systems of linear equations; real vector spaces; matrix algebra; determinants; linear transformations; eigenvalues; and diagonalization.
Prerequisite(s): DATA 110 or MATH 131

Curriculum: NS,QS

MATH 215 - Mathematics Resources, Opportunities, and Career Seminar (1 Hour)
This weekly seminar helps students become familiar with the scope of the mathematical sciences. The course is designed to help students plan their academic experience so they can successfully pursue the career of their choice after majoring or minoring in mathematics. Research and internship opportunities will be discussed, as will careers that demand mathematical skills. Standard modes of communicating mathematics, and other strategies for success in higher mathematics courses, will be included.
Prerequisite(s): MATH 131

MATH 220 - Discrete Mathematics (3 Hours)
Boolean algebra and propositional logic with applications. Elements of the theory of directed and undirected graphs. Permutations, combinations, and related combinatorial concepts. The course provides mathematical topics of particular value to students in computer science.
Prerequisite(s): MATH 132 or CSCI 112

Curriculum: NS,QS

MATH 270 - Traditional Japanese Mathematics (3 Hours)
This travel course will focus on the geometry that arose during Japan's 18th century cultural blossoming, despite its self-imposed isolation from the scientific revolution in Europe. The course begins on campus with a study of the techniques, important scholars, and historical context of traditional Japanese mathematics. During the travel portion of the course, students will visit key historical sites in Japan, view mathematical artifacts, and absorb the cultural aesthetics that still seem intimately connected with this country's traditional geometry. Offered alternate years.
Prerequisite(s): MATH 132 and permission of instructor

Curriculum: EL,NW

MATH 281 - T: Special Topics (3 Hours)
These courses focus on areas of mathematics not specifically covered in the general curriculum and are designed to meet the needs of students.

MATH 307 - Differential Equations: A Modeling Perspective (3 Hours)
An introduction to the theory and application of differential equations, including the development of mathematical models of scientific phenomena. Qualitative, numerical, and analytic tools will be used to analyze these models, and technology will also play a significant role. Topics include modeling via differential equations, analytic and numeric techniques, existence and uniqueness of solutions, equilibria, changing variables, systems of equations, phase planes, and qualitative analysis.
Prerequisite(s): MATH 132

MATH 317 - Number Theory (3 Hours)
An introduction to the theory of numbers. Topics covered will include mathematical induction, the division algorithm, the fundamental theorem of arithmetic, the Euler phi-function, congruence, Diophantine equations, the Chinese Remainder Theorem, quadratic residues, the Law of Quadratic Reciprocity, and cryptography. Students are expected to learn definitions and theorems in order to solve problems and prove results. Offered alternate years.
Prerequisite(s): MATH 220

MATH 321 - Modern Algebra I (3 Hours)
A study of the basic properties of abstract algebraic structures, including groups, rings, and fields. The course attempts to develop the student's ability to deal with abstract mathematical ideas and proofs, while providing widely used mathematical language and tools. MATH 213 is recommended but not required.
Prerequisite(s): MATH 220

MATH 322 - Modern Algebra II (3 Hours)
A continuation of MATH 321. Topics include rings, integral domains, factorization of polynomials, vector spaces, and fields. Offered as needed.
Prerequisite(s): MATH 321

MATH 330 - Graph Theory (3 Hours)
This course is an introduction to the theory of graphs. This mathematical theory deals with points and interconnecting lines, and has wide-ranging applications to computer science, operations research, and chemistry, among many other disciplines. Course topics include degree sequences, trees, Eulerian and Hamiltonian graphs, matching, factoring, coloring, planar graphs, connectivity, Menger's Theorem, and networks. Students are expected to prove theorems and understand applications of the material to practical problems.
Prerequisite(s): MATH 220 or permission of the instructor

MATH 345 - Mathematical Biology (3 Hours)
Mathematical biology is the discipline that uses mathematical models to help understand phenomena in biology through analysis and interpretation of experimental data. It is now widely accepted that a main trend in biology during the coming decades will be toward an increasingly interdisciplinary quantitative understanding of biological functions, and that the new generation of biologists will routinely use mathematical models and computational approaches to frame hypotheses, design experiments, and analyze results. In this course, students are introduced to a toolkit of modeling approaches for solving important problems in biology and medicine.
Prerequisite(s): ENGL 185 and BIOL 121 or BIOL 123

Curriculum: CC

MATH 350 - Game Theory (3 Hours)
This course is a mathematical introduction to the subject of game theory. Its prime objective is to equip the student with sufficient skills to solve applied mathematical problems, taken principally from the realm of economics. Topics covered will include Zermelo's algorithm, lotteries, utility functions, bimatrix games, bargaining, cooperative and noncooperative games, mixed strategies, zero-sum games, and Nash and subgame-perfect equilibriums. Students will be expected to use mathematical definitions, formulae, and techniques to solve game theoretic problems. Offered alternate years.
Prerequisite(s): MATH 203 or a minimum grade of B- in MATH 132

MATH 353 - Complex Analysis (3 Hours)
An introduction to the calculus of analytic functions. The principal topics are complex arithmetic, elementary functions of a complex variable, analyticity, contour integrals, Cauchy's theorem and its applications, and power series. Offered alternate years.
Prerequisite(s): MATH 203

MATH 360 - Mathematical Logic (3 Hours)
A course intended to introduce students to the concepts of truth, proof, and computability. Major topics of this course include the completeness theorem for first order logic, which shows that the concept of provability (from axioms) can be established; the Gödel incompleteness theorem, which shows there is an inherent gap between what is true (about the whole numbers, for example) and what can be proved about an axiomatic system; and the insolvability of the halting problem, which shows that computers can't do everything. Offered as needed.
Prerequisite(s): MATH 220 or permission of the instructor

MATH 371 - Probability (3 Hours)
An introduction to combinatorial theory, sample spaces, random variables, and mathematical expectation and probability distributions including their properties for both the discrete and continuous cases. Offered alternate years.
Prerequisite(s): MATH 203 or MATH 220

MATH 372 - Statistical Inference (3 Hours)
The theory and practice of statistical inference. Experimental and statistical design, point estimation, regression and correlation, confidence intervals, and significance tests. Mathematical foundations including the Central Limit Theorem. Offered alternate years.
Prerequisite(s): DATA 110 or MATH 131

MATH 381 - Special Topics in Mathematics (3 Hours)

MATH 382 - Special Topics in Mathematics (3 Hours)

MATH 391 - Independent Study (3 Hours)
An independent exploration of a specialized area in mathematics under the guidance of a member of the department.
Prerequisite(s): permission of the instructor, a cumulative GPA of 3.25 or greater, and approval of the curriculum committee

MATH 392 - Independent Study (3 Hours)
An independent exploration of a specialized area in mathematics under the guidance of a member of the department.
Prerequisite(s): permission of the instructor, a cumulative GPA of 3.25 or greater, and approval of the curriculum committee

MATH 415 - Mathematics and Data Science Seminar (1 Hour)
This course serves to present mathematics and data science in a variety of contexts. Students will read selections from current literature. Lectures given by students and guest speakers will present ideas or project results beyond the usual curriculum and lead to discussions. Students will gain experience making presentations, expressing arguments in writing, and critiquing arguments presented by others.
Prerequisite(s): MATH 220 or MATH 307 or DATA 210 and senior status

Curriculum: CS

MATH 421 - Real Analysis I (3 Hours)
A first course in the theory of functions of real variables. Topics include axiomatic description of the real number system, topology of Euclidean and metric spaces, limits and continuity, and differentiation. Students are expected not only to learn the material presented but also to construct proofs independently.
Prerequisite(s): MATH 220

MATH 422 - Real Analysis II (3 Hours)
A continuation of MATH 421. Topics include integration and sequences and series of functions. Offered as needed.
Prerequisite(s): MATH 421

MATH 431 - Topology (3 Hours)
An introduction to point-set topology. Topics will include topological spaces, metric spaces, continuous mappings, and homeomorphisms. Students are expected to learn basic definitions and theorems, and to construct proofs on their own. Offered alternate years.
Prerequisite(s): MATH 220

MATH 435 - Higher Geometry (3 Hours)
The axiomatic method will be used to develop a geometric system. Topics will be chosen from Euclidean geometry, plane hyperbolic geometry, and real projective geometry. This course is of particular value to students who anticipate entering secondary teaching. Offered alternate years.
Prerequisite(s): MATH 213

MATH 450 - Internship in Mathematics (Unpaid) (3 Hours)
Students in this course are placed in an appropriate organization (typically a commercial, industrial, government, nonprofit, or research facility) and follow an arranged set of readings relevant to their internship experience. Students will be expected to demonstrate (through a written report upon completion of the internship) an understanding of the mathematics used and of its utility in context. Application required; see Internship Program. Offered as needed. A special fee ($200) is charged for this course.
Curriculum: EL

MATH 470 - History of Mathematics (3 Hours)
This course is a study of some key topics in the history of mathematics, including areas such as algebra, geometry, trigonometry, calculus, and analysis. Starting from earliest times, it surveys the mathematics of the ancient Greeks, the Middle Ages, the Renaissance, the Enlightenment, and culminates with a look at some twentieth-century developments. Since this is an interdisciplinary subject, it will involve the use of skills from both history and mathematics. Students will be expected to analyze mathematical texts from the past as well as to solve mathematical problems from a variety of historical periods and sources. (EL when the course travels).
Prerequisite(s): MATH 203 or MATH 220

Curriculum: EL