MATHEMATICS

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PROGRAMS AVAILABLE
BACHELOR OF ARTS IN MATHEMATICS
CONCENTRATION IN MIDDLE SCHOOL MATHEMATICS EDUCATION
CONCENTRATION IN SECONDARY SCHOOL MATHEMATICS EDUCATION
MATHEMATICS MINOR
TEACHING LICENSURE

MATHEMATICS MAJOR PROGRAM

The Department of Mathematics offers a four-year program leading to a Bachelor of Arts in mathematics. The program fosters insights and solutions to a variety of problems through symbolic and numerical analysis. The practice of the discipline requires and engenders precise modes of thinking. The use of calculus, numerical methods, probability, statistics and logic is basic to the quantitative methods needed throughout society today. Students graduating with a degree in mathematics will be able to:

- Perform computations and procedures from a wide range of the various branches of mathematics;
- Demonstrate mathematical growth by acquiring a solid grasp of key concepts and themes;
- Develop fluency in reading and constructing mathematical proofs;
- Apply mathematical ideas and problem-solving to real-life situations in the various disciplines.

MATHEMATICS MAJOR

Requirements

MATH	220	Calculus I	3 cr
MATH	240	Proof I	3 cr
MATH	261	Linear Algebra	3 cr
MATH	310	Proof II	3 cr
MATH	320	Calculus II	3 cr
MATH	330	Calculus III	3 cr
MATH	430	Calculus IV	3 cr
PHYS	151	Introduction to Mechanics	4 cr

One course in each of the following areas:

Area I 3 cr

MATH	360	Number Theory
OR MATH	362	Algebraic Structures I

Area II 3 cr

MATH	380	Differential Equations
OR MATH	390	Numerical Analysis
OR MATH	455	Complex Variables
OR MATH	460	Real Analysis I

Area III 3 cr

MATH	281	Linear Programming
OR MATH	331	Probability and Statistics I
OR MATH	365	Math Modeling
OR MATH	444	Operations Research
OR MATH	465	Financial Mathematics

Area IV 3 cr

MATH	340	Graph Theory
OR MATH	344	Geometry

OR MATH 440 Topology

One computer programming courses: 3 cr
CSCI 121 OR CSCI 246 OR other computer programming course

Four additional mathematics courses 300 level or above 12 cr

TOTAL MATHEMATICS MAJOR REQUIREMENTS 52 cr

CONCENTRATION IN MIDDLE SCHOOL MATHEMATICS EDUCATION

Requirements

MATH	220	Calculus I	3 cr
MATH	240	Proof I	3 cr
MATH	261	Linear Algebra	3 cr
MATH	310	Proof II	3 cr
MATH	320	Calculus II	3 cr
MATH	330	Calculus III	3 cr
MATH	344	Geometry	3 cr
MATH	372	History of Mathematics	3 cr
MATH	430	Calculus IV	3 cr
PHYS	151	Introduction to Mechanics	4 cr

One course in each of the following areas:

Area I 3cr

MATH	360	Number Theory
MATH	362	Abstract Algebra

Area II 3cr

MATH	380	Differential Equations

MATH	390	Numerical Analysis	
MATH	455	Complex Variables	
MATH	460	Real Analysis	

Area III 3cr

MATH	281	Linear Programming	
MATH	331	Probability and Statistics I	
MATH	444	Operations Research	

One Computer Programming Course: 3 cr
CSCI 121 OR CSCI 246 OR another computer programming course

Three mathematics electives, 300 level or higher 9cr

TOTAL MIDDLE SCHOOL MATHEMATICS EDUCATION CONCENTRATION REQUIREMENTS **52 cr**

CONCENTRATION IN SECONDARY SCHOOL MATHEMATICS EDUCATION

MATH	220	Calculus I	3 cr
MATH	240	Proof I	3 cr
MATH	261	Linear Algebra	3 cr
MATH	310	Proof II	3 cr
MATH	320	Calculus II	3 cr
MATH	330	Calculus III	3 cr
MATH	331	Probability and Statistics I	3 cr
MATH	344	Geometry	3 cr
MATH	360	Number Theory	3 cr
MATH	362	Abstract Algebra	3 cr
MATH	372	History of Mathematics	3 cr

MATH	380	Differential Equations	3 cr
MATH	430	Calculus IV	3 cr
PHYS	151	Introduction to Mechanics	4 cr

One course to satisfy applied mathematics or mathematics modeling: 3cr

MATH	281	Linear Programming
MATH	340	Graph Theory
MATH	365	Math Modeling
MATH	390	Numerical Analysis
MATH	444	Operations Research

One Computer Programming Course: 3cr
CSCI 121 OR CSCI 246 OR another computer programming course

One additional mathematics elective, 300 level or above

TOTAL SECONDARY SCHOOL MATHEMATICS EDUCATION CONCENTRATION REQUIREMENTS 52 cr

MATHEMATICS MINOR PROGRAM

The mathematics minor develops mathematical skills at the calculus level and beyond. With the assistance of a member of the mathematics faculty, a student selects courses that readily complement and enhance his/her major discipline.

MATHEMATICS MINOR

Requirements

MATH	220	Calculus I	3 cr
MATH	240	Proof I	3 cr
MATH	320	Calculus II	3 cr

One of the following: 3 cr
A computer course (CSCI 121 or CSCI 246 or equivalent)
any mathematics elective, 200-level or above

One mathematics elective, 200 level or above 3 cr
Two mathematics electives, 300 level or above 6 cr

TOTAL MATHEMATICS MINOR REQUIREMENTS 21 cr

TEACHING LICENSURE

Students majoring in mathematics may choose to pursue initial teacher licensure as an early childhood teacher or elementary teacher. Also, mathematics majors may pursue initial licensure as a teacher of mathematics for the middle school or secondary levels. Students seeking any of these licensures must complete a mathematics major, education major and a licensure program in education.

COURSE DESCRIPTIONS

MATH 100 Math for Educators I 3 cr

Introduces the concepts of numbers, operations and geometry from an advanced standpoint. Explains the reasons behind the usual formulas and algorithms of arithmetic and geometry. Provides explanations suitable for the various kinds of student learners. Covers the concept of number, addition, subtraction, multiplication, division, area and some fractions.
Prerequisite: None

MATH 101 Math for Educators II 3 cr

Introduces the concepts of elementary mathematics from an advanced standpoint. Explains the reasons behind the usual algorithms and equations. Provides explanations suitable for the various kinds of student learners.

Covers decimals, franctions, long-division, similar triangles, ratios, percents, probabilities, word problems, conversions, rational numbers, irrational numbers, exponents, square roots and math history.
Prerequisite: MATH 100

MATH 102 Mathematics for Liberal Arts 3 cr
Presents mathematics topics designed to promote mathematical problem solving, reasoning, decision making and communication. Students will develop an understanding of the nature, purposes and accomplishments of mathematics. Topics selected from elementary set theory, logic, number theory, graph theory, voting theory, functions, difference equations and geometry. Course attributes: CMA.
Prerequisite: None

MATH 150 Precalculus 3 cr
Introduces topics necessary for the study of calculus. A detailed study of algebraic, trigonometric, exponential and logarithmic functions and equations, and their applications to modeling real world problems. Topics are considered from analytical, graphical and numerical points of view. Course attributes: CMA.
Prerequisite: Placement based on SAT scores and high school background

MATH 200 Math for Educators III 3 cr
Introduces the concepts of elementary functions, algebra and statistics from an advanced standpoint. Explains the reasons behind the usual procedures. Provides explanations suitable for the various kinds of student learner. Covers order of operations, variables, introductory algebra, basic statistics, functions, volumes and surface areas.
Prerequisite: MATH 101

MATH 220 Calculus I 3 cr
Examines limits, continuity, the derivative, differentiation of elemenatary functions, applications of the derivative and an introduction to the antiderivative. The first of a four-part sequence. Course attributes: CMA.
Prerequisite: MATH 150, placement based on SAT and high school background or department approval

MATH 232 Introduction to Statistics 3 cr
Examines descriptive statistics, probability, sampling theory and inferential statistics. Mathematics majors cannot use this course for credit towards their major. Course attributes: CMA.
Prerequisite: None

MATH 240 Proof I 3 cr
Introduces sets, Boolean logic, combinatorics, functions, and the basics of mathematical proof.
Prerequisite: Completion of Tier I Quantitative Reasoning or instructor approval

MATH 250 Discrete Mathematics 3 cr
Provides a foundation in mathematical topics central to the study of computer science, emphasizing mathematical reasoning and algorithms. Topics include propositional logic, Boolean algebra, mathematical proofs and induction, computer arithmetic, elementary combinatorics, recursion, graphs and trees, matrices, sequences and summation.
Prerequisite: None

MATH 261 Linear Algebra 3 cr

Investigates the theory of vector spaces, linear equations, linear transformations, determinants, inner product spaces, eigenvalues and eigenvectors.

Prerequisite: MATH 240

MATH 281 Linear Programming 3 cr

Examines the solution of linear programming problems using graphical methods, the simplex algorithm and the computer. Additional topics may include duality theory and applications chosen from the transportation problem, the personnel assignment problem and two-person, zero-sum games.

Prerequisite: MATH 261

MATH 286 Topics in Mathematics 3 cr

Examines sophomore level topics in mathematics that complement departmental offerings in mathematics or math competency courses. Emphasis is on the nature of mathematical thought and applications of mathematics.

Prerequisite: Completion of Tier I Quantitative Reasoning or instructor approval

MATH 310 Proof II 3 cr

Examines a wide variety of proof techniques (e.g. direct, by contradiction, by contrapostive, bi-directional, uniqueness, by induction, by counter-example). Students will practice these techniques and learn how and when to apply each one. Functions and relations will provide many examples, and be covered in-depth.

Prerequisite: MATH 240

MATH 320 Calculus II 3 cr
Studies antiderivatives, the definite integral, transcendental functions, techniques and applications of integration, an introduction to improper integrals. The second of a four-part sequence.
Prerequisite: MATH 220

MATH 328 Interest Theory 3 cr
Treats topics from the mathematical theory of compound interest. Problems dealing with annuities, amortized schedules, sinking funds and bonds will be analyzed.
Prerequisite: MATH 320

MATH 330 Calculus III 3 cr
Studies infinite series, plane curves, polar coordinates, vectors, vector-valued functions and analytic geometry in three-dimensional space. The third of a four-part sequence.
Prerequisite: MATH 320

MATH 331 Probability and Statistics I 3 cr
Examines probability laws, discrete and continuous random variables and their probability distributions, expectation, moments and moment generating functions, sequences of random variables and Markov chains.
Prerequisite: MATH 430 or concurrent enrollment in MATH 430

MATH 332 Probability and Statistics II 3 cr
Examines functions of random variables, sampling distribution, limit theorems, estimation, hypotheses testing, linear regression, correlation, analysis of variance and analysis of enumerative data.
Prerequisite: MATH 331

MATH 340 Graph Theory 3 cr
Investigates definitions and examples of graphs, graph isomorphism, paths and circuits, connectivity, trees, planar graphs, Euler's formula, graph coloring, four and five color theorems and applications.
Prerequisite: MATH 240

MATH 344 Geometry 3 cr
Studies geometries from an advanced standpoint. Some of the topics that may be covered are non-Euclidean geometry, geometry of the complex plane, affine geometry or projective geometry.
Prerequisite: MATH 310

MATH 345 Game Theory 3 cr
Introduces game theory terminology, zero-sum, two-person games, minimax theorem, optimal mixed strategies and applications to economics.
Prerequisite: MATH 261

MATH 360 Number Theory 3 cr
Introduces the basic concepts of number theory: the Euclidean algorithm, primes, divisibility theorems, Mersenne and Fermat numbers, linear Diophantine equations, congruences, unique factorization and quadratic reciprocity.
Prerequisite: MATH 261

MATH 362 Abstract Algebra 3 cr
Introduces the study of algebraic structures with a detailed examination of groups, their properties, and their mappings, including both isomorphic and homomorphic mappings. Cyclic, symmetric, and quotient groups will be studied, as well as groups of permutations, cosets, and normal subgroups. Also covers the Fundamental Homomorphism Theorem.

Prerequisite: MATH 310

MATH 365 Mathematical Modeling 3 cr
Explores the development of mathematical models that solve different types of problems, including both discrete and continuous real-world problems that are either deterministic or probabilistic. Determines solutions analytically and through the use of mathematical software.
Prerequisite: MATH 320

MATH 372 History of Mathematics 3 cr
Examines the historical development of mathematics and its impact from ancient to modern times.
Prerequisite: MATH 320

MATH 380 Differential Equations 3 cr
Examines first- and second-order differential equations with particular emphasis on nth order equations with constant coefficients, differential operators, systems of equations, series solutions, and Laplace transforms.
Prerequisite: MATH 330, CSCI 121 or CSCI 246

MATH 390 Numerical Analysis 3 cr
Studies the approximation of polynomials at points and over intervals; numerical solutions of algebraic and transcendental equations in one unknown using geometric and arithmetic methods; numerical differentiation; and integration.
Prerequisite: MATH 320

MATH 430 Calculus IV 3 cr
Concludes the four-semester sequence of calculus with the study of functions in two or more variables, their derivatives and partial derivatives, multiple integrals, line and surface integrals, Green's Theorem and Stoke's Theorem.

Prerequisite: MATH 330

MATH 440 Topology 3 cr
Covers various topological spaces. Continuity, connectedness, and compactness are analyzed and compared. Applications of continuity will be applied to the contraction mapping principle. Analysis of product spaces and quotient spaces. Alternate topics may be discussed.
Prerequisite: MATH 310

MATH 444 Operations Research 3 cr
Covers various interrelated topics such as linear programming, network analysis, game theory, probablilty and queing theory, and optimization theory.
Prerequisite: MATH 430

MATH 455 Complex Variables 3 cr
Studies the basic theory of functions of a complex variable including complex numbers and their algebra; analytic functions; Cauchy-Riemann conditions; and the differential and integral calculus of analytic functions.
Prerequisite: MATH 430

MATH 460 Real Analysis 3 cr
Examines the basis of calculus with a rigorous exploration of the function concept from both a set-theoretic and topological viewpoint with particular attention to the completeness of the real number system, limits, continuity and convergence of sequences and series.
Prerequisite: MATH 310, MATH 330

MATH 465 Financial Mathematics 3 cr
Introduces the concepts of probability theory: discrete and continuous random variables, and their probability distributions. Covers Brownian

motions and geometic Brownian motion, the binomial model, the Black-Scholes formula; the markets for futures, options, and other derivatives. Discusses the mechanics of trading, pricing, hedging, and managing risk using derivatives.
Prerequisite: MATH 320

MATH 486 Special Topics in Mathematics 3 cr
Introduces theory that is an extension of various upper-division mathematics courses. Special topics may explore, but are not restricted to: analysis, geometry and theory related to modern technology.
Prerequisite: To be determined by the instructor

MATH 500 Independent Study 1 to 3 cr
Open to juniors and seniors who wish to read in a given area or to study a topic in depth. Written reports and frequent conferences with the advisor are required.
Prerequisite: Junior/senior status, department approval

MATH 540 Internship in Mathematics 3 to 15 cr
Qualified students may be placed as interns in mathematically oriented positions. The internship is designed to supplement and apply classroom study.
Prerequisite: Junior/senior status, department approval