Mathematics

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**Major:** Mathematics courses – 111/112 or 121 or equivalent; 122; 220; 221; 224; 324; 327; 461 or 471 (culminating experience); two others, not including 110, 210, 211, 212 or 217, and including at least one at the 300 level or higher.

Cognate course – CS 121 or 221.

Comprehensive evaluation, with passing grade. Total of 10 major courses, plus 1 cognate = 11.

Recommended: Phy 115, Phi 321. Candidates for secondary teaching certification in Mathematics must include Mat 339.

**Minor:** Mathematics courses – 121; 122; three others, not to include 110, 210, 211, or 212. Total of 5 minor courses.

Bypass credit opportunities: Students who are placed directly into 122, Calculus II, and who receive a grade of B or above therein, will receive credit for 121, Calculus I, upon request. Bypass credit for other courses may be awarded in special cases.

**Mat 110. Earth Algebra.** Use of functions from high school algebra to analyze consumption of resources, emission of carbon dioxide and other active environmental issues, showing how mathematics can help make informed decisions about real situations. Graphing calculators used. Does not count toward major or minor. Satisfies General Degree Requirement III.C.

**Mat 111, 112. Calculus with Review.** A two-course sequence including a review of algebra, trigonometry, and analytic geometry integrated with an introduction to the theory of differential and integral calculus. Completion of 111/112 satisfies General Degree Requirement III.C. and the Abstraction and Formal Reasoning LADR.

**Mat 121. Calculus I.** An introduction to the theory of differential and integral calculus for functions of one variable. Includes the concepts of limit, continuity, derivatives, and indefinite integrals and definite integrals, culminating in the Fundamental Theorem of Calculus. Applications to related rates and optimization problems. Prerequisite: a high-school calculus course or placement via departmental placement test. Satisfies General Degree Requirement III.C and the Abstraction and Formal Reasoning LADR.

**Mat 122. Calculus II.** Differentiation and integration of logarithmic functions, exponential functions, and inverse trigonometric functions. Study of polar coordinates, conic sections, and various integration techniques. Applications to computations of volumes, surface areas, and centers of mass. Prerequisite: 121 or equivalent college course, or placement via departmental placement test. Satisfies General Degree Requirement III.C and the Abstraction and Formal Reasoning LADR.

**Mat 160. Special Topics.**

**Mat 210. Mathematics: Topics for the Liberal Arts.** Non-technical introduction to selected concepts of modern mathematics (such as logic, set theory, axiomatic systems, non-Euclidean geometry, number theory, graph theory, etc.) that illustrate the nature of mathematics and its connections to other areas of knowledge. Does not count toward major or minor. Satisfies the Abstraction and Formal Reasoning LADR or GDR III.C.

**Mat 211. Mathematics in Culture.** Survey of the historical and cultural origins of everyday arithmetical, algebraic, and geometric concepts and the ways in which these ideas have been reflected in the arts and humanities. Does not count toward major or minor (consider 311 for such purposes).
Satisfies General Degree Requirement III.C. Not open to students with prior credit in 311.

**Mat 212. Problem Solving with Elementary Mathematics.** General problem solving using logic, intuitive geometry, probability and statistics, and other selected topics. Required for those seeking certification in elementary education, but open to all. Does not count toward major or minor. No prerequisites. Satisfies General Degree Requirement III.C.

**Mat 217. Applied Statistics.** Use of graphs and numerical summaries to describe data from individual variables and to investigate relationships among variables. Design of statistical experiments. Survey of fundamental concepts of probability, including sampling distributions. Use of sample data to estimate, and to test hypotheses about, unknown parameters. Satisfies General Degree Requirement III.C and the Abstraction and Formal Reasoning LADR. Does not count toward major. No prerequisites.

**Mat 220. Logic, Sets and Relations.** An introduction to the foundations of mathematics, with emphasis on developing basic reasoning skills needed for constructing proofs. Satisfies General Degree Requirement III.C and the Abstraction and Formal Reasoning LADR.

**Mat 221. Calculus III.** Differentiation and integration of vector-valued functions. Study of functions of several variables, including partial derivatives and multiple integrals. Detailed study of infinite sequences and series. Prerequisite: 122 or equivalent. Satisfies GDR III.C or the Abstraction and Formal Reasoning LADR.

**Mat 224. Linear Algebra.** Systems of linear equations and their solutions. Study of the algebraic properties and applications of vectors, matrices, and linear transformations. Prerequisite: 121 or permission.

**Mat 231. Differential Equations.** Survey of basic techniques for describing dynamical systems by means of equations involving derivatives of functions, and of methods for finding functions which satisfy these equations. Prerequisite: 122.

**Mat 260. Special Topics.**

**Mat 301. Seminar.** Presentation, on topics of current interest, by faculty members and students. May be repeated for credit. .25 unit.

**Mat 307. Directed Study.** .50 unit.

**Mat 311. Mathematics in History.** Chronological survey of important discoveries in mathematics, examining the mathematicians that made them and the historical contexts in which they were made. Prerequisite: 121 or equivalent. Offered alternate years.

**Mat 315. Introduction to Operations Research.** Development of procedures for identifying the most desirable of many alternative decisions, as in problems involving job schedules, transportation networks and schemes, traffic flow plans, or inventory management. Prerequisite: 121 or equivalent. Offered on demand.

**Mat 321. Introduction to Real Analysis.** Development of the algebraic and topological properties of the real number system and the theoretical foundations of differential and integral calculus. Prerequisite: 221. Strongly recommended for students considering post-graduate study in mathematics. Offered on demand.

**Mat 323. Introduction to Complex Analysis.** Study of complex numbers and functions of a complex variable. Topics include algebra and geometry of the complex plane, derivatives, integrals, power series, Laurent series, and residue theory. Prerequisite: 221 or permission. Offered on demand.

**Mat 324. Algebraic Systems.** Study of concepts abstracted from algebraic properties of the classical number systems, including groups, rings, fields, order relations, and equivalence relations. Prerequisite: 122 or 220 or 224.

**Mat 327. Probability and Statistics.** Calculus-based survey, including axioms of probability, discrete and continuous random variables, standard probability functions (binomial, normal,
Poisson, etc.), mathematical expectation, generating functions, and a brief introduction to estimation and hypothesis testing. Prerequisite: 122.

**Mat 339. Foundations of Geometry.** Survey of ancient, classical and modern views regarding the nature of space, the description of spatial structures and the organization of facts about space into deductive theories. Prerequisite: 121 or permission.

**Mat 343. Discrete Mathematics.** Includes selected topics from graph theory and combinatorics: connectivity, colorings, cliques, planarity, directed graphs, cuts and flows, principle of inclusion and exclusion. Prerequisite: Mat 220 or permission.

**Mat 357. Internship.** Off-campus supervised experience in mathematics.

**Mat 359. Introduction to Topology.** Study of concepts, growing out of and underlying geometry and calculus, which have become important in physics, chemistry, logic, and computer science. Careful development of abstract notions such as topological spaces, continuity, topological equivalence, connectedness, and dimension, and related philosophical and historical matters in mathematics and liberal arts generally. Prerequisite: 121.

**Mat 360. Special Topics.** Topics may be drawn from analysis with complex variables, introduction to functional analysis, category theory, mathematical logic and model theory, recursive function theory, topology, universal algebra, or other areas.

**Mat 370. Directed Study.** Individual study of topics such as those listed under 360. One unit.

**Mat 431. Topics in Analysis.** Content varies. Prerequisite: 321. Offered on demand.

**Mat 434. Topics in Algebra.** Content varies. Prerequisite: 324. Offered on demand.

**Mat 437. Topics in Probability and Statistics.** Content varies. Prerequisite: 327. Offered on demand.

**Mat 439. Topics in Geometry.** Content varies. Prerequisite: 339. Offered on demand.

**Mat 461. Colloquium.** Content varies. May be repeated for credit.

**Mat 471. Independent Study.**