

Mathematics

Chair: Dr. John Harris

The program in mathematics embodies both views of mathematics: one, as the study of abstract structures and hence independent of the physical world; the other, as the cornerstone of all scientific inquiry. The program passes through phases of emphasis on problem solving, to formulating problems in mathematical language, to dealing with mathematical structures and abstract ideas.

The program leading to a Bachelor of Science or Bachelor of Arts degree in Mathematics is designed to provide a firm foundation in general principles for students whose main interest in mathematics is to teach mathematics at the secondary level, to pursue graduate study in mathematics, or to apply mathematics to related fields like actuarial science, engineering, or business.

For students interested in using mathematics for applications in computer science, the Mathematics major with a concentration in Computer Science is an excellent choice.

Career opportunities for Mathematics majors are many. The growth of automation and space science, the widespread use of computers, the increasing dependence of the actuarial, biological, computer, managerial, and social sciences on mathematics, and the modern emphasis on such topics as Probability, Statistics, Combinatorics, and Functional Analysis in Engineering and the Physical Sciences have created a demand for mathematicians. Also, the discipline and training necessary to obtain a degree in mathematics is recognized as an excellent foundation for careers that normally would not be considered mathematical, like law or medicine.

BACHELOR OF ARTS or BACHELOR OF SCIENCE IN MATHEMATICS

MAJOR REQUIREMENTS

Chemistry 101-102 or Biology 111-112; Mathematics 121, 122, 130, 192, 221, 222, 292, 322, 392, 401, 407, 492, and 6 credits from Mathematics 301, 302, 303, 304, 305, 306, 307, 308, 310, 398/399, 402, 406, 408, 491, or 501; Physics 121, 122, Computer Science 121.

BACHELOR OF SCIENCE, MATHEMATICS: ACTUARIAL CONCENTRATION

MAJOR REQUIREMENTS

Chemistry 101-102 or Biology 111-112; Mathematics 121, 122, 130, 192, 221, 222, 292, 304, 305, 392, 401, 407, 492, and 3 credits from Mathematics 301, 302, 303, 306, 307, 308, 310, 322, 398/399, 402, 406, 408, 491, or 501; Physics 121, 122; Computer Science 121; Stat 101; Econ 101, 102; Acct 101, 102; Fin 202; Management 101; Marketing 302.

BACHELOR SCIENCE IN MATHEMATICS SECONDARY EDUCATION CERTIFICATION

MAJOR REQUIREMENTS

Chemistry 101-102 or Biology 111-112; Mathematics 121, 122, 130, 192, 221, 222, 292, 303, 304, 322, 392, 401, 407, 492, Physics 121, 122, Computer Science 121; plus requirements listed under the Secondary Education program.

BACHELOR OF SCIENCE IN MATHEMATICS COMPUTER SCIENCE CONCENTRATION

MAJOR REQUIREMENTS

Computer Science 121, 122, 209 and 9 credits from Computer Science 210, 211, 240-245, 310, 345, 401, 402, 437, 440 or 445; Mathematics 121, 122, 130, 221, 222, 401, 407, 492; Physics 121, 122; Chemistry 101-102 or Biology 111-112.

Students are encouraged to communicate with Computer Science Faculty regarding course selections

Minor in Mathematics Requirements — Mathematics 121, 122, 221, and six credits from Mathematics 130, 222, 301, 302, 303, 304, 305, 306, 307, 308, 310, 322, 401, 402, 406, 407, 408, or 491.

Minor in Quantitative Methods Requirements — Mathematics 111, 112 or Math 121, 122; Statistics 101 or Math 304 or Business Statistics 301-302; Computer Science 101, 121; and one additional course (1 to 3 credits) in Computer Science. Not available to Math majors.

MATHEMATICS — COURSE DESCRIPTIONS

100. Preparatory Mathematics (3 credits)

A course designed to prepare students deficient in mathematics for successful performance in the mathematics courses required for degree programs. This course does not fulfill graduation requirements of a mathematics course and may not be taken after successful completion of any other mathematics course at Saint Francis University. *Fall and as needed.*

101. General Mathematics (3 credits)

Designed for students in a variety of majors. The nature of mathematics; an appreciation of the beauty, extent, and vitality of mathematics; some of its more modern concepts, and its impact on society. *Spring.*

105. Modern Elementary Mathematics I (3 credits)

For elementary education majors. Elementary theory of sets and logic, properties of operations in the set of whole numbers; algorithms for performing the operation. *Fall, Summer.*

106. Modern Elementary Mathematics II (3 credits)

Properties of operations in the sets of integers, rational numbers, and real numbers; elementary concepts of geometry. *Prerequisite: Mathematics 105. Spring, Summer.*

110. Pre-Calculus Mathematics (3 credits)

Essential mathematical background needed in calculus. It includes topics such as: functions, graphs, analytic geometry, polynomials, exponential and logarithmic functions, trigonometry, triangles, complex numbers and systems of equations. *Fall.*

111. Finite Mathematics (3 credits)

A unified treatment of basic concepts of set theory, logic, probability, statistics, matrix algebra, and linear programming. *Fall, Spring, Summer.*

112. Calculus (3 credits)

An intuitive approach to the fundamental notions of the derivative and integral of algebraic, exponential, and logarithmic functions; applications of basic techniques. Prerequisite: Math 110 or satisfactory performance on calculus placement exam. *Spring.*

121. Calculus with Analytic Geometry I (3 credits)

Introduction to differentiation and integration of functions of one real variable, applications to related disciplines; topics of analytic geometry introduced as needed. Prerequisite: Math 110 or satisfactory performance on calculus placement exam. *Fall.*

122. Calculus with Analytic Geometry II
(3 credits)

Differentiation and integration of transcendental functions; techniques of integration. *Prerequisite: Mathematics 121. Spring.*

130. Discrete Mathematics
(3 credits)

The study of finite systems in mathematics with an emphasis on applications in computer science. Topics include: set theory, relations, functions, matrices, graph theory, combinatorial analysis, algebraic systems, partially ordered sets/lattices, propositional calculus, and Boolean algebras. *Fall 2005, Spring 2007.*

192. Freshman Mathematics Seminar
(0 credits)

Sessions will cover a variety of student centered topics from student life, undergraduate research opportunities and presentations, graduate professional school entrance exams, career planning and preparation. *Fall.*

221. Calculus III
(3 credits)

Advanced techniques of integration; introduction to sequences and series. *Prerequisite: Mathematics 122. Fall.*

222. Calculus IV
(3 credits)

Differentiation and integration of multivariable functions; applications. *Prerequisite: Mathematics 221. Spring.*

292. Sophomore Mathematics Seminar
(0 credits)

Sessions will cover a variety of student centered topics from student life, undergraduate research opportunities and presentations, graduate/professional school entrance exams, career planning and preparation. *Fall.*

301. Logic and Set Theory
(3 credits)

Fundamental principles of inference; introduction to the theory of sets; transfinite arithmetic. *As needed.*

302. Number Theory
(3 credits)

Congruences, number-theoretic functions, Diophantine equations, divisibility properties of integers. Selected topics. *As needed.*

303. Foundations of Geometry
(3 credits)

Axiomatic development of projective, affine and Euclidian geometry. *Spring, odd-numbered years.*

304. Mathematical Statistics I
(3 credits)

Fundamental concepts of probability; particular probability distributions; sampling theory and hypothesis testing; correlation and regression. *Prerequisite: Mathematics 122. Spring 2006, Fall 2007.*

305. Mathematical Statistics II
(3 credits)

A continuation of Mathematics 304, covering general principles of statistical inference, small sampler distribution, design of experiment, non-parametric methods, sequential analysis, and Bayesian techniques. *Prerequisite: Mathematics 304. As needed.*

306-307. Ordinary Differential Equations I, II
(3 credits each)

Theory of first and higher order elementary differential equations, including Laplace transforms and power series. Practical applications. *Prerequisite: Mathematics 122. Mathematics 306 is a prerequisite for Mathematics 307. Spring, even-numbered years.*

308. Vector Analysis/Partial Differential Equations
(3 credits)

The algebra and geometry of vectors with applications to mechanics and dynamics; linear vector spaces and matrices; vector field theory; the vibrating string; solutions of PDE by series and integrals. *Prerequisite: Mathematics 222. As needed.*

310. Numerical Analysis
(same as Computer Science 310)
(3 credits)

Programmable algorithms, with error analysis, for: solving non-linear equations, systems of linear equations, matrix calculations, polynomial interpolation, least squares approximation, and numerical integration. Programming assignments. *Prerequisites: Computer Science 121, 203, Mathematics 221. As needed.*

322. Linear Algebra
(3 credits)

Basic theory of finite dimensional vector spaces, linear transformations over them, and associated matrix algebra. *Fall 2006, Spring 2008.*

392. Junior Mathematics Seminar
(0 credits)

Sessions will cover a variety of student centered topics from student life, undergraduate research opportunities and presentations, graduate/professional school entrance exams, career planning and preparation. *Fall.*

**398/399. Mathematics Internship
(3-15 credits)**

The integration of classroom theory with practical work experience under which students have specific periods of attendance at college and specific periods of employment, either full- or part-time, with or without pay. Credit may vary from three to 15 credits, but no more than four credits may be counted toward major requirements, with additional credits counted as free electives. Open only to Mathematics majors with approval of the department chair and the Provost. *Fall, Spring, Summer.*

**401. Real Analysis I
(3 credits)**

The Peano axioms and the construction of the Real Number System; topology of the Real Number System; limits and continuity; derivatives; the Riemann Integral. *Prerequisite: Mathematics 122. Fall, even-numbered years.*

**402. Real Analysis II
(3 credits)**

Further properties of the Riemann Integral; infinite series; sequences and series of functions; power series; the Stieltjes Integral; Fourier Series; introduction to Lebesgue Measure and the Lebesgue Integral. *Prerequisite: Mathematics 401. As needed.*

**406. Topology
(3 credits)**

An introduction to point-set topology. Properties of metric and general topological spaces. Applications to the space of real numbers. *Prerequisite: Mathematics 401. As needed.*

**407. Abstract Algebra I
(3 credits)**

Fundamentals of algebraic systems, including elementary theory of groups, rings, and fields. *Prerequisite: Junior or senior standing. Fall, odd-numbered years.*

**408. Abstract Algebra II
(3 credits)**

Algebraic structures including lattices, algebraic number fields and related topics. *Prerequisite: Mathematics 407. As needed.*

**491. Seminar: Special Problems
(1-3 credits)**

Open to qualified students with special areas of interest. *As needed.*

**492. Mathematics Seminar (same as
Physics 492)
(1 credit)**

Selection of an acceptable mathematics topic, research, and presentation of the research findings in written and oral form. *Prerequisite: Mathematics 222. Fall.*

**501. Independent Study in Mathematics
(1-8 credits)**

STATISTICS — COURSE DESCRIPTIONS

**101-102. Statistics I, II
(3 credits each)**

Methods used in the collection, presentation, analysis and interpretation of data, including experimental design, sampling theory, estimation theory, hypothesis testing, regression, correlation, analysis of variance and non-parametric techniques. *Computer analysis required. STAT 101: Fall, Spring, Summer. STAT 102: As needed.*

**103. Statistics Lab
(1 credit)**

Optional laboratory course. *Corequisite (or prerequisite): Statistics 101 or Business Statistics 301. As needed.*