

Mathematics

Contact Persons: *Marc Brodie, Ph.D.*
Theodore Erickson, Ph.D.
John Karwin, S.J.
Onkar Pandit
Kimberly Roth, Ph.D.

The essence of orderliness, form and elegance, mathematics is a basic tool for many disciplines and careers. The mathematics curriculum is designed to provide the student with a strong mathematics background enhanced by technological tools, such as the graphing calculator and symbolic algebra software. It also is flexible enough to accommodate the diverse interests of mathematics majors, including those preparing for graduate work, those preparing to become an actuary and those seeking to teach on the elementary or secondary level.

Upon completion of the Mathematics program, students will be able to:

1. Comprehend and simplify mathematical expressions.
2. Build or solve mathematical models.
3. Prove or disprove a theory with logical steps.
4. Understand and use modern technology in mathematics.
5. Pursue high level mathematical theory.

Core Fulfilling Courses

Mathematics Requirement 1 course

CSC 110	Computer Science I	(4 crs)
MAT 102	Math in Society	(3 crs)
MAT 105	Introduction to Statistics I	(3 crs)
MAT 108	Pre-Calculus	(3 crs)
MAT 111	Calculus I	(4 crs)

(A student with advanced placement may substitute a higher level MAT or CSC course to fulfill the core requirement.)

Requirements for Mathematics Major

Bachelor of Science Degree

MAT 111	Calculus I	(4 crs)
MAT 112	Calculus II	(4 crs)
MAT 211	Calculus III	(4 crs)
MAT 235	Discrete Math	(4 crs)
MAT 212	Differential Equations	(3 crs)
MAT 240	Linear Algebra	(4 crs)
MAT 382	Introduction to Research Seminar	(2 crs)

Upper-Level Requirements:

Three courses from MAT 351, MAT 352, MAT 411, MAT 413 (9 crs)

Upper-Level Electives:

Four courses from MAT 204 and MAT 300 and above (one may be taken from CSC and PHY) (12 crs)

MAT 482	Senior Seminar	(2 crs)
		<hr/>
		(48 crs)



Requirements for Certification in Math Education

The student wishing to pursue certification for teaching mathematics in the intermediate and/or secondary schools should consult the director of the teacher preparation program for specific requirements. Generally, the student completes the mathematics major as described above with two upper-level electives being specified as MAT 424 and MAT 335 or MAT 204. PSY 110 should be taken as early as possible.

Requirements for Mathematics Minor

Mathematics minors must complete a minimum total of 15 credit hours in mathematics beyond MAT 111.

Course Descriptions

MAT 096 Algebra Review (3 crs)

A review of topics from elementary and intermediate algebra, including first order equations, exponents and radicals, polynomials, quadratic expressions, quadratic equations, rational expressions, linear and nonlinear systems of equations, inequalities and the binomial theorem.

MAT 102 Math in Society (3 crs) (core)

This course is designed to meet the needs of students who do not have a specific course needed for support of their major. The fundamental properties of numbers, geometry and statistics are covered through the collection of modern and useful applications of mathematics. The course contains a collection of topics of modern society: Social Choice, Management Science, Growth and Symmetry and Statistics. Prerequisite: MAT 096.

MAT 105 Introduction to Statistics (3 crs) (core)

Descriptive statistics including measures of central tendency and variability, graphic representation, probability, the binomial, normal and T distributions, hypothesis testing and linear regression. Prerequisite: MAT 096.

MAT 108 Pre-Calculus (3 crs) (core)

A thorough preparation for calculus with analytic geometry, including conic sections, and the transcendental functions: logarithmic, exponential and trigonometric functions. Prerequisite: MAT 096.

MAT 111 Calculus I (4 crs) (core)

A theoretical introduction to differential calculus including limits, continuity, the basic rules for derivatives and applications including optimization problems. A brief introduction to integration leading to the Fundamental Theorem of Calculus completes this course. Prerequisite: MAT 108 or equivalent.

MAT 112 Calculus II (4 crs)

Transcendental functions, applications of integrals, volumes of revolution, surface areas; techniques of integration, including powers of trigonometric functions, integration by parts and by partial fractions, improper integrals, infinite series, Taylor's expansion and indeterminate forms. Prerequisite: MAT 111.

MAT 204 Scientific Statistics (3 crs)

An introduction to scientific statistics with emphasis on experimental design methods, such as random assignment, block design, factorial crossings and repeated measures. Various statistics analyses, such as analysis of variance and analysis of covariance are applied to the appropriate design. Prerequisite: MAT 111 (offered every spring semester).

MAT 211 Calculus III (4 crs)

Vectors and vector valued functions, extreme of multivariate functions and the method of Lagrange multipliers, surfaces in three dimensions, line and surface integrals; multiple integration and Stokes Theorem. Prerequisite: MAT 112.

MATH - Recommended Course Sequence

	Freshman		Sophomore		Junior		Senior	
FALL	ENG 105 or 110	3	MAT 211	4	MAT 351/352	3	MAT 352/351	3
	HIS 110	3	MAT 235	4	MAT 335/331	3	MAT 331/335	3
	MAT 111	4	PHY 110	4	Global Persp.	3	MAT 482	2
	FYS 101	1	PHY 121	1	RST/PHI 305	3	Electives	6
	MOL	3	RST 106/107	3	Science	3	FAS Elective	1
	PHI 105	3			FAS 101	1		
Semester total	17		16		16		15	
SPRING	MAT 112	4	LIT 120	3	MAT 411/413	3	MAT 413/411	6
	MAT 204	3	MAT 212	3	MAT 300/310/424	3	MAT 204/300/310/424	3
	HIS 120	3	MAT 240	4	MAT 310/413	3	Electives	9
	MOL	3	RST 20x	3	MAT 382	2		
	PSY 110	3	PHI 205	3	Elective	3		
					FAS Elective	1		
Semester total	16		16		15		15	
Total Credits	33		32		31		30	126

MAT 212 Ordinary Differential Equations (3 crs)

ODEs of first order: linear, homogeneous, separable and exact, with applications; orthogonal trajectories; those of second order: reducible to first order, general and particular solutions by the methods of undetermined coefficients, variations of parameters and power series; and an introduction to numerical methods.

Prerequisite: MAT 112.

MAT 235 Discrete Mathematics (4 crs)

Sets and relations, logic and truth tables, Boolean algebra, logic gates, graph theory, combinatorics, algorithms, matrix algebra and determinants. Prerequisites: MAT 108 or equivalent.

MAT 240 Linear Algebra (4 crs)

Solution spaces for systems of linear equations, elementary row operations, vector spaces, linear independence, linear transformations, change of basis, inner products, projections, the Gram-Schmidt process, eigenvalues and eigenvectors. Prerequisite: MAT 211 or MAT 235.

MAT 300 Advanced Topics in Mathematics (3 crs)

Topics will be selected by the instructor. Offered spring semester of even years to alternate with MAT 310. Permission of the instructor is required.

MAT 310 History of Mathematics (3 crs)

History of the development of mathematical concepts in algebra, geometry, number theory, analytical geometry and calculus from ancient times through modern times. Theorems with historical significance will be studied as they relate to the development of modern mathematics. Prerequisite: MAT 112 or MAT 235. Offered spring semester of even years to alternate with MAT 300.

MAT 331 Numerical Analysis (3 crs)

Numerical solution of linear systems and of non-linear equations; interpolation, approximation and numerical differentiation and integration (computer methods and programming will be utilized.)

Prerequisite: MAT 112. Offered fall semester of even years.

MAT 335 Applied Probability and Statistics (3 crs)

Introduction to Probability: discrete and continuous random variables (binomial, geometric, hypergeometric, Poisson, normal, exponential, Chi-square, gamma), sampling distribution (including CLT), multivariate distributions, stochastic processes.

Prerequisite: MAT 112. Offered fall semester of odd years.

MAT 351 Introduction to Abstract Algebra: Rings (3 crs)

Introduction to rings, integral domains; ideals and factor rings; homomorphisms and isomorphisms; polynomial rings, unique factorization, irreducible polynomials; extension fields, algebraic extensions, finite fields; geometric constructibility. Prerequisite: MAT 240. Offered fall semester of odd years.

MAT 352 Introduction to Abstract Algebra: Groups (3 crs)

Introduction to groups: finite groups and subgroups, cyclic groups, permutation groups, homomorphisms and isomorphisms, cosets and Lagrange's theorem, direct products of homomorphisms.

Prerequisite: MAT 240. Offered fall semester of even years.

**MAT 382 Introductory Research Seminar (2 crs)**

An introduction to research in mathematics with emphasis on acquiring and practicing skills needed for the senior research project to be completed in MAT 482. Topics include literature searches and software use for generating and presenting mathematical research. Required of all mathematics majors in their sophomore or junior year.

MAT 411 Real Analysis (3 crs)

Least Upper Bound Property of the set of all real numbers. Uniform continuity and properties of continuous functions, differentiation, integration, sequences of functions, uniform convergence and the interchange of limit theorems. Offered spring semester of odd years.

MAT 413 Introduction to Complex Variables (3 crs)

Analytic functions; power series; complex integration and Cauchy's theorem; entire functions; analytic continuation. Prerequisite: MAT 211, 212. Offered spring semester of even years.

MAT 424 Geometry (3 crs)

Euclid's Axioms, the parallel postulate, leading to non-Euclidean geometries, and an introduction to projective and affine geometries. Offered spring semester of even years.

MAT 482 Senior Seminar in Mathematics (2 crs)

Independent study of topics not usually covered in the MAT curriculum leading to a presentation of an elementary research or survey paper by the student under the direction of a professor. Required for all mathematics majors in the junior or senior year. Prerequisite: MAT 382.