

# Mathematics (MATH)

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## **MATH 5010. History of Mathematics. 3 Hours.**

Prerequisite: MATH 2261. A study of the development of mathematics from primitive times to the twentieth century; including numeral systems, arithmetical methods, origins of algebra, geometry, trigonometry, analytic geometry, calculus; and selected topics from modern mathematics.

## **MATH 5040. Set Theory. 3 Hours.**

Prerequisite: MATH 2262. Propositional and predicate logic; mathematical induction. Logic and structure of sets as related to mathematical proof. Relations and cardinality.

## **MATH 5140. Mathematics for Special Education Teachers. 3 Hours.**

Prerequisite: MATH 1111. Fundamental mathematical concepts beginning with prenumber notions and then extending to number concepts, numeration systems, and computational algorithms for whole and rational numbers; geometry and measurement, and the role of technology in mathematical instruction.

## **MATH 5161. Mathematics for Early Childhood Teachers I. 3 Hours.**

Prerequisite: Grade of "C" or higher in either MATH 1101 or MATH 1111 and admission to the Teacher Education Program of the College of Education, or permission of instructor. An in-depth study of the concepts and processes underlying the P-5 school mathematics curriculum, with special emphasis on numeration, number systems, estimation, algebraic thinking, and computational algorithms. Problem solving and historical context serve as unifying strands.

## **MATH 5180. Mathematics for Middle School Teachers. 3 Hours.**

Prerequisite: Grade of "C" or higher in either MATH 1101 or MATH 1111. Concepts and processes that provide the for the middle-grades mathematics curriculum (5-8). Includes an in-depth study of the real number system with emphasis on the rational number system and axiomatic differences among number systems. Other topics include relations and functions, geometry (including coordinate geometry and graphing), measurement, and elementary probability and statistics.

## **MATH 5190. Algebra and Geometry for Teachers. 3 Hours.**

Prerequisite: C or better in either MATH 2261 or MATH 3180. An in-depth study of concepts and processes underlying the middle and secondary school mathematics curriculum with special emphasis placed upon the integrated development of algebra, geometry, and analytical geometry. Problem solving and historical context serve as unifying strands.

## **MATH 5340. Ordinary Differential Equations. 3 Hours.**

Prerequisite: MATH 2262 or consent of the instructor. Differential equations of first and second order, linear equations of higher order, applications.

## **MATH 5510. Foundations of Geometry. 3 Hours.**

Prerequisite: MATH 3040/5040. A study of the Euclidean and non-Euclidean plane geometry from both synthetic and metric approaches. Topics include concepts related to incidence, betweenness, plane separation and convexity, congruence, and parallelism, with some attention given to geometric transformations.

## **MATH 5600. Probability and Statistics. 3 Hours.**

Prerequisite: MATH 2262 or MATH 1262 with a grade of "C" or higher. Descriptive statistics, probability distributions for discrete and continuous random variables, statistical inference, one way analysis of variance, and regression analysis.

## **MATH 6081. Modern Algebra I. 3 Hours.**

Prerequisite: MATH 4150 or MATH 3040/5040 or consent of the instructor. Topics from groups, rings, and fields. Subgroups, cyclic groups, permutation groups, normal subgroups, homomorphisms, Cayley's and Lagrange's Theorems, factor groups, abelian groups, direct products. Introduction to rings and fields.

## **MATH 6082. Modern Algebra II. 3 Hours.**

Prerequisite: MATH 4081/6081. Continuation of MATH 6081 with emphasis on rings and fields. Rings, integral domains, and fields. Vector spaces, extension fields, finite fields.

## **MATH 6110. Number Theory. 3 Hours.**

Prerequisite: MATH 2262. Elementary properties of integers including divisibility, unique factorization, progressions and prime numbers. Linear congruences and residue classes, complete and reduced residue systems, Chinese Remainder Theorem, quadratic residues, law of quadratic reciprocity, Theorems of Fermat and Wilson, Fibonacci and perfect numbers, sums of squares, elementary theory of continued fractions.

## **MATH 6150. Linear Algebra. 3 Hours.**

Prerequisites: Either MATH 2150 and MATH 3040/5040 or consent of instructor. Introduction to the theory of vector spaces, with emphasis on finite-dimensional vector spaces, linear systems, matrices, linear transformations, eigenvalues, and related subjects.

## **MATH 6161. Mathematical Reasoning. 3 Hours.**

Prerequisite: C or better in either MATH 3162 or MATH 3180. An in-depth study of concepts and processes underlying the P-8 school mathematics curriculum with special emphasis on informal and formal mathematical reasoning. Problem solving and historical context serve as unifying strands. The analysis and remediation of student errors manifested in the application of conceptual and procedural mathematical knowledge will also be addressed.

**MATH 6260. Mathematical Analysis. 3 Hours.**

Prerequisites: MATH 3040/5040 or consent of instructor or MATH 2263 with a grade of "A" or "B". A study of the principles of mathematical analysis; point set topology in Euclidean and metric spaces, numerical sequences and series, continuity, differentiation, integration, sequences and series of functions.

**MATH 6300. Functions of a Complex Variable. 3 Hours.**

Prerequisite: MATH 2263. Introductory study of the algebraic and geometric properties of the complex number system and functions of a complex variable. Limits, continuity, and differentiation of complex functions. Analytic functions and the Cauchy-Riemann conditions. Integration of complex functions; Cauchy-Goursat theorem; Cauchy integral formula; the theorems of Morera and Liouville. Taylor and Laurent series expansions. Residues and poles with applications to integration. Conformal mappings.

**MATH 6547. Introduction to Mathematical Statistics. 3 Hours.**

Data analysis, sampling, and probability; standard methods of statistical inference, including t-tests, chi-square tests, and nonparametric methods. Applications include use of a statistical computer package.

**MATH 6621. Mathematical Statistics I. 3 Hours.**

Prerequisites: MATH 2263 and MATH 3600 or 5600. Distributions of random variables, conditional probability and stochastic independence, multivariate and some special distributions, and distributions of functions of random variables.

**MATH 6622. Mathematical Statistics II. 3 Hours.**

Prerequisite: MATH 4621/6621. Introduction to statistical inference, sufficient statistic, estimation theory, theory of statistical tests, and inferences about normal models.

**MATH 6651. Numerical Analysis I. 3 Hours.**

Prerequisites: MATH 2262 and either CS 1301 or CS 1338. Developmental and implementation of efficient numerical methods; locating roots of nonlinear equations; solving systems of linear equations; numerical differentiation and integration; interpolation; approximation of functions.

**MATH 6652. Numerical Analysis II. 3 Hours.**

Prerequisites: MATH 4651/6651 and MATH 3340/5340. Continuation of MATH 6651. Determination of eigenvalues and eigenvectors of matrices; method of least squares, and curve fitting; numerical solutions of ordinary and partial differential equations.

**MATH 6901. Operations Research I. 3 Hours.**

Prerequisite: MATH 2150 or MATH 4150/6150. Mathematical aspects and applications of operations research. Topics are selected from linear programming (mainly), integer programming, and dynamic programming.

**MATH 6902. Operations Research II. 3 Hours.**

Prerequisite: MATH 3600/5600 or MATH 4621/6621 (note that MATH 4901/6901 is not a prerequisite). An introduction to stochastic operations research. Topics are selected from stochastic modeling and optimization, probability models, queuing theory, and Monte Carlo simulation.

**MATH 6910. Mathematical Models. 3 Hours.**

Prerequisite: MATH 2263 and MATH 3600 or 5600, each with a grade of "C" or higher, or consent of instructor. An introduction to the basic principles and applications of classical mathematical models, optimization models and probabilistic models.

**MATH 6990. Special Topics in Mathematics. 3 Hours.**

Prerequisite: Consent of instructor and Head of Department of Mathematics and Computer Science. Topics and credit to be assigned. May be taken for more than once if topics are different.

**MATH 7610. Special Problem and Solving Strategies. 3 Hours.**

Special problems and solving strategies. Prerequisite: Math 2212 with a grade of B or better or permission from the instructor. The course will concentrate on developing solving strategies of difficult mathematical problems which require creativity and profound understanding of mathematics. Among topics to be covered: induction and pigeonhole principle, arithmetic, algebra, summation of series, intermediate real analysis, inequalities.

**MATH 7820. Historical and Cultural Development of Mathematics I. 3 Hours.**

Exploration of the historical and cultural development of mathematics between ~3000 B.C. and ~1600 A.D. Mathematics topics to include the development of arithmetic, geometry (practical, deductive, and axiomatic), number theory, trigonometry, syncopated and symbolic algebra, probability, and statistics. This course is for high school mathematics teachers in the M.A.T. or M.Ed. programs who have had a full sequence of calculus courses and a first course in linear algebra.