

# MATHEMATICS (MTH)

---

## **MTH-5010 Numbers and Mathematical Thinking (3 semester hours)**

This course will integrate the common core standards in a review of various introductory mathematics topics to build the participants' foundational knowledge in numbers and operations. It will focus on further developing the participants' mathematical thinking, conceptual understanding of the real and complex number systems, and link that to vector and matrix quantities, number theory and modern algebra concepts. Students will reason quantitatively, use modeling, problem-solving, and other mathematical practices to accomplish these goals.

## **MTH-5020 Statistics and Probability (3 semester hours)**

This course will deepen student understanding of critical concepts in statistics and probability related to core standards. They will gain the ability to collect and analyze data related to educational research. The course provides students with the requisite background in descriptive and inferential statistics to interpret categorical and quantitative data, make inferences, and draw conclusions. Conditional probability and decision making using probability will be a part of the modeling in this course.

## **MTH-5030 Understanding and Teaching Algebra (3 semester hours)**

This course will reinforce basic algebra concepts, present participants with advanced algebra topics, and present algebra as a modeling and a problem solving technique. The course will emphasize the understanding of the structure of algebra, polynomials, rational functions, and creating reasoning with equations and inequalities. Students will investigate how these topics connect to the algebra that is taught in the middle and high school grades. The course will integrate seamlessly concepts and methods of teaching algebra. After researching best practices, students will present a lesson on one of these topics. A discussion of the best practices and biggest challenges of teaching such a topic will be discussed by the group as they critique each lesson. Every student in the class will be expected to present and evaluate the work of their peers.

## **MTH-5040 Understanding and Teaching Geometry (3 semester hours)**

The course will primarily be a presentation of advanced geometry topics and will include connections to methods of teaching geometry. The majority of the class will be devoted to discussion of Euclidian and modern geometry topics that will deepen students' understanding of basic and advanced geometry concepts. Topics such as congruence, similarity, right triangles and trigonometry, circles, coordinate geometry, geometric measurements, and transformations will be presented. Students will be asked to prepare and present lessons. Following the presentation, a discussion of the best practices and biggest challenges of teaching such a topic will be discussed by the group as they critique each lesson. Every student in the class will be expected to present and evaluate the work of their peers. The course will emphasize the use of geometry software such as Geometry Sketchpad, Geogebra, Cabri, etc.

## **MTH-5100 Foundations of Higher Mathematics (3 semester hours)**

The fundamentals of advanced mathematics and an introduction to mathematical proofs. Topics include logic, quantifier notation, set operations, functions, relations, the integers, and study of rational, real, and complex numbers as fields. Various types of proof techniques will be studied and applied to problems from number theory, geometry, analytic geometry, discrete mathematics, logic, and calculus.

## **MTH-5200 Modern Geometries (3 semester hours)**

A study of absolute, finite, and non-Euclidean geometries from an axiomatic viewpoint.

## **MTH-5300 Number Theory (3 semester hours)**

Topics include the theory of mathematical induction, divisibility theory in the integers, prime numbers and their distribution, the theory of congruence and modular arithmetic, Fermat's theorem, quadratic reciprocity, Diophantine equations, and number theoretic functions and their applications.

## **MTH-5400 Probability and Statistics (3 semester hours)**

This course includes probability for discrete sample spaces, probability distributions, Chebyshev's theorem, moment generating functions, continuous random variables, sampling distributions, point and interval estimation, theory of hypothesis testing, regression and correlation, and introductory analysis of variance.

## **MTH-5500 Technology in the Mathematics Classroom (3 semester hours)**

Hands-on experiences working with current technology (scientific calculators, graphic calculators, computers, and computer software) for elementary, middle school, and secondary school mathematics. Presentation and evaluation of methods and strategies for employing technology as a regular part of instruction and assessment, including discussion of educational foundations.

## **MTH-5600 Assessment and Curriculum Development in Mathematics (3 semester hours)**

A balanced study of theoretical research-based foundations and classroom-reform based perspectives on assessment and evaluation in school mathematics. Consideration of alternate forms of assessment and evaluation of mathematics teaching and of students' mathematical learning. Topics include assessment standards, scoring rubrics, performance assessment, and portfolios. Curriculum goals and issues are also addressed; recent developments in curriculum; learning research; alternate modes of presentation.

## **MTH-5701 Research Seminar I (1 semester hours)**

This seminar serves as an introduction to methods of critical reading of research reports and to the structure and scope of mathematics education research.

## **MTH-5702 Research Seminar II (1 semester hours)**

Students will investigate recent developments and relevant research in mathematics education, and be introduced to the process of formal inquiry, as well as the skills necessary to read and evaluate the research.

**Prerequisite(s):** MTH-5701.

## **MTH-5703 Research Seminar III (1 semester hours)**

Students will read and evaluate original research, discuss issues of validity and reliability in research, and learn to assemble components for the writing of research.

**Prerequisite(s):** MTH-5702.

## **MTH-5704 Research Seminar IV (1 semester hours)**

Students will define a problem and begin investigation of it as a research project. The project must deal with a problem in mathematics education and may be local or national in scope.

**Prerequisite(s):** MTH-5703.

## **MTH-5810-9 Selected Topics in Mathematics (Variable semester hours)**

This course will address a specific area of study in Mathematic snot already covered by other course offerings. Prerequisites vary by topic.

**MTH-6010 Calculus Concepts and Applications I (3 semester hours)**

This course presents opportunities for students to expand and deepen their knowledge and understanding of calculus concepts and application. Basic concepts such as limits derivatives and integrals will be covered. The course includes examples of teaching approaches as applied to the teaching and learning of calculus. It will also focus on solving applications of calculus in STEM fields.

**Prerequisite(s):** MTH-5030 or MTH-5040.

**MTH-6020 Mathematical Connections (3 semester hours)**

The course will present students with topics that relate different mathematics branches to each other. The course will emphasize problem-solving as a technique to establish these connections and use mathematics as a tool to solve problems.

**Prerequisite(s):** MTH-5030; MTH-5040.

**MTH-6030 Applications in STEM (3 semester hours)**

The course follows a problem-based model of inquiry that will emphasize all mathematical practices. Students will explore the interdisciplinary nature of STEM, and investigate problems and projects from the physical sciences, life sciences, space science, technology and engineering. They will analyze, research, find the appropriate mathematical tools to model, and solve these problems.

**Prerequisite(s):** MTH-5030; MTH-5040.

**MTH-6040 Technology in Mathematics Classrooms (3 semester hours)**

This course will present and evaluate methods and strategies for employing technology as a regular part of instruction and assessment, including discussion of educational foundations. Students will research a relevant use of technology that could be used in their curriculum and share it with their classmates. Peer evaluation will provide helpful feedback.

**Prerequisite(s):** MTH-5030; MTH-5040.

**MTH-6060 Calculus Concepts and Applications II (3 semester hours)**

This course is a continuation of the first calculus course and focuses on techniques and applications. Integration and series will be emphasized. The course includes examples of teaching approaches as applied to the teaching and learning of calculus. It will focus also on solving applications of calculus in STEM fields.

**Prerequisite(s):** MTH-6010.

**MTH-6100 Abstract Algebra I (3 semester hours)**

Introduction to group theory. Topics include equivalence relations, groups, subgroups, cyclic groups, permutation groups, isomorphisms, cosets, external direct products, normal subgroups, factor groups, group homeomorphisms, rings, and integral domains. Open to graduate students in mathematics only.

**MTH-6200 Abstract Algebra II (3 semester hours)**

Continuation of MTH6100. Introduction to commutative rings, with emphasis on polynomial rings, fields vector spaces, and algebraic extensions.

**Prerequisite(s):** MTH-6100.

**MTH-6300 Advanced Calculus I (3 semester hours)**

Reexamination of the calculus of functions of one variable: convergence, continuity, differentiation, the mean-value theorem, and the Riemann integral. Open to graduate students in mathematics only.

**MTH-6400 Advanced Calculus II (3 semester hours)**

Further study of sequences and series of functions, functions of several variables, and an introduction to complex analysis.

**Prerequisite(s):** MTH-6300.

**MTH-6701 Research Project (2 semester hours)**

Students will analyze data collected from the implementation of a previously identified research project. Participants will complete their projects, submit a written report of their research, and present their findings.

**Prerequisite(s):** MTH-5704.

**MTH-6810-9 Selected Topics in Mathematics (Variable semester hours)**

This course will address a specific area of study in Mathematic snot already covered by other course offerings. Prerequisites vary by topic.