



Mathematics

Graduate Faculty

Dr. Heidi Hansen, Dr. Eric Lund, Dr. Todd Frauenholtz, Dr. Colleen Livingston, Dr. Jenna O'Dell, Dr. Derek Webb, Dr. Randy Westhoff

Programs

- Elementary and Middle Level Mathematics Education, M.S. *master*
- Mathematics Education, M.S. *master*

Elementary and Middle Level Mathematics Education, M.S. *master*

Required Credits: 34

Required GPA: 3.00

I. REQUIRED EDUCATION CORE

Complete the following courses:

- ED 6100 Educational Research I (3 credits)
- ED 6107 Advanced Educational Psychology (3 credits)
- MATH 6050 Assessment in the Mathematics Classroom (3 credits)

II. REQUIRED MATHEMATICS ELECTIVE COURSES

Complete the following courses:

- MATH 6061 Number Sense For Teachers (3 credits)
- MATH 5064 Number Concepts (4 credits)
- or MATH 6062 Number Theory For Teachers (3 credits)

Select at least 5 courses from the following:

- MATH 5065 Mathematical Foundations of Algebra (4 credits)
- MATH 5066 Geometry and Technology (4 credits)
- MATH 5067 Data, Probability, and Statistics (4 credits)
- MATH 6200 Structures of Discrete Mathematics (3 credits)
- MATH 6500 Geometry In The Classroom For Teachers (3 credits)
- MATH 6600 Probability For Teachers (3 credits)

III. REQUIRED PORFOLIO AND RESEARCH

Note: MATH 6050 should be taken prior to the collection of evidence for the pedagogical portfolio.

Note: Consult with advisor before registering for MATH 6055.

Complete the following courses:

- MATH 6055 Pedagogical Portfolio and Action Research (2 credits)

Program Learning Outcomes | Elementary and Middle Level Mathematics Educations, M.S.

1. Knowledge: Students will gain an in depth understanding of mathematics content appropriate for elementary and middle level teachers.

2. Pedagogy: Students will develop an understanding of the uses and limitations of a variety of instructional methodologies.

3. Curricular Design: Student will design lessons and curriculum that communicate mathematical concepts to learners with diverse learning styles and ability levels.

4. Research: Students will gain a understanding of the literature and use that understanding to answer research questions in a specialized area of mathematics education.

5. Professional Advancement: Students will apply what they have learned to improve the learning of their students and enhance the mathematics curriculum at their schools.

Mathematics Education, M.S. *master*

Required Credits: 32

Required GPA: 3.00

I. REQUIRED EDUCATION CORE

Complete the following courses:

- ED 6100 Educational Research I (3 credits)
- ED 6107 Advanced Educational Psychology (3 credits)
- MATH 6050 Assessment in the Mathematics Classroom (3 credits)

II. REQUIRED MATHEMATICS ELECTIVE COURSES

Select at least 12 credits from the following:

Note: Some courses listed have prerequisites not required in this program.

Other math content courses may be used with consent of advisor.

- MATH 5240 Number Theory (3 credits)
- MATH 5260 Mathematical Problem Solving (3 credits)

- MATH 5310 Linear Algebra (4 credits)
- MATH 5371 Modern Algebra (3 credits)
- MATH 5410 Introduction to Analysis (3 credits)
- MATH 5440 Introduction to Fractals & Chaos (3 credits)
- MATH5470
- MATH 5560 Classical and Modern Geometry (3 credits)
- MATH 5710 Mathematical Modeling (3 credits)
- MATH 5720 Numerical Methods (3 credits)
- MATH 5760 Topics in Applied Mathematics (3 credits)
- MATH 5820 History of Mathematics (3 credits)
- MATH 6350 Advanced Abstract Algebra (3 credits)
- MATH 6550 Advanced Geometry (3 credits)
- STAT 5631 Probability and Statistics I (4 credits)
- STAT 5632 Probability and Statistics II (3 credits)
- STAT5650
- STAT 5660 Statistics for the Health Sciences (3 credits)

III. REQUIRED MATHEMATICS PEDAGOGY ELECTIVE COURSES

Select at least 9 credits from the following (or other pedagogy courses approved by an advisor):

- MATH 5064 Number Concepts (4 credits)
- MATH 5065 Mathematical Foundations of Algebra (4 credits)
- MATH 5066 Geometry and Technology (4 credits)
- MATH 5067 Data, Probability, and Statistics (4 credits)
- MATH 6061 Number Sense For Teachers (3 credits)
- MATH 6062 Number Theory For Teachers (3 credits)
- MATH 6200 Structures of Discrete Mathematics (3 credits)
- MATH 6500 Geometry In The Classroom For Teachers (3 credits)
- MATH 6600 Probability For Teachers (3 credits)

IV. REQUIRED PORTFOLIO EVALUATION AND RESEARCH

Note: Consult with an advisor before registering for MATH 6055:

- MATH 6055 Pedagogical Portfolio and Action Research (2 credits)

COMPETENCY REQUIREMENT

Completion of MATH 6050, Assessment in the Mathematics Classroom, with a grade of 'B' or better, or the equivalent as approved by the department.

Program Learning Outcomes | Mathematics Education, M.S.

1. Knowledge: Students will gain an in depth understanding of mathematics content appropriate for secondary school teachers.
2. Pedagogy: Students will develop an understanding of the uses and limitations of a variety of instructional methodologies.
3. Curricular Design: Student will design lessons and curriculum that communicate mathematical concepts to learners with diverse learning styles and ability levels.
4. Research: Students will gain a understanding of the literature and use that understanding to answer research questions in a specialized area of mathematics education.
5. Professional Advancement: Students will apply what they have learned to improve the learning of their students and enhance the mathematics curriculum

at their schools.

Courses

All-University Courses

The course numbers listed below, not always included in the semester class schedule, may be registered for by consent of the advisor, instructor, or department chair, or may be assigned by the department when warranted. Individual registration requires previous arrangement by the student and the completion of any required form or planning outline as well as any prerequisites.

1910, 2910, 3910, 4910 DIRECTED INDEPENDENT STUDY
 1920, 2920, 3920, 4920 DIRECTED GROUP STUDY
 1930, 2930, 3930, 4930 EXPERIMENTAL COURSE
 1940, 2940, 3940, 4940 IN-SERVICE COURSE
 1950, 2950, 3950, 4950 WORKSHOP, INSTITUTE, TOUR
 1960, 2960, 3960, 4960 SPECIAL PURPOSE INSTRUCTION
 1970, 2970, 3970, 4970 INTERNSHIP
 1980, 2980, 3980, 4980 RESEARCH
 1990, 2990, 3990, 4990 THESIS

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Mathematics Courses

MATH 5064 Number Concepts (4 credits)

This course provides a background in number concepts that are pertinent to school mathematics. Topics include scientific notation, number sense, properties of integers, prime and composite numbers, divisors, GCDs, LCMs, the number of divisors, the sum of divisors, the Euclidean Algorithm, famous unsolved problems, finite mathematical systems, modular arithmetic, introductory graph theory and applications, permutations, combinations, sorting, congruences, sequences, direct and indirect proofs, mathematical induction, and traveling salesman problem and algorithms. Emphasis will be given to problem solving techniques as they relate to number concepts.

MATH 5065 Mathematical Foundations of Algebra (4 credits)

This course investigates concepts of patterns, relations, and functions.

MATH 5066 Geometry and Technology (4 credits)

This course examines the concepts of patterns, shape and space; spatial sense; plane, solid, and coordinate geometry systems; generalizing geometric principals; limits, derivatives and integrals; and appropriate use of technology for Geometry. Prerequisites: MATH 1011 or equivalent or consent of instructor; (Might not be offered every year.)

MATH 5067 Data, Probability, and Statistics (4 credits)

This course explores data investigations and concepts of randomness and uncertainty. The collection, display, analysis, and interpretation of data are studied. Additional topics include randomness, sampling, probability in simple and compound events, the prediction of outcomes using a variety of techniques, and the comparison of theoretical and empirical results of experiments.

MATH 5069 Mathematics and Culture (3 credits)

This course will introduce students to the relationships between mathematics and cultures and how an understanding of these relationships can increase learning and success in the mathematics classroom. The main focus of this course is on current cultures and their mathematics although some history of cultural mathematics will be covered. Cultures from around the world will be examined and students will also be given the opportunity to study cultures of particular interest to them or of particular relevance to their career as an educator. This course is designed for students studying to become and students who already are mathematics educators. Prerequisite(s): graduate status, or consent of instructor.

MATH 5240 Number Theory (3 credits)

Properties of integers, primes and their distribution, linear and quadratic congruences, number-theoretic functions, Diophantine equations, Fibonacci numbers, primitive roots and quadratic reciprocity.

MATH 5260 Mathematical Problem Solving (3 credits)

Investigation of problems and the process of problem solving across a variety of mathematical areas. Development and application of strategies used to solve problems with emphasis on multistep and nonroutine problems. Application of the process of mathematical modeling to real situations.

MATH 5310 Linear Algebra (4 credits)

Systems of linear equations, linear transformations, matrix operations, vector spaces, eigenvalues and eigenvectors, orthogonality, and applications.

MATH 5371 Modern Algebra (3 credits)

A study of abstract algebraic systems with an emphasis on groups and an introduction to rings. Prerequisite: MATH 5310 or equivalent.

MATH 5410 Introduction to Analysis (3 credits)

Functions, sequences, and properties of limits. Topics from calculus including continuity, differentiation, and integration. Open and closed sets, cluster points, and other topological properties.

MATH 5440 Introduction to Fractals & Chaos (3 credits)

An introduction into the topics of fractal geometry, chaos, and dynamic mathematical systems. Topics included are iteration, fractals and fractal dimension, iterated function systems, Julia set, Mandelbrot set, and bifurcation.

MATH 5560 Classical and Modern Geometry (3 credits)

Euclidean and non-Euclidean geometry, axiomatic systems, the geometry of solids, transformations, measurement, and fractal geometry.

MATH 5710 Mathematical Modeling (3 credits)

Mathematical modeling of applications that involve difference equations, matrices, probability, differentiation, and integration. Applications may be chosen from among the biological and physical sciences, economics, the social sciences, or other areas of interest. A graphing calculator is required.

MATH 5720 Numerical Methods (3 credits)

Root finding techniques, fixed point iteration, polynomial interpolation, methods for solving linear and nonlinear systems of equations, numerical integration and differentiation, numerical solutions of differential equations, and the method of steepest descent. Prerequisite: Programming competency or consent of instructor.

MATH 5760 Topics in Applied Mathematics (3 credits)

This course focuses on an advanced topic from applied mathematics. Possible topics include game theory, operations research, and cryptography. May be repeated for up to 6 credits with different topics. (Might not be offered every year.)

MATH 5820 History of Mathematics (3 credits)

Historical investigation and presentation of the sources and growth of mathematical knowledge and principles, including Peano's axioms, the Axiom of Choice, and Russell's Paradox. Prerequisite: Consent of instructor.

MATH 5961 Special Purpose Instruction (3 credits)

A course intended for specific groups or organizations outside the University community.

MATH 5962 Special Purpose Instruction (3 credits)

A course intended for specific groups or organizations outside the University community.

MATH 5963 Special Purpose Instruction (3 credits)

A course intended for specific groups or organizations outside the University community.

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A course intended for specific groups or organizations outside the University community.

MATH 5967 Special Purpose Instruction (3 credits)

A course intended for specific groups or organizations outside the University community.

MATH 5968 Special Purpose Instruction (3 credits)

A course intended for specific groups or organizations outside the University community.

MATH 5969 Special Purpose Instruction (3 credits)

A course intended for specific groups or organizations outside the University community.

MATH 6050 Assessment in the Mathematics Classroom (3 credits)

Examination of two important parts of assessment. First is the assessment of students: changes in assessment, new tools for assessment, implementing new assessments, and using the results of assessment. Second, teachers need to understand and know how to assess their teaching or changes in their teaching practices. Teachers learn to pose measurable questions, collect data, statistically analyze the data, interpret the data, and present conclusions. Teachers are given assistance in transferring this process to analyzing their teaching practices or programs in their school. Prerequisite: Teaching license or consent of the instructor.

MATH 6055 Pedagogical Portfolio and Action Research (2 credits)

This course is the culmination of the student's coursework, analysis, and study. In MATH 6050, Assessment in the Mathematics Classroom, students examine the current practices in individual and classroom assessment and study the fundamentals of applying statistical methods for instructional analysis. Students implement those skills in this course. Students construct instructional units in some of the courses needed for their program. Students complete one instructional unit change in their classroom and analyze the unit as per the outline from MATH 6050. Students also conduct a literature review that directly relates to their instructional unit changes. The portfolio consists of the literature review, instructional unit changes, and analysis and is evaluated by the student's graduate committee. The student cannot proceed with the oral defense until the portfolio has been approved by the committee. This course is graded Satisfactory/Unsatisfactory only. Prerequisite: Teaching license or consent of the instructor.

MATH 6061 Number Sense For Teachers (3 credits)

Number sense is the ability to understand numbers, ways of representing numbers, relationships among numbers, and number systems, according to the National Council of Teachers of Mathematics. This course focuses on these issues by examining problems with quantitative information and exploring reasonable solutions. Prerequisite: Teaching license or teaching position or consent of instructor.

MATH 6062 Number Theory For Teachers (3 credits)

Analysis of activities and mathematical games to understand the underlying mathematics. Students also study the division algorithm, prime and composite numbers, greatest common divisor, least common multiple, the Euclidean algorithm, mathematical induction, linear Diophantine equations, famous number theory conjectures, and additional elementary number theory topics. Prerequisite: Teaching license or teaching position.

MATH 6200 Structures of Discrete Mathematics (3 credits)

Topics include problem solving, the counting principle, combinations, permutations, graphs, Euler circuits, Hamiltonian paths, Pascal's triangle, Venn diagrams, scheduling, and voting theory. Students are expected to use the concepts and methods of discrete mathematics to model and solve problems. Emphasizes instructional strategies to help all students learn. Prerequisite: MATH 6061.

MATH 6350 Advanced Abstract Algebra (3 credits)

Designed to deepen the algebraic background of students through the study of elementary number theory and modular arithmetic; the development of the rational, real and complex number systems; and an introduction to rings, integral domains and fields. Prerequisites: MATH 5310 or equivalent.

MATH 6500 Geometry In The Classroom For Teachers (3 credits)

This course uses typical classroom materials to examine the Van Hiele model, 3-dimensional and 2-dimensional geometric shapes, and measurement concepts. Emphasizes instructional strategies, manipulatives, and tools to enhance student learning. Prerequisite: Teaching experience or consent of the instructor.

MATH 6550 Advanced Geometry (3 credits)

Historical development and theorems of Euclidean and non-Euclidean geometry, properties of polygons and polyhedra, tessellations of the plane, measurement and strategies for teaching geometry.

MATH 6600 Probability For Teachers (3 credits)

Introduction to the terms and models of elementary probability. Emphasizes instructional strategies to help all students learn. Topics include definition of terms, the counting principle, event modeling, event analysis, probability determinations, empirical and theoretical probabilities, and use of simulations to analyze real world problems. Prerequisite: Teaching experience or consent of the instructor.

MATH 6980 Research (2 credits)

Research carried out by the student that is based on appropriate methodology and scholarship.

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