

# MATHEMATICS (MATH)

## **MATH 1505 Intermediate Algebra with Applications 5 s.h.**

This course is intended to prepare STEM students for their college-level mathematics requirement. Topics include linear and nonlinear equations and inequalities; problem solving; relations of function types that include linear, polynomial, radical, rational, exponential, and logarithmic; applications. Math Placement Level 10 or higher. Does not count toward a degree.

## **MATH 1507 Intermediate Algebra 3 s.h.**

Topics include functions of the following: linear, polynomial, rational, exponential, and logarithmic. Emphasis on function relations and graphing by algebraic techniques and technology. Solving linear, nonlinear equations and inequalities. Does not count toward a degree.

**Prereq.:** MATH 1501 or Level 20 on Math Placement Test.

## **MATH 1510 College Algebra 4 s.h.**

This course is primarily intended to prepare STEM students (along with MATH 1511) for MATH 1570 or 1571 and business students for MATH 1552. Topics include real numbers, equations and inequalities, linear, quadratic, polynomial, exponential, and logarithmic functions, graphing techniques, systems of equations, and applications. The course fulfills the general education requirements for mathematics.

**Prereq.:** MATH 1505 or MATH 1507 with a "C" or better or Math Placement Level 35 or higher or Math Placement Level 20 and concurrent enrollment in MATH 1510C.

**Gen Ed:** Mathematics.

## **MATH 1510C Corequisite Support for College Algebra 1-3 s.h.**

This course is intended to provide corequisite support for students requiring remediation in mathematics while they are concurrently enrolled in MATH 1510 (College Algebra). Emphasis will be placed on prerequisite skills needed for college algebra as well as just in time review through the use of appropriate technology. Does not count toward a degree.

**Prereq.:** Concurrent enrollment in MATH 1510.

## **MATH 1511 Trigonometry 3 s.h.**

This course, along with MATH 1510 is primarily intended to prepare STEM students for MATH 1570 or MATH 1571. Topics include algebraic structure and graphs of trigonometric functions and inverse trigonometric functions, angle measurements, similar triangles, trigonometric identities, vectors, complex numbers, polar coordinates and solving trigonometric equations with applications.

**Prereq.:** MATH 1505 or MATH 1507 with grade of "C" or better or Math Placement Level 35 or Math Placement Test Level 20 and concurrent enrollment in MATH 1511C.

**Gen Ed:** Mathematics.

## **MATH 1511C Corequisite Support for Trigonometry 1-3 s.h.**

This course is intended to provide corequisite support for students requiring remediation in mathematics while they are concurrently enrolled in MATH 1511 (Trigonometry). Emphasis will be placed on prerequisite skills needed for trigonometry as well as just in time review through the use of appropriate technology. Does not count toward a degree.

**Prereq.:** Concurrent enrollment in MATH 1511.

## **MATH 1513 Algebra and Transcendental Function 5 s.h.**

Function concepts including trigonometric, exponential, and logarithmic functions. Application problems and graphing. Supplemental topics.

**Prereq.:** Math Placement Level 45 or higher.

**Gen Ed:** Mathematics.

## **MATH 1552 Applied Mathematics for Management 4 s.h.**

Apply functions, linear systems, linear programming to business including use of technology; mathematics of finance and an introduction to limits, derivatives and integrals with business applications. No credit for students who have completed MATH 1570 or MATH 1571.

**Prereq.:** MATH 1510 with grade of "C" or better or at least Level 45 on the Mathematics Placement Test.

**Gen Ed:** Mathematics.

## **MATH 1552C Corequisite Support for Applied Math for Management 1-3 s.h.**

This course is intended to provide corequisite support for students requiring remediation in mathematics while they are concurrently enrolled in MATH 1552 (Applied Math for Management). Emphasis will be placed on prerequisite skills needed for business calculus as well as just in time review through the use of appropriate technology. Does not count toward a degree.

**Prereq.:** Concurrent enrollment in MATH 1552.

## **MATH 1564 Foundations of Middle School Mathematics 1 4 s.h.**

Conceptual foundations of topics from number theory, operations, functions, algebra, geometry, measurement, probability, and data analysis. Emphasis on multiple approaches and representations, problem solving, and communication of mathematical reasoning. Includes inquiry-based laboratory experiences with manipulatives and computing technology.

**Prereq.:** At least Level 40 on the Mathematics Placement Test or concurrent registration in MATH 1507 (for both).

## **MATH 1570 Applied Calculus 1 4 s.h.**

The elements of differential and integral calculus, with emphasis on applications. Analytical geometry, differentiation and integration techniques and series representations. Introduction to differential equations, transform calculus, and Fourier analysis. This is a basic methods course particularly adapted for those who require applied topics in mathematics. Not applicable toward the Mathematics major. Credit will not be given for both MATH 1549 and MATH 1570.

**Prereq.:** MATH 1513, or MATH 1510 and MATH 1511 grade of "C" or better, or at least Level 50 on the Mathematics Placement Test.

**Gen Ed:** Mathematics.

## **MATH 1571 Calculus 1 4 s.h.**

A sequence of integrated courses in analytic geometry and calculus. A detailed study of limits, derivatives, and integrals of functions of one and several variables with applications.

**Prereq.:** MATH 1513, minimum grade of "C", or MATH 1510 and MATH 1511, minimum grade of "C" in both courses, or at least Level 70 on the Mathematics Placement Test.

**Gen Ed:** Mathematics.

## **MATH 1571H Honors Calculus 1 4 s.h.**

A sequence of integrated courses in analytic geometry and calculus. A detailed study of limits, derivatives, and integrals of functions of one and several variables with applications.

**Prereq.:** MATH 1513, minimum grade of "C", or MATH 1510 and MATH 1511, minimum grade of "C" in both courses, or at least Level 70 on the Mathematics Placement Test.

**Gen Ed:** Mathematics.

## **MATH 1572 Calculus 2 4 s.h.**

A sequence of integrated courses in analytic geometry and calculus. A detailed study of limits, derivatives, and integrals of functions of one and several variables with applications.

**Prereq.:** C or better in MATH 1571.

**Gen Ed:** Mathematics.

## **MATH 1572H Honors Calculus 2 4 s.h.**

A sequence of integrated courses in analytic geometry and calculus. A detailed study of limits, derivatives, and integrals of functions of one and several variables with applications.

**Prereq.:** MATH 1571 OR MATH 1581H grade of "C" or better.

**Gen Ed:** Mathematics.

## **MATH 1580H Honors Biomathematics 1 2 s.h.**

Counting techniques, probability, matrices and linear systems. Emphasis on the role of mathematical models in explaining and predicting phenomena in life sciences.

**Prereq.:** Admission to NEOMED-YSU program.

**MATH 1581H Honors Biomathematics 2 4 s.h.**

Limits, derivatives, integrals; emphasizes theory, proofs, nonlinear epsilonics, medical/health applications. Rigorously develops logarithmic/exponential functions. Major projects applying differential equations to medicine. Credit can be given for both MATH 1571 and MATH 1581H if taken in that order; MATH 1581H can be prerequisite for MATH 1572.

**Prereq.:** Admission to YSU-BaccMed program.

**Gen Ed:** Mathematics.

**MATH 1585H Accelerated Honors Calculus 1 5 s.h.**

A sequence of honors courses in analytical geometry and calculus which cover essentially the same material as MATH 1571, 1572, 2673, in two semesters instead of three. A detailed study of limits, derivatives, and integrals of functions of one and several variables and their applications. This sequence will be offered at most once during each academic year.

**Prereq.:** ACT math subscore of 32, AP Calculus score of 4 or higher, or at least one unit of high school calculus with a score of 28 or higher on placement exam or instructor permission.

**Gen Ed:** Mathematics.

**MATH 1586H Honors Calculus Laboratory 1 1 s.h.**

Introduction to mathematical modeling of topics covered in calculus. Emphasizes the use of technology such as computer algebra systems, technical document processing, and graphics software for solving problems and reporting solutions.

**Prereq.:** MATH 1571 or concurrent with 1585H.

**MATH 2623 Quantitative Reasoning 3 s.h.**

Mathematics models emphasizing basic ideas in mathematics and statistics, stressing concept formation rather than manipulative skills.

**Prereq.:** at least Level 20 on the Mathematics Placement Test or Level 10 on Mathematics Placement Test and concurrent enrollment in MATH 2623C.

**Gen Ed:** Mathematics.

**MATH 2623C Corequisite Support for Quantitative Reasoning 1-3 s.h.**

This course is intended to provide corequisite support for students requiring remediation in mathematics while they are concurrently enrolled in MATH 2623 (Quantitative Reasoning). Emphasis will be placed on prerequisite skills needed for MATH 2623 as well as just in time review through the use of appropriate technology. Does not count toward a degree.

**Prereq.:** Concurrent enrollment in MATH 2623.

**MATH 2623H Honors Quantitative Reasoning 3 s.h.**

Mathematics models emphasizing basic ideas in mathematics and statistics, stressing concept formation rather than manipulative skills. Credit will not be given for both MATH 2623 and STAT 2625.

**Prereq.:** MATH 1501 or Level 20 on the Mathematics Placement Test.

**Gen Ed:** Mathematics.

**MATH 2651 Mathematics for Early Childhood Teachers 1 3 s.h.**

A conceptual development of mathematics topics underlying today's Pre-K-grade 3 curriculum. Emphasis on multiple approaches, problem solving, and communication of mathematics. Incorporates classroom activities, manipulatives, technology, and activities developmentally appropriate for young children.

**Prereq.:** at least Level 20 on the Mathematics Placement Test or Level 10 on the Mathematics Placement Test and concurrent enrollment in MATH 2651C.

**MATH 2651C Corequisite Support for Mathematics for Early Childhood Teachers 3 s.h.**

This course is intended to provide corequisite support for students requiring remediation in mathematics while they are concurrently enrolled in MATH 2651. Emphasis will be placed on prerequisite skills needed for Algebra, Number and Operations, and Quantity topics as well as just in time review through the use of appropriate technology. Does not count toward a degree.

**Prereq.:** Concurrent enrollment in MATH 2651.

**MATH 2652 Mathematics for Early Childhood Teachers 2 3 s.h.**

A conceptual development of mathematics topics underlying today's Pre-K-grade 3 curriculum. Emphasis on multiple approaches, problem solving, and communication of mathematics. Incorporates classroom activities, manipulatives, technology, and activities developmentally appropriate for young children.

**Prereq.:** MATH 2651.

**Gen Ed:** Mathematics.

**MATH 2665 Foundations of Middle School Mathematics 2 4 s.h.**

Conceptual foundations of topics from number theory, operations, functions, algebra, geometry, measurement, probability, and data analysis. Emphasis on multiple approaches and representations, problem solving, and communication of mathematical reasoning. Includes inquiry-based laboratory experiences with manipulatives and computing technology.

**Prereq.:** At least Level 40 on the Mathematics Placement Test or concurrent registration in MATH 1507 (for both).

**Gen Ed:** Mathematics.

**MATH 2670 Applied Calculus 2 5 s.h.**

The elements of differential and integral calculus, with emphasis on applications. Analytical geometry, differentiation and integration techniques and series representations. Introduction to differential equations, transform calculus, and Fourier analysis. This is a basic methods course particularly adapted for those who require applied topics in mathematics. Not applicable toward the Mathematics major. Credit will not be given for both MATH 1549 and MATH 1570.

**Prereq.:** MATH 1570 grade of "C" or better.

**Gen Ed:** Mathematics.

**MATH 2673 Calculus 3 4 s.h.**

A sequence of integrated courses in analytic geometry and calculus. A detailed study of limits, derivatives, and integrals of functions of one and several variables with applications.

**Prereq.:** MATH 1572 with a "C" or better.

**MATH 2673H Honors Calculus 3 4 s.h.**

A sequence of integrated courses in analytic geometry and calculus. A detailed study of limits, derivatives, and integrals of functions of one and several variables with applications.

**Prereq.:** MATH 1572 with a "C" or better.

**MATH 2686H Accelerated Honors Calculus 2 5 s.h.**

A sequence of honors courses in analytical geometry and calculus which cover essentially the same material as MATH 1571, 1572, 2673, in two semesters instead of three. A detailed study of limits, derivatives, and integrals of functions of one and several variables and their applications. This sequence will be offered at most once during each academic year.

**Prereq.:** MATH 1585H.

**Gen Ed:** Mathematics.

**MATH 2687H Honors Calculus Laboratory 2 1 s.h.**

Introduction to mathematical modeling of topics covered in calculus. Emphasizes the use of technology such as computer algebra systems, technical document processing, and graphics software for solving problems and reporting solutions.

**Prereq.:** MATH 1572 or concurrent with MATH 1572H or 1586H.

**MATH 3701 Biomathematics Seminar 1 s.h.**

Introduction to interdisciplinary research in biology and mathematics. Topics include current research by faculty and students, cross disciplinary communication, report writing, technical presentations, literature reading, laboratory techniques and safety. May be repeated once. Listed also as BIOL 3701.

**Prereq.:** MATH 1571 or MATH 1585H or BIOL 2601 or BIOL 2602.

**MATH 3702 Problem Solving Seminar for Secondary Mathematics 3 s.h.**

Approaches to and practice with problem solving with examples from a broad spectrum of mathematics. Emphases include problems at the level of the Praxis II examination for mathematics and problems suitable for high school contests such as the American Mathematics Competition 10 and 12.

**Prereq.:** MATH 1572 or MATH 1585H or consent of instructor.

**MATH 3705 Differential Equations 3 s.h.**

Methods and theory of solving differential equations with applications. Existence, uniqueness. First order equations. Higher order linear equations. Introduction to partial differential equations and boundary value problems, including Laplace's equation.

**Prereq.:** C or better in MATH 2673.

**MATH 3705H Honors Differential Equations 3 s.h.**

Methods and theory of solving differential equations with applications. Existence, uniqueness. First order equations. Higher order linear equations. Introduction to partial differential equations and boundary value problems, including Laplace's equation.

**Prereq.:** MATH 2673 grade of "C" or better.

**MATH 3715 Discrete Mathematics 3 s.h.**

A course in discrete mathematical structures to prepare students for advanced courses. Topics include set theory, functions and relations, logic and quantifiers, truth tables and Boolean expressions, induction and other techniques of proof, and graphs. Credit will not be given for both CSCI 3710 and MATH 3715.

**Prereq.:** MATH 1572 or MATH 1585H.

**MATH 3720 Linear Algebra and Matrix Theory 3 s.h.**

Matrices; matrix operations; linear transformations; applications.

**Prereq.:** MATH 1572 or MATH 1585H.

**MATH 3721 Abstract Algebra 1 4 s.h.**

Introduction to abstract algebra investigating fundamental concepts in group and ring theory. Topics include groups, subgroups, cyclic groups, permutation groups, cosets, direct products, homomorphisms, factor groups, rings, integral domains and polynomial rings.

**Prereq.:** MATH 3715 and MATH 3720.

**MATH 3745 Topics in Mathematical Modeling 3 s.h.**

This course exposes students to methods of mathematical modeling through applications. Tools used to develop, refine, test, and present mathematical models will be discussed. Topics covered and projects undertaken may vary with each course offering and are designed to expose students to the types of problems modeled by applied mathematicians working in business, government, industry, or research. Course may be repeated depending on projects or topics presented.

**Prereq.:** MATH 2673 or MATH 2686H or permission of the instructor.

**MATH 3745H Honors Topics in Mathematical Modeling 3 s.h.**

This course exposes students to methods of mathematical modeling through applications. Tools used to develop, refine, test, and present mathematical models will be discussed. Topics covered and projects undertaken may vary with each course offering and are designed to expose students to the types of problems modeled by applied mathematicians working in business, government, industry, or research. Course may be repeated depending on projects or topics presented.

**Prereq.:** MATH 2673 or MATH 2686H or permission of the instructor.

**MATH 3750 History of Mathematics 3 s.h.**

A survey of the historical development of mathematics.

**Prereq.:** MATH 3715.

**MATH 3751 Real Analysis 1 4 s.h.**

Introduction to the properties of the real number system and metrics and metric properties, with critical analysis of limits, continuity, differentiability, integration, and other fundamental concepts underlying the calculus.

**Prereq.:** MATH 3715 and one of MATH 2673 or MATH 2686H.

**MATH 3760 Numerical Analysis 1 3 s.h.**

The theory and techniques of numerical computation. The solution of a single equation, interpolation methods, numerical differentiation and integration, direct methods for solving linear systems.

**Prereq.:** MATH 3720 and CSIS 2610.

**MATH 3767 Algebra/Geometry for Middle School Teachers 1 4 s.h.**

An integrated, conceptual, and function-centered approach to the foundations of algebra, geometry, and trigonometry for preservice middle childhood mathematics specialists. Emphasis on multiple approaches and representations, problem solving, and communication of mathematical reasoning. Includes inquiry-based laboratory experiences. Not applicable to the mathematics major.

**Prereq.:** MATH 1564 and either 40 on the Mathematics Placement test or MATH 1507.

**MATH 3768 Algebra/Geometry for Middle School Teachers 2 4 s.h.**

An integrated, conceptual, and function-centered approach to the foundations of algebra, geometry, and trigonometry for preservice middle childhood mathematics specialists. Emphasis on multiple approaches and representations, problem solving, and communication of mathematical reasoning. Includes inquiry-based laboratory experiences. Not applicable to the mathematics major.

**Prereq.:** MATH 2665 and either 40 on the Mathematics Placement test or MATH 1507.

**MATH 3785 Numerical Methods 3 s.h.**

Matrices, matrix operations, and the application of numerical methods. Not applicable to the Mathematics major.

**Prereq.:** MATH 2670 and ENTC 1505, or equivalent.

**MATH 3795 Topics in Mathematics 2-3 s.h.**

The study of a mathematical topic or the development of a special area of mathematics. May be repeated once.

**Prereq.:** MATH 1570 or MATH 1571 or MATH 2623 or MATH 2651.

**MATH 4822 Abstract Algebra 2 3 s.h.**

A continuation of MATH 3721 with special emphasis on fields. Additional topics in pure or applied algebra.

**Prereq.:** MATH 3721 or equivalent.

**MATH 4823 Abstract Algebra 3 3 s.h.**

This course introduces advanced topics in field theory. Topics may include principal ideal domains, irreducibility, quotient rings, algebraic extensions, finite fields, splitting fields, and the Galois group.

**Prereq.:** MATH 4822.

**MATH 4830 Foundations of Geometry 3 s.h.**

The development of Euclidean and non-Euclidean geometries from postulate systems.

**Prereq.:** MATH 3715.

**MATH 4832 Euclidean Transformations 3 s.h.**

General properties of functions and transformations; isometries and transformations of the Euclidean plane; the complex plane, its geometry and subfields; transformational, analytical, and vector approaches to Euclidean geometry; connections to other branches of mathematics and applications.

**Prereq.:** MATH 3720 and MATH 4830.

**MATH 4855 Ordinary Differential Equations 3 s.h.**

A second course in differential equations with emphasis on nonlinear problems and qualitative methods or on boundary value problems. Topics are chosen from: proofs of fundamental theorems, phase plane analysis, limit cycles and the Poincare-Bendixon theorem, biological models, stability via Liapunov functions, asymptotic methods, and boundary value problems.

**Prereq.:** MATH 3705 and MATH 3720.

**MATH 4857 Partial Differential Equations 3 s.h.**

Introduction to partial differential equations (PDE) including solution techniques and applications. Classifications of the basic types of PDE's (hyperbolic, parabolic and elliptic) and dependence on boundary and initial conditions. Topics include Fourier series, integral transforms (Fourier, Laplace), and applications in vibrations, electricity, heat transfer, fluids or other selected topics.

**Prereq.:** MATH 3705 and MATH 3720.

**MATH 4869 Functions, Calculus, and Applications for Middle School Teachers 3 s.h.**

Polynomial and exponential functions, limits, derivatives, integrals, and applications. Interpretation of slope and area in graphs of functions from applied settings. Applications of limits to the derivations of geometric formulas. Relations between tables, graphs, and the symbolic representation of functions.

**Prereq.:** MATH 3767 or consent of instructor.

**MATH 4870 Mathematics Seminar for Middle School Teachers 3 s.h.**

Problem solving from a broad spectrum of mathematics topics (Number Sense and Operations; Algebra, Functions, and Calculus; Measurement and Geometry; Statistics, Probability, and Discrete Mathematics) designed to prepare future middle school mathematics teachers to address Common Core Standards. May be repeated 2 times.

**Prereq.:** MATH 3767, MATH 3768, MATH 4869, and either STAT 2601 or STAT 2625.

**MATH 4875 Complex Variables 3 s.h.**

Complex numbers and their geometric representation, analytic functions of a complex variable, contour integration, Taylor and Laurent series, residues and poles, conformal mapping.

**Prereq.:** MATH 3751 or equivalent.

**MATH 4880 Introduction to Topology 3 s.h.**

An introduction to the basic concepts of general topology: compactness, connectedness, and continuity in topological spaces.

**Prereq.:** MATH 3721 and MATH 3751.

**MATH 4882 Biomathematics Research 1-2 s.h.**

Interdisciplinary and individualized study of a topic in biology and mathematics. Student project mentored jointly by faculty in biology and mathematics. May be repeated once. Grading is Traditional/PR. Listed also as BIOL 4882.

**Prereq.:** MATH 3701, BIOL 3701, senior status and permission of the department chairperson.

**MATH 4884 Mathematical Logic 3 s.h.**

An introduction to the study of theories in formalized languages and to the theory of models.

**Prereq.:** MATH 3721 or PHIL 3719.

**MATH 4896 Senior Undergraduate Research Project 2 s.h.**

Individualized study of a topic in mathematics culminating in a written report and an oral presentation at a national or regional meeting or a local seminar. May be repeated once.

**Prereq.:** 24 s.h. of mathematics applicable to the mathematics major including either MATH 3721 or MATH 3751 and permission of the department chairperson.

**Gen Ed:** Capstone.

**MATH 4897H Thesis 2 s.h.**

Individualized study of a topic in mathematics culminating in a written report and an oral presentation at a national or regional meeting or a local seminar.

**Prereq.:** 24 s.h. of mathematics applicable to the mathematics major including both MATH 3721 and MATH 3751 and permission of the department chairperson.

**MATH 5821 Topics in Abstract Algebra 4 s.h.**

A course in abstract algebra aimed at developing a broad understanding of the subject. Credit will not be given for both MATH 3721 and MATH 5821.

**Prereq.:** MATH 3715 and MATH 3720.

**MATH 5825 Advanced Linear Algebra 3 s.h.**

A study of abstract vector spaces, linear transformations, duality, canonical forms, the spectral theorem, and inner product spaces.

**Prereq.:** MATH 3721.

**MATH 5828 Number Theory 3 s.h.**

A study of congruences, Diophantine equations, quadratic residues, special number theory functions, and selected applications.

**Prereq.:** MATH 3721.

**MATH 5835 Introduction to Combinatorics and Graph Theory 3 s.h.**

The pigeonhole principle; permutations, combinations, the binomial theorem; the inclusion-exclusion principle; recurrence relations; graphs and digraphs, paths and cycles, trees, bipartite graphs and matchings.

**Prereq.:** MATH 3715 and MATH 3720.

**MATH 5845 Operations Research 3 s.h.**

An introduction to operations research with emphasis on mathematical methods. Topics may include: linear programming, sensitivity analysis, duality theory, transportation problems, assignment problems, transshipment problems, and network problems.

**Prereq.:** MATH 3715 and MATH 3720.

**MATH 5851 Topics in Analysis 4 s.h.**

A course in analysis aimed at developing a broad understanding of the subject. Credit will not be given for both MATH 3751 and MATH 5851.

**Prereq.:** MATH 2673 or MATH 2686H and MATH 3720 and MATH 3715.

**MATH 5852 Real Analysis 2 3 s.h.**

Uniform convergence of sequences of functions and some consequences; functions on  $n$ -space: derivatives in vector spaces, mean value theorem, Taylor's formula, inverse mapping theorem, implicit mapping theorem.

**Prereq.:** MATH 3720 and MATH 3751 or equivalent.

**MATH 5860 Topics in Numerical Analysis 3 s.h.**

A course in numerical analysis aimed at developing a broad understanding of the subject. Credit will not be given for both MATH 3760 and MATH 5860.

**Prereq.:** MATH 3720 and CSIS 2610.

**MATH 5861 Numerical Analysis 2 3 s.h.**

Numerical methods of initial-value problems, eigenvalue problems, iterative methods for linear and nonlinear systems of equations, and methods involving least squares, orthogonal polynomials, and fast Fourier transforms.

**Prereq.:** MATH 2673 or MATH 2686H and MATH 3760 or equivalent.

**MATH 5875 Complex Variables 3 s.h.**

Complex numbers and their geometric representation, analytic functions of a complex variable, contour integration, Taylor and Laurent series, residues and poles, conformal mapping.

**Prereq.:** MATH 3751 or equivalent.

**MATH 5895 Selected Topics in Mathematics 2-3 s.h.**

The study of a standard mathematical topic in depth or the development of a special area of mathematics. May be repeated twice.

**Prereq.:** 24 s.h. of mathematics applicable to the mathematics major including either MATH 3721 or MATH 3751.

**MATH 6901 Mathematics Workshop 1-6 s.h.**

Intensive study and activity in a topic related to mathematics, its applications, or the teaching of mathematics. May be repeated. Grading is S/U.

**MATH 6905 Teaching Practicum 1 s.h.**

Intensive preparation for teaching lower-level mathematics courses, featuring formal instruction and orientation on teaching issues, evaluated presentations, mentored classroom instruction, and weekly teaching seminars. Topics include course design, policies, syllabi, grading; classroom teaching problems; orientation in Mathematics Assistance Center, specific lower-level mathematics courses, online tutorial services. Required of and limited to graduate assistants in the Department of Mathematics and Statistics. To be taken each semester student is a graduate assistant. Grading is S/U. Does not count toward credit in the program.

**MATH 6910 Advanced Engineering Mathematics 1 3 s.h.**

Theory and solution techniques used in engineering applications. Topics include brief review of ordinary differential equations and linear algebra; vector calculus, integral theorems, complex analysis, series, residue theory, potential theory, special functions, integral transforms, partial differential equations and applications in mathematical modeling.

**Prereq.:** MATH 3705.

**MATH 6911 Advanced Engineering Mathematics 2 3 s.h.**

Theory and solution techniques used in engineering applications. Topics include brief review of ordinary differential equations and linear algebra; vector calculus, integral theorems, complex analysis, series, residue theory, potential theory, special functions, integral transforms, partial differential equations and applications in mathematical modeling.

**Prereq.:** MATH 6910.

**MATH 6915 Mathematical Foundations 3 s.h.**

Order-theoretic and monadic foundations of mathematics: ordered structures; topologies; powerset operators of a function; applications to continuity, compactness, algebra, logic, and calculus.

**Prereq.:** MATH 3721 Abstract Algebra I and MATH 3751 Real Analysis I, or permission of graduate coordinator.

**MATH 6922 Advanced Topics in Group and Ring Theory 3 s.h.**

A continuation of MATH 5821 with special emphasis on groups acting on sets, Sylow's Theorem and its applications, ring homomorphisms, ideals, and polynomial rings. Credit will not be given for MATH 4822 and MATH 6922.

**Prereq.:** MATH 3721 or MATH 5821.

**MATH 6923 Advanced Topics in Field Theory 3 s.h.**

This course introduces the major results in advanced field theory. These results include splitting fields, algebraic extensions, finite extensions, cyclotomic polynomials, and finite fields. Credit will not be given for MATH 4823 and MATH 6923.

**Prereq.:** MATH 4822 or MATH 6922.

**MATH 6924 Galois Theory 3 s.h.**

An introduction to Galois Theory with special emphasis on the Galois group, the Fundamental Theorem of Galois Theory, and radical extensions.

**Prereq.:** MATH 4823 or MATH 6923.

**MATH 6928 Advanced Number Theory 3 s.h.**

Advanced study of number theory: theory and distribution of primes, computational number theory, and additive number theory.

**Prereq.:** MATH 5828.

**MATH 6930 Differential Geometry 3 s.h.**

Classical differential geometry of curves and surfaces, differentiable manifolds with tensors.

**Prereq.:** MATH 5852.

**MATH 6942 Advanced Operations Research 3 s.h.**

Topics may include integer programming, advanced linear programming, nonlinear programming, dynamic programming, queuing theory, Markov analysis, game theory, and forecasting models.

**Prereq.:** MATH 5845 and STAT 3743 Probability and Statistics.

**MATH 6955 Advanced Differential Equations 3 s.h.**

Proofs of existence and uniqueness of nonautonomous, nonlinear equations. Additional topics may include advanced linear systems, partial differential equations, and integral equations.

**Prereq.:** MATH 5852 and either MATH 3705 or MATH 4855 or permission of graduate coordinator.

**MATH 6957 Partial Differential Equations 3 s.h.**

An introduction to partial differential equations (PDE) and their applications. The classification of the basic types of linear partial differential equations, development of how boundary and initial conditions affect solutions, exploration, and application of solution techniques for PDEs and explosions in orthogonal functions will be presented.

**Prereq.:** MATH 3705 and MATH 3720 or equivalent .

**MATH 6965 Abstract Analysis 1 3 s.h.**

Lebesgue integration and measure on the real line. General measure theory and functional analysis, including the Radon-Nikodym theorem, the Fubini theorem, the Hahn-Banach theorem, the closed graph and open mapping theorems, and weak topology.

**Prereq.:** MATH 5852 and either MATH 4880 or MATH 6915 or permission of graduate coordinator.

**MATH 6975 Complex Analysis 1 3 s.h.**

Analytic and meromorphic functions of a complex variable, contour integration, the Cauchy-Goursat theorem, Taylor and Laurent series, residues and poles, conformal mapping. Credit will not be given for both MATH 5875 and MATH 6975.

**Prereq.:** MATH 3751 Real Analysis I, or permission of graduate coordinator.

**MATH 6980 Topology 1 3 s.h.**

Basic concepts of topological spaces and mappings between them, including compactness, connectedness, and continuity. Credit will not be given for both MATH 4880 and MATH 6980.

**Prereq.:** MATH 3721 Abstract Algebra I and MATH 3751 Real Analysis I, or permission of graduate coordinator.

**MATH 6981 Topology 2 3 s.h.**

Separation, metrization, compactification. Additional topics will be selected from point-set topology, fuzzy topology, algebraic topology, combinatorial topology, topological algebra.

**Prereq.:** MATH 4880 or MATH 6980, or permission of graduate coordinator.

**MATH 6990 Independent Study 1-3 s.h.**

Study under the supervision of a staff member. May be repeated.

**Prereq.:** Consent of graduate coordinator.

**MATH 6995 Special Topics 1-3 s.h.**

Specialized topics selected by the staff. May be repeated up to 12 semester hours.

**Prereq.:** Permission of graduate coordinator and department chair.

**MATH 6996 Mathematical Project 1-3 s.h.**

Individual research project culminating in a written report or paper, though not as broad in scope as a thesis. May be repeated once if the second project is in a different area of mathematics.

**MATH 6999 Thesis 3 s.h.**

A student may register for six semester hours in one semester or for three semester hours in each of two semesters.

**MATH 7005 Advanced Topics in Categorical Topology 3 s.h.**

Content varies with each offering. Implements ideas from MATH 6915, MATH 6980, MATH 6981, and studies categorical methods in topology and related concrete categories. Emphasis on current literature and open questions. May be repeated with approval of graduate coordinator.

**Prereq.:** MATH 6915, MATH 6980, MATH 6981, or equivalent, or permission of the graduate coordinator.

**MATH 7015 Advanced Topics in Foundations of Topology 3 s.h.**

Content varies with each offering, implements ideas from MATH 6915, MATH 6980, MATH 6981, and studies foundations of topology from a variety of viewpoints (algebraic, categorical, logical, order theoretic, powerset theoretic, set theoretic, etc.). Emphasis on current literature and open questions. May be repeated with approval of graduate coordinator.

**Prereq.:** MATH 6915, MATH 6980, MATH 6981, or equivalent, or permission of graduate coordinator.

**MATH 7025 Advanced Topics in General Topology 3 s.h.**

Content varies with each offering, implements ideas from MATH 6915, MATH 6980, MATH 6981, and studies various topics in point-set topology. Emphasis on current literature and open questions. May be repeated with approval of graduate coordinator.

**Prereq.:** MATH 6980, MATH 6981, or equivalent, or permission of graduate coordinator.

**MATH 7035 Advanced Topics in Lattice-Valued Topology 3 s.h.**

Content varies with each offering. Implements ideas from MATH 6915, MATH 6980, MATH 6981, and studies topology from the standpoint of lattice-valued (fuzzy) subsets. Emphasis on current literature and open questions. May be repeated with approval of graduate coordinator.

**Prereq.:** MATH 6915, MATH 6980, MATH 6981, or equivalent, or permission of the graduate coordinator.

**MATH 7045 Advanced Topics in Topological Analysis 3 s.h.**

Content varies with each offering. Implements ideas from MATH 6915, MATH 6965, MATH 6966, MATH 6980, MATH 6981, and studies the overlap between topology and abstract analysis (topological games, topological groups, separate versus joint continuity, etc.). Emphasis on current literature and open questions. May be repeated with approval of graduate coordinator.

**Prereq.:** MATH 6915, MATH 6965, MATH 6980, MATH 6981, or equivalent, or permission of graduate coordinator.

**MATH 7055 Seminar in Topology and Abstract Analysis 3 s.h.**

Content varies with each offering. Implements ideas from MATH 6915, MATH 6930, MATH 6965, MATH 6980, MATH 6981, MATH 6984, and focuses on current research activities of seminar participants. Student registrants are expected to make at least one major presentation each month of the term.

May be repeated with approval of graduate coordinator.

**Prereq.:** Permission of graduate coordinator.