Mathematical Sciences

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Mission

The Department of Mathematical Sciences is dedicated to education, research, and service in mathematics.

Our educational mission is to provide excellent instruction and resources for the mathematics education of our students through our courses and degree programs. As the language of science, mathematics is of fundamental importance to the general education of UAH students, particularly students planning careers in science and engineering. Through our bachelor's, master's and doctoral degree programs, our goal is to help produce the new generations of well-educated mathematicians that are critical for the progress of mankind.

Our mission in research and scholarship is to discover and disseminate new mathematics and to apply mathematics to problems in engineering and in the physical, biological, and social sciences.

Our service mission is to promote and communicate the importance of mathematics in society and to help maintain standards of excellence in mathematics through refereeing and reviewing. Our service mission is to work with other departments and units in UAH to achieve the goals of the College of Science and the university as a whole.

We recognize that the components of our mission are not separate but are intimately interrelated. Excellence in teaching, research, and service can only be achieved together.

The mathematical sciences faculty offers courses in mathematics and statistics for a Bachelor of Arts or Bachelor of Science degree in mathematics, a Bachelor of Arts or Bachelor of Science degree in mathematics with an Alabama Class B Teacher's Certificate, and a minor or second major in mathematics for students majoring in other areas of study. Courses also satisfy individual needs to supplement other areas of study and to satisfy general education requirements (GER).

Mathematical Sciences B.S. or B.A.

The B.S. or B.A. in Mathematics consists of:

• Major core
• Major electives
• BS General Education Requirements (GER)
• Ancillary requirements
• General electives

Concentrations Within the Mathematical Sciences B.S. or B.A.

• Concentration I leads to a B.A. or B.S. degree with a major in mathematics, and is appropriate for students planning careers in industry or graduate study in mathematics.

• Concentration II leads to a B.A. or B.S. degree with a major in mathematics, and meets the requirements for an Alabama Class B Middle/Junior High School Teacher's Certificate or an Alabama Class B High School Teacher's Certificate.

• Concentration III is restricted to students who are pursuing a double major in mathematics and another discipline

Majors in Mathematical Sciences

• Mathematical Sciences, BS or BA (http://catalog.uah.edu/undergrad/colleges-departments/science/mathematical-sciences/mathematics-bs-ba)
• Mathematical Sciences, BS or BA - Secondary Education (http://catalog.uah.edu/undergrad/colleges-departments/science/mathematical-sciences/mathematics-bs-ba-concentration-ii)
• Mathematical Sciences, BS or BA - Double Major (http://catalog.uah.edu/undergrad/colleges-departments/science/mathematical-sciences/mathematics-bs-ba-concentration-iii)

Minor in Mathematical Sciences

• Mathematics (http://catalog.uah.edu/undergrad/colleges-departments/science/mathematical-sciences/mathematics-minor)

MA 004 - BASIC ALGEBRA
Semester Hours: 3

For students with a deficiency in high school credit in algebra or who need an algebra review.
MA 033 - HIGH SCHOOL GEOMETRY
Semester Hours: 3
For students with a deficiency in high school credit in geometry.

MA 107 - ALGEBRA WITH APPLICATIONS
Semester Hours: 3
Algebra review, functions and graphs, linear models, exponential logarithmic functions, mathematics of finance, sets and probability. Prerequisites: Level 1 placement.

MA 110 - FINITE MATHEMATICS
Semester Hours: 3
Algebra review, elementary functions, matrices, logic, sets, counting, and an introduction to probability and statistics. MA 110 is an AGSC core course. No credit is given to students who have already received credit for MA 171 or above. Prerequisites: Level 1 placement.

MA 112 - PRECALCULUS ALGEBRA
Semester Hours: 3
Real number systems, exponents, radicals, factoring, absolute value, inequalities, function notation, functions, inverse functions, graphing techniques, polynomial and rational functions, operations with complex numbers, conic sections, and theory of equations. Prerequisites: Level 1 placement.

MA 113 - PRECALCULUS TRIGONOMETRY
Semester Hours: 3
Exponential and logarithmic functions, trigonometric functions of angles and real numbers, graphing trigonometric functions, inverse trigonometric functions, solving trigonometric equations, verifying identities, laws of sines and cosines, vectors, trigonometric form of complex numbers, DeMoivre's theorem, summation notation, arithmetic and geometric sequences and series.

MA 115 - PRECALCULUS ALGEBRA & TRIG
Semester Hours: 4
The algebra of functions, including polynomial, rational, exponential, and logarithmic functions; systems of equations and inequalities; trigonometric and inverse trigonometric functions; trigonometric identities and equations; a brief introduction to DeMoivre's Theorem, vectors, polar coordinates, and the binomial theorem. This course is intended for students who plan to take at least MA 171 (Calculus A) but who do not need the full two-semester sequence in precalculus (MA 112, 113). MA 115 is an

MA 120 - CALCULUS WITH APPLICATIONS
Semester Hours: 3
Limits, continuity, differentiation, applications of the derivative, integration, the fundamental theorem of calculus, applications of the integral. Prerequisites: MA 107, MA 110, or MA 112, or Level 2 or 3 Placement.

MA 171 - CALCULUS A
Semester Hours: 4
Limits, derivatives, applications of the derivative, definite and indefinite integrals, exponential and logarithmic functions, and inverse functions. Prerequisites: MA 113 or MA 115, or Level 3 Placement.

MA 171R - CALCULUS A RECITATION
Semester Hours: 0

MA 172 - CALCULUS B
Semester Hours: 4
Techniques of integration, applications of the integral, polar coordinates, sequences, series, and conic sections. Prerequisites: MA 171 with a grade of C or better.

MA 201 - CALCULUS C
Semester Hours: 4
Vectors, vector-valued functions, partial derivatives, multiple integrals, vector fields, line and surface integrals. Prerequisites: MA 172 with a grade of C or better.

MA 227 - CALCULUS III /CALHOUN
Semester Hours: 4
MA 230 - MATH FOR ELEMENTARY TEACHERS  
Semester Hours: 3  
The course emphasizes the use of logical thinking in mathematics and the development of students’ understandings of algorithm design. Directed at providing the elementary education student the mathematical background necessary for an understanding of the mathematical principles that are introduced to children in the elementary grades. Emphasis on sets, logic, an understanding of the number systems (integers, fractions, decimals, percents) and number theory. Prerequisites: MA 107, MA 110, or MA 112.

MA 231 - MATH FOR ELEM SCH TCHERS II  
Semester Hours: 3  
Rational numbers, real numbers, algebra, statistics, probability, geometric shapes, measurement, and geometry (using triangle congruence and similarity, coordinates, and transformations). Prerequisites: MA 230 with a grade of C or better.

MA 238 - APPL DIFFERENTIAL EQUATIONS  
Semester Hours: 3  
This course provides an elementary introduction to the techniques and necessary theory for solving the basic differential equations usually encountered by beginning science and engineering students. General topics include analytical and graphical methods for solving and analyzing first order differential equations; Euler's numerical method; the basic theory of higher-order, linear differential equations, with major emphasis on equations with constant coefficients; variation of parameters; the Laplace transform as a tool for solving differential equations. MA 238 is an AGSC core course.

MA 244 - INTRO TO LINEAR ALGEBRA  
Semester Hours: 3  
Systems of linear equations, matrices, matrix operations, determinants, vector spaces, bases, dimension of a vector space, inner product, Gram-Schmidt process, linear transformations, change of basis, similar matrices, eigenvalues and eigenvectors, diagonalization, symmetric matrices, and applications. Prerequisites: MA 120 or MA 145 or MA 172.

MA 281 - ELEMENTS OF STATISTICAL ANALYS  
Semester Hours: 3  
Descriptive statistics, fundamentals of probability theory, fundamentals of statistical inference, including estimation and hypothesis testing, and use of a typical statistical package such as MINITAB. Prerequisites: MA 113, or MA 115, or Level 2 Placement.

MA 299 - MATHEMATICS PROJECT  
Semester Hour: 1  
Individualized special projects in mathematics and its applications for inquisitive and well prepared sophomore-level undergraduate students. No credit allowed toward major or minor in mathematics. S/U grading. Approval of department chair and instructor required.

MA 301 - INTRO ELEMENTARY NUMBER THEORY  
Semester Hours: 3  
Fundamental properties of integers, divisibility, linear Diophantine equations, congruency, Euler function, Chinese Remainder Theorem, Fermat Theorems, Wilson Theorem, and applications to Cryptography.

MA 321 - PROBABILITY & STAT/OAKWOOD  
Semester Hours: 3  
Symbolic logic and methods of proof, set theory, combinations and permutations, equivalence relations and functions, mathematical induction and recurrence relations, cardinality (finite, countably infinite, and uncountable sets), and decimal representation of the rational and real numbers. Prerequisites: MA 172 and MA 244.

MA 330 - FOUNDATIONS OF MATH  
Semester Hours: 3  
This course is a calculus-based introduction to probability with special emphasis on the interplay between probability and statistics. Topics include descriptive statistics; probability spaces; discrete distributions (including the binomial, geometric, hypergeometric, and Poisson); continuous distributions (including the uniform, exponential, and normal); joint distributions; mean, variance, and general expected value; independence and correlation; the law of large numbers; and the central limit theorem. Prerequisites: MA 120 or MA 172 with a grade of C or better.
MA 399 - MATHEMATICS PROJECT
Semester Hour: 1

Individualized special projects in mathematics and its applications for inquisitive and well prepared junior-level undergraduate students. No credit allowed toward a major or minor in mathematics. S/U grading. Approval of department chair and instructor required.

MA 401 - COMPLEX ANALYSIS/ATHENS
Semester Hours: 3

MA 415 - INTRO NUMERICAL METHODS
Semester Hours: 3

Derivation and analysis of approximate methods for the solution of nonlinear equations, interpolation and integration of functions, and techniques for the solution of systems of linear equations and for approximating solutions of elementary differential equations. Emphasis is placed on obtaining an intuitive understanding of both the problem at hand and the numerical method used to solve it. Prerequisites: MA 201, MA 244, or CS 121.

MA 420 - INTERM DIFFERENTIAL EQUATIONS
Semester Hours: 3

This is a second course in differential equations. Course topics include series solutions for second order differential equations and the method of Frobenious; eigenvalue and eigenvector methods for solving systems of linear first order equations; the qualitative theory of nonlinear equations; boundary value problems and the Sturm-Liouville theory. Prerequisites: MA 201, MA 244 and MA 238.

MA 421 - DIFFERENTIAL EQUATIONS/ATHENS
Semester Hours: 3.3

MA 433 - INTRODUCTION TO GEOMETRY
Semester Hours: 3

Axiomatic development of geometry, introduction to non-Euclidean geometries with emphasis in elliptic and hyperbolic geometries, selected topics in Euclidean geometry.

MA 442 - ALGEBRAIC STRUCTURES W/APPLIC
Semester Hours: 3

Mappings, binary operations, equivalence relations, groups and subgroups, Lagrange’s theorem, homomorphisms and isomorphisms, normal subgroups and quotient groups, rings, fields, ordered integral domains, fields of quotients, error correcting codes, linear codes, and decoding. Prerequisites: MA 244 and either MA 330 or 385.

MA 450 - COMBINATORIAL ENUMERATION
Semester Hours: 3

Counting, pigeonhole principle, permutations and combinations, generating functions, principle of inclusion and exclusion, Polya’s theory of counting.

MA 452 - INTRO TO REAL ANALYSIS
Semester Hours: 3

Sequences, limits, continuity, differentiation of functions of one real variable, Riemann integration, uniform convergence, sequences and series of functions, power series, and Taylor series. Prerequisites: MA 330.

MA 453 - INTRO TO COMPLEX ANALYSIS
Semester Hours: 3

Complex algebra, analytic functions, Cauchy-Riemann equations, exponential, trigonometric, and logarithmic functions, integration, Cauchy integral theorem, Morera’s theorem, Liouville’s theorem, maximum modulus theorem, residue theory, Taylor and Laurent series, and applications.

MA 456 - METHODS OF PARTIAL DIFF EQUA
Semester Hours: 3

Survey of theory and methods for solving elementary partial differential equations. Topics include first-order equations and the method of characteristics, second-order equations, reduction to canonical form, the wave equation, the heat equation, Laplace’s equation, separation of variables, and Fourier series.

MA 458 - APPLIED LINEAR ALGEBRA
Semester Hours: 3

Fundamental concepts of linear algebra are developed with emphasis on real and complex vector spaces, linear transformations, and matrices. Systems of equations, inverses of matrices, determinants, vector spaces, linear transformations, eigenvalues and eigenvectors, normal matrices, canonical forms of matrices, applications of systems of linear differential equations, and use of computer software such as MATLAB.
MA 460 - INTRO FOURIER ANALYSIS  
Semester Hours: 3  
Brief development of trigonometric and exponential Fourier series, derivation of the classical Fourier transform from series, classical properties of Fourier transforms, transforms of functions, convolution, elementary development of the delta function, transforms of periodic functions, use of transforms to solve systems, introduction to the discrete transform and/or multidimensional transforms, as time permits. Prerequisites: MA 238 and MA 244.

MA 465 - INTRO TO MATH MODELING  
Semester Hours: 3  
Applying mathematics by formulating, analyzing, and criticizing mathematical models of various phenomena. Examples will be chosen from the physical, biological, and social sciences. Emphasizes development and use of simple mathematical models by having student study general modeling principles and case studies (some open-ended) drawn from various sources. Prerequisites: MA 201, MA 238, and MA 244.

MA 487 - INTRO TO MATH STATISTICS  
Semester Hours: 3  
This is an introductory, calculus-based course in mathematical statistics. Topics include a review of basic probability, including probability spaces, independence, distributions and expected value; the fundamental theorems of probability, including the law of large numbers and the central limit theorem; estimation, including point estimation and interval estimates for means, variances, and proportions; hypothesis testing, including tests for means, variance, and goodness of fit; an introduction to correlation and regression; theory of inference, including sufficiency and power. Prerequisites: MA 201 and either MA 385 or ISE 390.

MA 490 - SEL TOP UNDERGRAD MATH  
Semester Hours: 1-3  
Requested undergraduate topics. Approval of instructor required.

MA 499 - MATHEMATICS PROJECT  
Semester Hour: 1  
Individualized special projects in mathematics and its applications for superior undergraduate students. No credit is allowed toward a major or minor in mathematics. S/U grading. Approval of department chair and instructor required.