

# Mathematical Sciences (MAT)

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## Courses

### **MAT 092. Arithmetic Review. 3 Hours.**

A review of basic arithmetic concepts in preparation for Beginning Algebra. Topics include arithmetic of whole numbers, arithmetic of fractions and decimals; ratio and proportion; percentage. Course Information: Placement test is required to register for this course. This course is not designated for transfer credit, nor will credit be given toward a degree.

### **MAT 094. Beginning Algebra. 3 Hours.**

Introduction to elementary algebra with applications. Topics include operations with real numbers, operations involving algebraic expressions, factoring, exponents, polynomials, solving linear equations and their graphs. Course Information: Prerequisite: Academic preparation credit in MAT 092, or a placement score for Beginning Algebra on the COMPASS Placement Test. This course is not designated for transfer credit, nor will credit be given toward a degree.

### **MAT 096. Intermediate Algebra. 3 Hours.**

Emphasizes topics important in preparation for the study of calculus. Topics include polynomial and rational functions, exponential and logarithmic functions and equations, inequalities, and systems of equations. Course Information: Prerequisite: Academic preparation credit in MAT 094, or a placement score for Intermediate Algebra on the COMPASS Placement Test. This course is not designated for transfer credit, nor will credit be given toward a degree.

### **MAT 102. College Algebra. 3 Hours.**

Topics include polynomial, rational, logarithmic, exponential functions and equations, inequalities, and systems of equations. Course Information: This course does not satisfy the general education mathematics requirement. Prerequisite: Intermediate Algebra and geometry with a grade of C or better, or equivalent. Students may take MAT 102 and MAT 103 concurrently (see course description for MAT 103). Placement test may be required to register for this course.

### **MAT 103. Trigonometry. 2 Hours.**

Topics include angles, right triangle trigonometry, trigonometric functions and their graphs, trigonometric equations, trigonometric representations of complex numbers and applications. Course Information: This course does not satisfy the general education mathematics requirement. Prerequisite: Intermediate algebra and geometry with a grade of C or better, or equivalent. Students must have taken College Algebra, or equivalent, and earned a grade of C or better, or be concurrently enrolled in College Algebra to register for MAT 103. Placement test may be required to register for this course.

### **MAT 111. Quantitative Reasoning. 3 Hours.**

This course is designed to satisfy the mathematics general education requirement and is not designed to fulfill mathematics requirements for either science or mathematics majors. Develops competency in problem solving and analysis helpful in personal decision making. Topics will include no more than four of the following: functions, graphing, counting techniques and probability, statistics, finance, modeling, estimating, geometry, game theory, and logic. Course Information: Prerequisite: Geometry and intermediate algebra with a grade of C or better. Placement test may be required to register for this course. This course fulfills a general education requirement at UIS in the area of Mathematics (IAI Code: M1 904) or UIS: Mathematics Skills.

### **MAT 112. Mathematics in Daily Life. 3 Hours.**

Focuses on mathematical reasoning and the solving of real-life problems. Three topics will be chosen from the following list: geometry, graph theory, counting techniques and probability, mathematics of finance, and mathematical modeling. Course Information: Prerequisite: Geometry and intermediate algebra with a grade of C or better. Placement test may be required to register for this course. This course fulfills a general education requirement at UIS in the area of Mathematics (IAI Code: M1 904) or UIS: Mathematics Skills.

### **MAT 113. Business Calculus. 4 Hours.**

Fundamental concepts, methods, and techniques of single-multivariable differential and integral calculus. Topics include introduction to derivatives, integrals and their applications, and marginal analysis. Course Information: Prerequisite: Geometry and college algebra with a grade of C or better. Placement test may be required to register for this course. This course fulfills a general education requirement at UIS in the area of Mathematics (IAI Code: M1 904) or UIS: Mathematics Skills.

### **MAT 114. Finite Mathematics and Its Applications. 4 Hours.**

This course is designed especially for students in business, economics, social sciences and life sciences (with applications drawn from these fields). The course covers basic concepts of linear equations, linear inequalities, systems of linear equations and matrices, systems of inequalities and linear programming, simplex method, set and counting theory, probability theory, stochastic processes (Markov processes are presented), theory of games, the mathematics of finance and mathematical modeling. Course Information: Prerequisite: Geometry and college algebra with a grade of C or better. Placement test may be required to register for this course. This course fulfills a general education requirement at UIS in the area of UIS: Mathematics Skills.

### **MAT 115. Calculus I. 4 Hours.**

Limits and their properties. Definitions and some techniques of differentiation and the evaluation of definite integrals, with applications. Course Information: Prerequisite: College Algebra and Trigonometry with a grade C or better. This course fulfills a general education requirement at UIS in the area of Mathematics (IAI Code: M1 904) or UIS: Mathematics Skills.

### **MAT 116. Calculus II. 4 Hours.**

Applications of integration, with some formal techniques and numerical methods. Calculus of further transcendental functions (inverse trigonometric functions, exponentials, logarithms). Improper integrals, infinite sequences and series. Course Information: Prerequisite: MAT 115 with a grade of C or better, or equivalent. This course fulfills a general education requirement at UIS in the area of Mathematics (IAI Code: M1 902) or UIS: Mathematics Statistics.

**MAT 121. Applied Statistics. 3 Hours.**

May be used to meet the mathematics general education requirement for admission to UIS. Topics may include descriptive statistics, elementary probability, basic probability distributions, sampling, estimation, testing of hypotheses, simple linear regression, and correlation. Course Information: Prerequisite: Intermediate algebra and geometry with grades of C or better. Placement test may be required to register for this course. This course fulfills a general education requirement at UIS in the area of Mathematics (IAI Code: M1 902) or UIS: Mathematics Statistics.

**MAT 122. Contemporary Statistics. 3 Hours.**

Emphasis on concepts and applications through the using of the computer. Topics include descriptive statistics, basic probability distributions, sampling, and estimation, testing of hypotheses, correlation, simple linear regression, and analysis of categorical data. Course Information: Prerequisite: Geometry and intermediate algebra with a grade of C or better. Placement test may be required to register for this course. This course fulfills a general education requirement at UIS in the area of UIS: Mathematics Statistics.

**MAT 199. Math Studio. 0 Hours.**

The Math Studio serves as supplemental instruction for the 100-level Mathematics courses in the UIS General Education Curriculum, including MAT 111, MAT 112, and MAT 121. Students must be enrolled in one of those Math courses to enroll in MAT 199. Course Information: Credit/No Credit grading only.

**MAT 217. Calculus III. 4 Hours.**

Basic analytic geometry in three dimensions, using vectors. Real-valued functions of two and three variables, partial derivatives, gradient and directional derivatives, level curves and surfaces, and maxima and minima. Parametrized curves in space, line integrals. Multiple integrals, with applications. Course Information: Prerequisite: MAT 116 with a grade of C or better, or equivalent. This course fulfills a general education requirement at UIS in the area of Mathematics Statistics.

**MAT 302. Discrete Mathematics. 4 Hours.**

Topics include sets, functions, relations; propositional and predicate logic, including truth tables and valid reasoning; Boolean algebra, minimization with Karnaugh maps, and Quine McClusky method; integer, rational, real, modular arithmetic, different bases, and complementary number systems; mathematical induction; recurrence relations; graph theory; and automata theory. Course Information: Prerequisite: College algebra with a grade of C or better. This course fulfills a general education requirement at UIS in the area of Mathematics (IAI Code: M1 902) or UIS: Mathematics Skills.

**MAT 330. Entrance Assessment. 0 Hours.**

Evaluation of mathematical sciences knowledge upon entering the program. Must be taken during the student's first semester of study.

**MAT 332. Linear Algebra. 4 Hours.**

A theoretical course involving systems of linear equations, matrices, vectors in  $n$ -space, vector spaces, linear transformations, eigenvalues and eigenvectors, diagonalization, quadratic forms, and canonical forms. Course Information: Prerequisite: MAT 116 with a grade of C or better or equivalent.

**MAT 336. Introduction to Differential Equations and Its Applications. 4 Hours.**

This course is designed to fulfill the mathematics requirements for either mathematics majors or sciences. This course serves as an introduction to differential equations. Modeling with differential equations is also introduced throughout the course. Course Information: Prerequisite: MAT 116 (IAI Code M1 900-2) and MAT 332, both with grade C or better.

**MAT 400. Topics in Mathematics. 1-4 Hours.**

Various topics; description changes according to topic offered. Course Information: May be repeated if topics vary. See course schedule for prerequisites.

**MAT 401. History Of Mathematics. 4 Hours.**

Introduction to the development of major mathematical concepts. History of computation, probability, algebra, geometry, trigonometry, and calculus. Evolution and changes in the rigor of mathematics from 1500 B.C. Biographies of male and female mathematicians are included. Course Information: Prerequisite: MAT 115 with a grade of C or better or equivalent.

**MAT 403. Abstract Algebra. 4 Hours.**

Topics include group theory, rings, and fields. Course Information: Prerequisite: MAT 332 with a grade of C or better or equivalent.

**MAT 404. Geometry. 4 Hours.**

A systematic study of the consequences of the parallel postulate in Euclidean and non-Euclidean geometries. Course Information: Prerequisite: MAT 332 with grade of C or better.

**MAT 405. Introduction to Topology. 4 Hours.**

Topology is the study of those properties of space that are preserved under continuous and bi-continuous mappings. Topics include: Set Theory, Topological Spaces, Continuous Functions, Homeomorphisms, Product Topology, Metric Topology Connectedness and Compactness, Separation Axioms. Course Information: Prerequisite: MAT 403 with grade of C or better.

**MAT 415. Advanced Calculus. 4 Hours.**

Vector calculus, partial and directional derivatives, implicit function theorem, change of variables in multiple integrals, maxima and minima, line and surface integrals, theorems of Gauss, Green, and Stoke. Course information: Prerequisite: MAT 217 with a grade of C or better, or equivalent, and MAT 332 with grade of C or better.

**MAT 416. Real Analysis. 4 Hours.**

Rigorous treatment of the fundamental concepts of analysis for real functions of a single variable: topics include the real number systems, sequences and series, limits, continuity, derivatives, and the Riemann integral, sequences and series of functions. Course Information: Prerequisite: MAT 415 with grade of C or better.

**MAT 420. Topics in Statistics and Probability. 1-4 Hours.**

Various topics; description changes according to topic offered. Course Information: May be repeated if topics vary. Students may register in more than one section per term. See course schedule for prerequisites.

**MAT 421. Statistical Methods. 4 Hours.**

Introductory course for statistical analysis techniques. Topics may include review of basic statistics, multiple linear regression, analysis of enumerative data, analysis of variance, multiple comparisons, design of experiments, and analysis of covariance. Additional topics may be chosen from principal components, factor analysis, discriminant analysis, and nonparametric tests. Course Information: Prerequisite: Intermediate algebra with grade of C or better.

**MAT 431. Mathematical Statistics I. 4 Hours.**

Introduction to theory and application of probability models. Topics include random variables, mathematical expectation, Chebyshev's inequality, marginal and conditional distribution, independence, probability distributions and their properties, transformation of variables, moment-generating functions, limiting distribution, and central limit theorem. Course Information: Prerequisite: MAT 217 with grade of C or better or equivalent.

**MAT 432. Mathematical Statistics II. 4 Hours.**

Introduction to theory and application of statistical inference. Topics include sampling distributions, point estimation, including maximum likelihood estimation and the application of criteria such as consistency, unbiasedness, and minimum variance; interval estimation, Bayesian estimation, statistical hypothesis testing, including power functions, Type I and Type II errors, Newman-Pearson lemma, and likelihood ratio tests. Course Information: Prerequisite: MAT 431 with grade of C or better.

**MAT 442. Probability Modeling and Computer Simulation. 4 Hours.**

Explores the principles and concepts of probability theory and introduces computer simulation methodology. Topics include fundamental concepts of probability, random variables, random number generators, probability distributions, mathematical expectation, introduction of simulation, concepts in sampling, sampling models, estimation, and discrete event stochastic processes. Course Information: Prerequisite: MAT 116 with grade of C or better or equivalent and one semester of programming language.

**MAT 444. Operations Research Methods. 4 Hours.**

Quantitative methods necessary for analysis, modeling, and decision making. Topics include linear programming, transportation model, network models, decision theory, games theory, PERT-CPM, inventory models, and queueing theory. Additional topics may be chosen from integer linear programming, system simulation, and nonlinear programming. Course Information: Same as PAD 431. Prerequisite: MAT 332 with grade of C or better.

**MAT 491. Exit Assessment. 0 Hours.**

This is a senior level course designed to measure student learning in mathematics for program exit. MAT 491 must be taken during the final semester before graduation. Credit/No Credit grading only.

**MAT 499. Tutorial. 1-12 Hours.**

Intended to supplement, not supplant, regular course offerings. Students interested in a tutorial must secure the consent of the faculty member concerned before registration and submit any required documentation to him or her. Course Information: May be repeated to a maximum of 12 hours.