

MATH: MATHEMATICS (MATH)

MATH 112. Basic Mathematics I. (3 Credits)

A course for students who plan to pursue a major in humanities and social sciences. Problem solving, real numbers, algebraic expressions, linear equations, systems of linear equations, proportions, geometry, graphs of linear functions, mathematics of finance. Prerequisite: Two units of high school mathematics and placement criteria 201808.

MATH 113. Basic Mathematics II. (3 Credits)

The second part of a basic mathematics sequence. Sets, logic, probability and statistics. Prerequisite: MATH 112.

MATH 120. College Algebra. (3 Credits)

A pre-calculus course in algebra. Functions and their graphs, transformation of functions, polynomial, rational, exponential and logarithmic functions, systems of equations; applications of these algebraic concepts to other disciplines. 201608.

MATH 121. Trigonometry. (3 Credits)

Exponential and logarithmic functions, trigonometric functions, analytic trigonometry, and applications of trigonometry. Prerequisite: MATH 120 College Algebra 201608.

MATH 122. Finite Mathematics. (3 Credits)

Solving systems of Linear Equations and Inequalities, Introduction to Matrices and Linear Programming, Mathematics of Finance, Sets, Counting and Probability. Prerequisite: MATH 120 College Algebra 201608.

MATH 130. Number And Operations. (3 Credits)

ONLY for students seeking certification to reach PreK - 3/PreK - 6 Examines number systems and operations, elementary number theory, concepts of integers and rational number, proportions, logic, computational algorithms, and current techniques in a problem-solving environment. Will include student investigations and hands-on activities. Prerequisites: Two units of high school mathematics and placement criteria 201808.

MATH 131. Algebra And Functions. (3 Credits)

ONLY for students seeking certification to teach PreK - 3/PreK - 6 Basic algebraic operations, linear and quadratic equations, linear systems of equations and inequalities, algebraic and trigonometric functions in the context of modeling and various representations of functions (graphical, tabular, and symbolic). Will include student investigations and hands-on activities. Prerequisites: MATH 130 202508.

MATH 150. Precalculus. (4 Credits)

Functions, Polynomial and rational functions, Inverse functions, exponential logarithmic functions, trigonometric functions; and an introduction to sequences and limits. Students successfully completing this course cannot take MATH 120 or MATH 121 for credit. Prerequisites: Two units of high school mathematics and placement criteria.

MATH 112. Business Calculus. (3 Credits)

Calculus for Non-Science and Non-Mathematics majors. Fundamental concepts of limits, continuity, derivatives and integrals of functions and their application to problems in various disciplines. This course cannot be taken as a Mathematics elective by Mathematics majors. Prerequisites: MATH 122 Finite Mathematics 201608.

MATH 230. Geometry And Measurement. (3 Credits)

A basic study of properties and relationships of polygons and polyhedral, transformation geometry, coordinate geometry, construction, deductive and inductive reasoning, the processes of measurement through geometric investigations, and an introduction to non-Euclidean geometries. This course does not satisfy the requirements of MATH 340. ONLY for students seeking certification to reach PreK - 3/PreK - 6 Prerequisites: MATH 131.

MATH 260. Calculus I. (4 Credits)

Analytic Geometry (introduction to conic sections), review of functions and their graphs, limit and rate of change, continuity, derivatives, derivatives of trigonometric functions, chain rule, implicit differentiation, higher derivatives, related rates, applications of differentiation: maximum and minimum values, The Mean Value Theorem, the first and second derivative tests, optimization problems, Antiderivatives, areas, definite integral, Fundamental Theorem of Calculus, indefinite integrals, areas between curves (in the Cartesian Plane), substitution rule Prerequisite: MATH 150 Precalculus or MATH 121 Algebra and Trigonometry 201608.

MATH 261. Calculus II. (4 Credits)

Techniques and applications of integrations, improper integrals, sequences and series, differentiation and integration of power series, Prerequisites: MATH 260.

MATH 280. Discrete Math Computer Science. (3 Credits)

Fundamental techniques in discrete mathematics for application in computer science. Sets, mathematical logic, proof techniques, relations, functions, mathematical induction, counting principle, and analysis of algorithms. Prerequisite: MATH 120 202508.

MATH 284. Discrete Mathematics I. (3 Credits)

Binary number system, computer codes, computer arithmetic, logic and truth table, sets and relations, Boolean algebra, logic gates; simplification of logic circuits, graphs, and directed graphs equivalence relations. Prerequisite: MATH 120 202508.

MATH 285. Discrete Mathematics II. (3 Credits)

Duality, mathematical induction and contradiction, recurrence relations, posets and sorting, vectors and matrices, planar and non-planar graphs, networks, error propagation, combinatorics, circuits, lattices, algebraic systems and machines, algorithms for flowcharting and programming. Prerequisite: MATH 284 Discrete Mathematics I or MATH 280 Discrete Mathematics for Computer Scientists.

MATH 290. Foundations Of Mathematics. (3 Credits)

A study of the development of mathematical concepts and of the great mathematicians who introduced these concepts; development of integral and differential calculus, development of concepts in modern algebra and the use of rigorous set theory as the foundation for analysis, algebra and topology. Prerequisite: MATH 261 Calculus II or concurrent with MATH 261.

MATH 292. Introduction to Number Theory. (3 Credits)

Divisibility theory and prime numbers, Euclidean algorithm, congruence, residue classes. Euler's function, primitive roots, Chinese remainder theorem. Quadratic residues, continued fractions, and Gaussian integers. Prerequisites: MATH 150 Precalculus or equivalent 201608.

MATH 294. Mathematics of Finance I. (3 Credits)

Interest rates, accumulated and discount function, annuities, forborne and deferred, perpetuities, amortization. schedules and sinking funds, bonds and related securities, depreciation, yield curve, duration, convexity, and immunization. Prerequisite: MATH 120 College Algebra or permission of the instructor 201808.

MATH 295. Mathematics Of Finance II. (3 Credits)

Advanced theory of interest and annuity; non-level annuities under geometric or arithmetic progression, annuities with different payment and conversion periods, amortization schedules, sinking funds, yield rate, bond and stock; introductory financial concepts including derivatives, options, futures, arbitrage opportunities and non-arbitrage models. Prerequisite(s): MATH 294 Mathematics of Finance I and STAT 330 Probability and Statistics I 201808.

MATH 298. Internship in Mathematics I. (1 Credit)

The internship allows students to obtain practical work experience related to mathematics under closely supervised conditions for approximately 45 clock hours. Students must complete a Memorandum of Agreement prior to commencing the internship. Course may be taken more than once for credit but no more than 3 times. Prerequisite: Junior standing and permission of department.

MATH 299. Intro Problem Solving Seminar. (3 Credits)

A seminar-based approach which examines areas including the appropriate uses of technology, cooperative learning projects, problem-solving, and mathematics content on the state mandated licensing examination for secondary mathematics. Mathematical topics will include algebra and number theory, measurement, trigonometry, functions, and calculus and basic probability theory. Prerequisite: MATH 261.

MATH 300. Foundation of Mathematics. (3 Credits)

Conic sections and polar coordinates, indeterminate forms, improper integrals, Taylor's theorem, L'Hopital's rule, Taylor's polynomials, sequences and series, absolute and conditional convergence, differentiation and integration of power series, vectors in the plane and in space, and cylindrical and spherical coordinates. Prerequisite: MATH 201 Calculus II or MATH 261 Calculus II 202508.

MATH 317. Stochastic Processes. (3 Credits)

Conditional probability and conditional expectations, continuous and discrete time stochastic processes including random walks. Markov chains, Poissons process, Brownian motion, and Gaussian processes. Prerequisites: MATH 360 Calculus III, STAT 330 Probability and Statistics I 201901.

MATH 321. Combinatorics. (3 Credits)

Techniques for counting and enumeration including recurrence relations, binomial coefficients, the principle of inclusion and exclusion, graph theory, and networks. Prerequisites: MATH 280 or MATH 284.

MATH 325. Linear Algebra. (3 Credits)

Systems of linear equations, matrices, determinants, vector spaces, bases, dimensions, linear independence, eigenvalues and eigenvectors, and linear transformations. Prerequisite: MATH 260.

MATH 335. Mathematical Modeling. (3 Credits)

Formulation and analysis of mathematical models with applications to Biology, Finance, Engineering and other areas of science, examples include: population dynamics, predator-prey, epidemiology, enzyme kinetics, diffusion and chemical reactions. Prerequisite: MATH 260.

MATH 340. Euclidean & Noneuclid Geomet I. (3 Credits)

A study of the foundations of Euclidean geometry including transformations deductive and inductive reasoning and an introduction to non-Euclidean geometries. Prerequisite: MATH 120 College Algebra 201808.

MATH 341. Euclidean & Noneucl Geometr II. (3 Credits)

Euclidean geometry, logic and incidence geometry, Hilbert's axioms, projective geometry, neutral geometry, parallel postulate - history and independence, Non-Euclidean geometry, geometric transformations, hyperbolic geometry and philosophical implications. Prerequisite: MATH 340 Modern Geometry 201608.

MATH 348. Introduction to Game Theory. (3 Credits)

Introduction to game theory, the study of strategic behavior among parties having opposed, mixed or similar interests. Formal descriptions of games/conflicts of interest, including zero-sum and non-zero sum games. Identification of equilibria, mixed strategies, and the minimax theorem. Identification and analysis of archetypal strategic situations, including the Prisoner's Dilemma. Dominance, backward induction, Nash equilibrium, and signaling. Applications of formal game theory to professional game design, and game design principles. Prerequisite: MATH 260 201901.

MATH 350. Differential Equations. (3 Credits)

Introduction to differential equations, initial value problems, modeling and solutions of first-order differential equations, solutions of higher-order differential equations, boundary value problems, series solutions, Laplace transform. Prerequisite: MATH 261 201608.

MATH 352. Intro to Mathematical Biology. (3 Credits)

This course is designed to develop mathematical models in biology and study the behavior of such models using numerical techniques and review the mathematical concepts behind many important biological principles. Topics will be drawn from conversation biology, genetics, and physiology. Mathematics and computational methods to be reviewed include functions in biology, difference and differential equations, integration as needed, probability, numerical matrix algebra and curve fitting software. Students can receive credit either for MATH 352 or BIOL 352 but not for both. Prerequisites: MATH 200 Calculus I, BIOL 120 Principles of Biology I and BIOL 121 Principles of Biology II, or consent of instructor. 201608.

MATH 355. Dynamical Systems & Chaos. (3 Credits)

Existence and uniqueness for solutions of ordinary differential equations and difference equations, linear systems, nonlinear systems, stability, periodic solutions, bifurcation theory. Prerequisite: MATH 350 201608.

MATH 360. Calculus III. (4 Credits)

Prerequisite: MATH 261 Calculus II 201808.

MATH 380. Seminar in Actuarial Science. (3 Credits)

Application of the fundamental probability tools to problems encountered in actuarial science. Risk management and insurance, corporate finance, price theory, actuarial models, loss models, simulation and survival models. Course serves as the capstone course in the Actuarial Science track. Co-requisite: MATH 295.

MATH 392. Introduction Linear Programmin. (3 Credits)

Introduction to operation research, modeling with linear programming, the simplex method and sensitivity analysis, duality, degeneracy, and applications. Prerequisite: MATH 260.

MATH 395. Math Problem Solving Seminar. (3 Credits)

A capstone course designed to examine the appropriate uses of technology, cooperative learning projects, problem-solving, mathematics content on the state mandated licensing examination for Secondary Mathematics, and presentations by experienced mathematics educators and business leaders. Mathematical topics include data analysis, probability, matrix algebra and discrete mathematics. Students must register and take the state mandated licensing examination for secondary mathematics as a requirement of the course. (May not be used as a mathematics elective). Prerequisite: Admitted to Teacher Education Candidacy and MATH 299, STAT 330 or STAT 340.

MATH 398. Internship in Mathematics II. (3 Credits)

The internship allows students to obtain practical work experience related to mathematics under closely supervised conditions for approximately 135 clock hours. Students must complete a Memorandum of Agreement prior to commencing the internship. Course may be taken more than once for credit but no more than 2 times. Prerequisite: Junior standing and permission of department advisor 201808.

MATH 400. Advanced Calculus I. (3 Credits)

Introduction to inductive and deductive reasoning, introduction to proofs, proofs of theorems involving sets, functions and inverse functions, composite functions, Study limit and continuity using delta-epsilon approach, limit theorems, properties of continuous functions. Prerequisite: MATH 301 Multivariate Calculus 201608.

MATH 401. Advanced Calculus II. (3 Credits)

Differentiability, Riemann integrals, Riemann-Stieltjes, improper integrals, fundamental theorem of calculus, sequence and series of functions, convergence of series, uniform convergence, power series of functions. Prerequisite: MATH 400.

MATH 415. Matrix Theory. (3 Credits)

Matrix algebra, matrix factorization, vector and matrix norms, condition numbers, singular values, diagonalization and similar matrices, Jordan canonical form, unitary and orthogonal transformations, and the eigenvalue problems. Prerequisite: MATH 325 Linear Algebra 201808.

MATH 417. Numerical Linear Algebra. (3 Credits)

Numerical methods for solution of linear systems, perturbation theory and linear least square problem, QR factorization, conditioning and stability of linear systems, iterative methods for linear systems, symmetric eigenproblem and singular value decomposition, nonsymmetric eigenvalue problems, discrete and fast Fourier transform. Prerequisite: MATH 325 Linear Algebra 201608.

MATH 425. Abstract Algebra I. (3 Credits)

Abstract groups, subgroups, cyclic groups, groups of symmetries, even and odd permutations, the alternating group cosets, normal subgroups, Lagrange's theorem, quotient groups, solvable groups, mappings, group homomorphisms, isomorphisms. Prerequisite: MATH 201 Calculus II or MATH 261 Calculus II 201608.

MATH 426. Abstract Algebra II. (3 Credits)

Rings, ring homomorphisms, subrings, ideals, quotient rings, integral domains, polynomial extensions of rings, fields and field extensions. Prerequisite: MATH 425.

MATH 429. Approximation Theory. (3 Credits)

Best approximation in normal spaces, approximation by algebraic polynomials and Weierstrass theorem, trigonometric polynomials, uniform approximation by trigonometric polynomials, Chebyshev polynomials, characterization of the best approximation, and orthogonal polynomials. Prerequisite: MATH 400 Advanced Calculus 201608.

MATH 430. Optimizations Theory. (3 Credits)

Optimization fundamentals, unconstrained and constrained optimization. Lagrange multipliers, nonlinear programming algorithms and convex optimization. Prerequisite: MATH 360 201608.

MATH 432. Complex Variables. (3 Credits)

Brief introduction of Complex numbers and its properties, Elementary functions of Complex variable, Analytic functions and its basic properties, Contour integration, Cauchy's Theorem and Integral formula, Maximum modulus principles, Series representation of analytic functions, Taylor's Theorem, Classification of singularities, Laurent series, Calculation of residues. Prerequisite: MATH 301 Multivariate Calculus or MATH 361 Calculus III 201608.

MATH 445. Introduction to Topology. (3 Credits)

Metric and topological spaces, separation axioms, connectedness, compactness, homeomorphisms and product spaces. Prerequisite: MATH 425 202508.

MATH 452. Numerical Analysis. (3 Credits)

A survey of modern numerical methods with emphasis on those best suited for digital computer application. Polynomial interpolation, iterative methods for solving simultaneous linear and non-linear equations, solutions of algebraic equations, solutions to differential equations. Prerequisite: MATH 261 Calculus II 201808.

MATH 470. History Of Mathematics. (3 Credits)

An introduction to the chronological history of mathematics and the mathematicians who made significant contributions, emphasizing the evolution of basic concepts ranging from primitive number systems through the foundations of set theory. Mathematical analysis, probability, statistics, algebra, trigonometry, calculus, number theory and geometry. Prerequisite: MATH 300 202508.

MATH 473. Discrete Wavelet Transfor/Appl. (3 Credits)

Introduction to digital images, complex numbers and Fourier series, convolution and filters, the Haar wavelet transformation, Daubechies wavelet transformations, wavelet shrinkage. Prerequisites: MATH 325 Linear Algebra and MATH 261 Calculus II 201808.

MATH 475. Introd to Difference Equations. (3 Credits)

Dynamics of first-order difference equations, equilibrium points and their stability, periodic points, cycles and their stability, difference equations associated to differential equations, Euler's method, difference calculus, linear difference equations, first and higher order, homogeneous with constant coefficients, non-homogeneous by the methods of undetermined coefficients, limiting behavior of solutions, nonlinear equations transformable to linear difference equations. Prerequisites: MATH 325 Linear Algebra, MATH 350 Differential Equations 201608.

MATH 490. Graph Theory. (3 Credits)

Basic definitions of graphs, Eulerian and Hamiltonian graphs, graph decompositions, matchings, trees, bipartite graphs, vertex colorings, network algorithms planar graphs, Kuratowski's theorem and the Four-color Theorem. Prerequisites: MATH 284 or MATH 280.

MATH 493. Topics in Mathematics. (3 Credits)

Topics in mathematics not covered in ordinary courses. The course may be repeated once for credit if content is different. Prerequisite: Consent of instructor.

MATH 495. Senior Project. (1-3 Credits)

A capstone course designed to review, unify, and extend concepts and skills developed in previous mathematics courses and give students additional experience in presenting mathematical concepts in oral and written form and improving problem-solving skills and expose students to research. Prerequisite: Senior academic standing 202508.

MATH 499. Gre Mathematics Review. (3 Credits)

Whole numbers, fractions, decimals, percent's, signed numbers, averages and medians, powers, exponents and roots, algebraic expressions, equations, verbal problems, counting problems, ratio and proportions, sequence and progressions, inequalities, lines, polygons, tri-angles, quadrilaterals, circles, area and perimeter, coordinate geometry, tables, circle, line and bar graphs, cumulative graphs, analytical reasoning tactics, and logical reasoning tactics. A considerable part of the course will be devoted to practice tests similar to quantitative tests of GRE in order to develop the problem-solving and test-taking techniques required.