

MATHEMATICS (MATH)

MATH-100 College Mathematics 4 Credits

Prerequisites: None

A study of functions and their algebra and graphs. Special functions of engineering and science are emphasized, including polynomial, trigonometric, and exponential functions and their inverses. Concepts and methods of algebra, trigonometry, and analytic geometry important to calculus are also emphasized. NOTE: While there are no pre-reqs for this course, enrollment is a result of Math Placement exam score. Failure to take this exam results in placement in MATH-100. Credits for MATH-100 do not apply to degree requirements. Also, placement in MATH-100 may delay entry in courses for which calculus is a prerequisite.

Lecture: 4, Lab 0, Other 1

MATH-101 Calculus I 4 Credits

Prerequisites: None

An introduction to the theory and techniques of differentiation of polynomial, trigonometric, exponential, logarithmic, hyperbolic, and inverse functions of one variable. Also included are limits, continuity, derivative applications and interpretations. Computer software will be used to aid in understanding these topics. NOTE: Students can place into 101 with a sufficient score on the Math Placement Exam, or permission of Department Head.

Lecture: 4, Lab 0, Other 0

MATH-101X Calculus I 4 Credits

Prerequisites: None

This course is for students showing a lack of proficiency in algebra and trigonometry on the Math Placement examination. The course contains the same material as MATH-101 but in addition, includes a review of algebraic expressions, trigonometric functions and their inverses, and analytic geometry. Computer software will be used to aid in understanding these topics. NOTE: Students can place into 101X with a sufficient score on the Math Placement Exam, or permission of Department Head.

Lecture: 4, Lab 0, Other 1

MATH-102 Calculus II 4 Credits

Prerequisites: MATH-101

NOTE: Students also must receive a minimum grade of C in MATH-101. Riemann integration and the Fundamental Theorem of Calculus, including applications to area, volume, etc., and basic methods for conversion of integrals including change of variable, substitutions, partial fractions, integration by parts, improper integrals and numerical integration. Also introduced are sequences and series in one variable with emphasis on Taylor Series. Computer software will be used to aid in understanding these topics.

Lecture: 4, Lab 0, Other 0

MATH-102H Calculus II - Honors 4 Credits

Prerequisites: MATH-101

Honors Calculus II is a deeper, more conceptual, rigorous, and limit based version of Calculus II (MATH-102). It is designed for students with strong mathematical skills. Riemann integration and the Fundamental Theorem of Calculus, including applications to area, volume, etc., and basic methods for conversion of integrals including change of variable, substitutions, partial fractions, integration by parts, improper integrals and numerical integration. Also introduced are sequences and series in one variable with emphasis on Taylor Series. Computer software will be used to aid in understanding these topics.

Lecture: 4, Lab 0, Other 0

MATH-102X Calculus II 4 Credits

Prerequisites: MATH-101 or MATH-101X

NOTE: Students also must receive a minimum grade of C in MATH-101X. This course is for students who want to improve their skills in Trigonometry and Differential Calculus. It contains the same material as MATH-102 but is taught at a slower pace and with more examples and sample problems. In addition, it includes reviews of Trigonometry and Differential Calculus.

Lecture: 4, Lab 0, Other 1

MATH-191 Mathematics Special Topics 4 Credits

Prerequisites: None

This course is often offered as Pre-Calculus for Business, and in this form, available only to those students majoring in Business Administration. Course is equivalent to MATH-100.

Lecture: 4, Lab 0, Other 0

MATH-203 Multivariate Calculus 4 Credits

Prerequisites: MATH-102 or MATH-102H or MATH-102X

A study of polar coordinates, parametric equations, and the calculus of functions of several variables with an introduction to vector calculus. Topics include surface sketching, partial derivatives, gradients, differentials, multiple integrals, cylindrical and spherical coordinates and applications. Computer software will be used to aid in understanding these concepts.

Lecture: 4, Lab 0, Other 0

MATH-203H Multivariate Calculus - Honors 4 Credits

Prerequisites: MATH-102H or MATH-102 or MATH-102X

Honors Multivariate Calculus is an extended, deeper, more conceptual, rigorous, and limit-based version of Multivariate Calculus (MATH-203). The course is designed for students with strong mathematical skills. The topics include parametric equations, polar, Cartesian, cylindrical, and spherical coordinates, vector algebra, equations of lines, planes, and quadratic surfaces, calculus of functional of several variables, unconstrained and constrained optimization problems, multidimensional integrals, change of variables, and elements of vector calculus. Computer software will be used to aid in understanding these topics and for graphical visualization.

Lecture: 4, Lab 0, Other 0

MATH-203X Multivariate Calculus 4 Credits

Prerequisites: MATH-102 or MATH-102H or MATH-102X

A study of polar coordinates, parametric equations, and the calculus of functions of several variables with an introduction to vector calculus. Topics include surface sketching, partial derivatives, gradients, differentials, multiple integrals, cylindrical and spherical coordinates and applications. Computer software will be used to aid in understanding these concepts.

Lecture: 5, Lab 0, Other 0

MATH-204 Differential Equations & Laplace Transforms 4 Credits

Prerequisites: MATH-203 or MATH-203H or MATH-203X

Minimum Class Standing: Freshman

Terms Offered: Summer, Fall, Winter, Spring

An introduction to the principles and methods for solving first order, first degree differential equations, and higher order linear differential equations. Includes a study of the Laplace transform and its application to the solution of differential equations. Existence and uniqueness theorems for O.D.E.'s are also discussed.

Lecture: 4, Lab 0, Other 0

MATH-204H Differential Equations and Laplace Transforms - Honors 4 Credits

Prerequisites: MATH-203 or MATH-203H

Honors Differential Equations and Laplace Transform is an extended, deeper, more conceptual, rigorous version of MATH-204. The course is designed for students with strong mathematical skills. The additional topics include Cauchy-Euler Equation, the Dirac Delta Function, Linear Models: Boundary Value Problems, Systems of Linear Differential Equations, and optional advanced topics, e.g. Power Series Solution and Solutions About Singular Points.

Lecture: 4, Lab 0, Other 0

MATH-258 Probability and Statistics 4 Credits

Prerequisites: MATH-102 or MATH-102X or MATH-102H

Minimum Class Standing: Sophomore 1

This course introduces fundamentals of probability together with examples of discrete and continuous random variables, including Bernoulli, binomial, Poisson, normal, exponential and gamma random variables. Descriptive and inferential parametric statistics for one and two populations is covered. Correlation, simple and multiple linear regression, and single factor ANOVA are studied. A statistical package MINITAB or R is used throughout the course.

Lecture: 4, Lab 0, Other 0

MATH-291 Mathematics Special Topics 4 Credits

Prerequisites: None

Terms Offered: As needed

Mathematics Special Topics

Lecture: 4, Lab 0, Other 0

MATH-305 Numerical Methods and Matrices 4 Credits

Prerequisites: MATH-204 or MATH-204H

Minimum Class Standing: Sophomore

An introduction to numerical methods including the study of iterative solutions of equations, interpolation, curve fitting, numerical differentiation and integration, and the solution of ordinary differential equations. An introduction to matrices and determinants; application to the solution of linear systems.

Lecture: 4, Lab 0, Other 0

MATH-307 Matrix Algebra 4 Credits

Corequisites: MATH-102

Prerequisites: MATH-101 or MATH-101X

A study of matrix concepts including such topics as basic algebraic operations, determinants, inversion, solution of systems of linear equations, vector spaces, basis and dimension, eigenvalues, and eigenvectors.

Lecture: 4, Lab 0, Other 0

MATH-308 Abstract Algebra 4 Credits

Prerequisites: (MATH-307) or (CS-211 and MATH-101) or (CS-211 and MATH-101X)

Minimum Class Standing: Sophomore

Students will learn topics in modern algebra and will practice proof techniques. Topics will include: congruence classes, modular arithmetic, groups, subgroups, normal subgroups, Lagrange's theorem, rings, subrings, ideals, quotient rings, isomorphisms and homomorphisms, polynomial arithmetic, fields, divisors, factorization, and proofs of the main theorems. The course is required for mathematics majors and is also useful in cryptography and quantum physics.

Lecture: 4, Lab 0, Other 0

MATH-313 Boundary Value Problems 4 Credits

Prerequisites: MATH-204 or MATH-204H

Minimum Class Standing: Sophomore 2

An introduction to linear partial differential equations (PDE's) and basic techniques of applied mathematics used to solve initial, boundary value problems associated with these equations. Topics include: derivation of some of the fundamental PDE's' and boundary conditions that arise in science and engineering; Fourier Series; Sturm-Liouville Systems including eigenvalues, eigenfunctions and eigenfunction expansions; the separation of variables techniques; Fourier Transforms. Applications to problems of science and engineering will be given throughout the course.

Lecture: 4, Lab 0, Other 0

MATH-321 Real Analysis I 4 Credits

Prerequisites: MATH-203 or MATH-203H or MATH-203X

Minimum Class Standing: Junior

A more advanced study of functions in one real variable including limits, uniform continuity, differentiation, integration, and sequences and series of functions; topology of R.

Lecture: 4, Lab 0, Other 0

MATH-327 Probability & Stochastic Modeling 4 Credits

Prerequisites: MATH-203 or MATH-203H or MATH-203X

Minimum Class Standing: Sophomore

This is a calculus-based introduction to probability theory and stochastic modeling. Students will learn fundamentals of probability, discrete and continuous random variables, expectation, independence, Bayes' rule, important distributions and probability models, joint distributions, conditional distributions, distributions of functions of random variables, moment generating functions, the Central Limit Theorem, laws of large number. Programming language R will be introduced and used throughout the course.

Lecture: 4, Lab 0, Other 0

MATH-328 Methods of Applied Mathematics 4 Credits

Prerequisites: MATH-204 or MATH-204H

Minimum Class Standing: Junior

Topics from advanced calculus, dimensional analysis and scaling, perturbation and asymptotic methods, calculus of variations and integral equations. Applications of these tools to problems in engineering will be included.

Lecture: 4, Lab 0, Other 0

MATH-330 Biostatistics 4 Credits

Prerequisites: MATH-258

Minimum Class Standing: Sophomore II

This course covers topics in the design of experiments and data analysis useful in biostatistics; including screening tests, analysis of categorical data, nonparametric methods, ANOVA and ANCOVA, nested designs, multiple regression, logistic regression and its extensions, design and analysis techniques for epidemiologic studies. Computer packages such as MINITAB or R will be used for all applications and the analysis of data sets.

Lecture: 4, Lab 0, Other 0

MATH-350 Financial Mathematics 4 Credits

Prerequisites: (MATH-102 or MATH-102X or MATH-102H)

Minimum Class Standing: Junior

This course provides an understanding of the fundamental concepts of financial mathematics, and how they are applied in calculating present and accumulated values for various streams of cash flows. These concepts are later used in reserving, valuation, pricing, asset/liability management, investment income, capital budgeting, and valuing contingent cash flows. Key terms studied include inflation, rates of interest, term structure of interest rates, yield rate, equation of value, accumulation function, discount function, annuity, perpetuity, interest rate swaps and bonds. Procedures like determining equivalent measures of interest, discounting, accumulating,, amortization will be covered. Modern topics of financial analysis will be introduced, such as yield curves, spot rates, forward rates, duration, convexity and immunization.

Lecture: 4, Lab 0, Other 0

MATH-360 Life Contingencies I 4 Credits

Prerequisites: MATH-350

Minimum Class Standing: Junior

This course is an introduction to life insurance mathematics based on a stochastic approach. This course is to develop a student's knowledge of the theoretical basis of certain actuarial models and the application of those models to insurance and other financial risks. Definitions of key terms will be studied, including actuarial present value, survival model, life insurance, annuities, and benefit premiums.

Lecture: 4, Lab 0, Other 0

MATH-361 Life Contingencies II 4 Credits

Prerequisites: MATH-360

Minimum Class Standing: Junior 2

This is a continuation of Life Contingencies I. Development is based on a stochastic approach to life insurance models. Definitions of key terms will be studied, including benefit reserves, and multi-life and multiple-decrement models.

Lecture: 4, Lab 0, Other 0

MATH-412 Complex Variables 4 Credits

Prerequisites: MATH-203 or MATH-203H or MATH-203X

Minimum Class Standing: Sophomore

An introduction to the theory of complex variables. Includes basic algebra of complex numbers, analytic functions and the Cauchy-Riemann equations, elementary transformations, complex integration, the Cauchy integral formulas, Taylor and Laurent series, and the theory of residues.

Lecture: 4, Lab 0, Other 0

MATH-416 Vector Analysis 4 Credits

Prerequisites: MATH-203 or MATH-203H or MATH-203X

Minimum Class Standing: Sophomore 2

An introduction to vector algebra and calculus including vector products, vector functions, and their differentiation and integration, gradients, line and surface integrals, conservative fields and potentials functions, Green's theorem, parametric equations, curvature, and curvilinear coordinates.

Lecture: 4, Lab 0, Other 0

MATH-418 Intermediate Differential Equations 4 Credits

Prerequisites: (MATH-204 or MATH-204H) and MATH-305

Minimum Class Standing: Junior

Systems of linear and nonlinear ordinary differential equations (ODE's) will be studied. Topic include: systems of linear ODE's, matrix methods, variation of parameters, and perturbation methods and boundary layers, phase portraits and stability of nonlinear ODE's. Numerical methods for solving systems of ODE's will be presented and used to solve physical problems of applied mathematics and engineering.

Lecture: 4, Lab 0, Other 0

MATH-421 Real Analysis II 4 Credits

Prerequisites: MATH-321

Minimum Class Standing: Junior 2

An introduction to the study of real functions including metric spaces, normed linear spaces, Hilbert Spaces, and linear operators.

Lecture: 4, Lab 0, Other 0

MATH-423 Partial Differential Equations 4 Credits

Prerequisites: MATH-305 and MATH-313

Minimum Class Standing: Junior

This course is a continuation of MATH-313. Topics include Bessel's equation and Legendre's equation, boundary value problems in curvilinear coordinate systems, Green's functions for ordinary and partial differential equations. Applications to problems of science and engineering will be given throughout the course.

Lecture: 4, Lab 0, Other 0

MATH-427 Statistical Inference & Modeling 4 Credits

Prerequisites: MATH-327

Minimum Class Standing: Sophomore I

A study of statistics including point and interval estimation, consistency and sufficiency, Minimum Variance Unbiased Estimators, Uniformly Most Powerful tests, likelihood ratio tests, goodness of fit tests, an introduction to non-parametric methods. Linear models, including regression analysis and Analysis of Variance are included. Programming in R will be introduced and used throughout the course.

Lecture: 4, Lab 0, Other 0

MATH-428 Sampling Theory 4 Credits

Prerequisites: MATH-327

Minimum Class Standing: Senior

A study of sampling theory including probability sampling, simple random sampling, sample size estimates, stratified sampling, and cluster sampling.

Lecture: 4, Lab 0, Other 0

MATH-450 Statistics for Risk Modeling 4 Credits

Prerequisites: MATH-427

Minimum Class Standing: Junior I

This course will prepare students to understand key concepts in the following categories of applied statistics: statistical learning, R programming language, construction of generalized linear models, regression-based time series models, principal components analysis, decision tree models and cluster analysis. Students will choose appropriate models, interpret model results and perform necessary calculations for statistical inference and prediction to answer the underlying business questions. Students are also assumed to have knowledge of probability and mathematical statistics.

Lecture: 4, Lab 0, Other 0