Mathematics (MA)

Courses

MA 4 Introductory and Intermediate Algebra 4 Credits (4,0)
Introductory and intermediate level algebra. Topics include but are not limited to: operations and properties of real numbers; solving linear, inequality, and quadratic equations; formulas with applications; functions and graphing linear equations; operations with polynomials; factoring; rational expressions and equations; radical expressions and equations; and systems of equations. Credit is not applicable to any degree. A grade of "C" or higher is required to pass this course.

MA 6 Intermediate Algebra 3 Credits (3,0)
This is an intermediate algebra course. Topics include fundamental concepts of algebra; linear equations and inequalities; polynomials; rational expressions; exponents and radicals quadratic equations; functions and graphing; and systems of linear equations and inequalities. Credit not applicable to any degree. A grade of "C" or higher is required to pass this course.
Prerequisites: Math Placement

MA 111 Pre-Calculus for Aviation 3 Credits (3,0)
A pre-calculus course designed for the student of aviation. Review of the fundamentals of algebra; linear equations and inequalities; quadratic equations; variation; polynomial, rational, exponential, logarithmic, and trigonometric functions; radian measure; right triangle solutions, vectors, and the laws of sines and cosines.
Prerequisites: MA 6 or MA 4

MA 112 Applied Calculus for Aviation 3 Credits (3,0)
This course presents basic calculus, designed for the student of aviation. Topics include differentiation and integration of algebraic functions; applications to velocity, acceleration, area, curve sketching and computation of extreme values.
Prerequisites: MA 111 or (MA 140 and MA 142) or MA 145

MA 120 Quantitative Methods I 3 Credits (3,0)
An algebra methods course with applications to business and economics. Operations, relations, functions, modeling, and problem solving; systems of linear equations and inequalities.
Prerequisites: MA 6 or MA 4

MA 140 College Algebra 3 Credits (3,0)
This course focuses on fundamentals of exponents, radicals, linear and quadratic equations, inequalities, functions, graphing techniques, and complex numbers. It includes an introduction to function; curve sketching; elementary theory of equations; sequences and series; matrix algebra and systems of equations; linear; polynomial; logarithmic; exponential; inverse and composite functions; variation; and systems of equations.
Prerequisites: MA 6 or MA 4

MA 142 Trigonometry 3 Credits (3,0)
Trigonometric functions and their graphs; identities; radian measure with applications; compound, half, and double angle identities; solving elementary trigonometric equations, right and oblique triangles; law of sines and cosines; inverse trigonometric functions; vectors and trigonometric form of a complex number.
Prerequisites: MA 6 or MA 4

MA 143 Precalculus Essentials 3 Credits (3,0)
Introduction to the calculus sequence with an emphasis on functions and their graphs, including polynomial, rational, exponential, logarithmic and trigonometric; radian measure; trigonometric identities and equations.
Prerequisites: MA 6 with a minimum grade of C

MA 145 College Algebra and Trigonometry 5 Credits (5,0)
Fundamentals of exponents, radicals, linear and quadratic equations, inequalities, elementary theory of equations, sequences and series, functions, exponential, logarithmic, and trigonometric functions, radian measure, trigonometric identities and equations, vectors, laws of sines, cosines, solutions of right triangles, and complex numbers.
Prerequisites: MA 6 or MA 4

MA 199 Special Topic in Mathematics 1-6 Credit
Individual independent or directed studies of selected topics.

MA 210 Introduction to Data Science 3 Credits (3,0)
Basic principles of data collection and management, summary and visualization, ethics and privacy, statistical inference and machine learning. No previous exposure to programming or statistics is expected.
Prerequisites: MA 111 or MA 120 or MA 140

MA 220 Quantitative Methods II 3 Credits (3,0)
This course is an introductory calculus course with applications to business and economics; limits; differentiation and integration of algebraic, exponential, and logarithmic functions; applications of differentiation to maximizing and minimizing; curve sketching; and marginal values.
Prerequisites: MA 111 or MA 120 or MA 140

MA 222 Business Statistics 3 Credits (3,0)
This course is a study of basic descriptive and inferential statistics. Topics include types of data, sampling techniques, measures of central tendency and dispersion, elementary probability, discrete and continuous probability distributions, sampling distributions, hypothesis testing, confidence intervals, and simple linear regression.
Prerequisites: MA 111 or MA 120 or MA 140 or MA 145

MA 241 Calculus and Analytical Geometry I 4 Credits (4,0)
Limits and continuity; differentiation and integration of algebraic and elementary transcendental functions; applications of first and second derivatives.
Prerequisites: MA 143 with a minimum grade of C or qualifying score on the mathematics skills assessment

MA 242 Calculus and Analytical Geometry II 4 Credits (4,0)
Differentiation and integration of transcendental functions; special integration techniques; applications of the definite integral; numerical methods; infinite series.
Prerequisites: MA 241

MA 243 Calculus and Analytical Geometry III 4 Credits (4,0)
Solid analytic geometry; vector functions in three dimensions; partial differentiation; directional derivative and gradient; line integrals; multiple integrals
Prerequisites: MA 242

MA 245 Applied Differential Equations 3 Credits (3,0)
Applied treatment of ordinary differential equations; Laplace transforms; matrix algebra and applications; computer techniques; numerical methods; least squares fit; normal distribution and applications.
Prerequisites: MA 242

MA 270 Computational Mathematics Seminar 1 Credit
Introduction to computational models drawn from a variety of scientific application areas. Models will be taught using guided inquiry, open-ended inquiry, cooperative learning, writing, and oral presentations. Each module used will be guided by a five-step process: problem statement; model of problem; methods chosen to solve; implementation; assessment of the model. Models will be implemented using computer algebra systems.
Corequisites: MA 241

MA 299 Special Topics in Mathematics 1-6 Credit
Individual independent or directed studies of selected topics.

MA 305 Introduction to Scientific Computing 3 Credits (3,0)
This course is an introduction to the Unix operating system, programming in a high level language (e.g., C or Fortran), and the use of mathematical libraries. Applications may include root-finding algorithms, quadrature, least squares, linear systems, and first order differential equations.
Prerequisites: MA 242 and EGR 115 or CS 223

MA 320 Decision Mathematics 3 Credits (3,0)
The mathematical concepts and applications in mathematical model building and problem solving. Included are mathematical areas that are basic to decision theory.
Prerequisites: MA 222

MA 325 Matrix Methods 1 Credit (1,0)
Matrices and matrix algebra, determinants, systems of linear equations, Gaussian elimination, eigenvalues and eigenvectors, applications in science and engineering.
Prerequisites: MA 242

MA 341 Introduction to Mathematical Analysis 3 Credits (3,0)
Careful treatment of the theoretical aspects of the calculus of functions of a real variable. Topics include the real number system, limits, continuity, derivatives, the Riemann integral, elementary notions of topology, and metric spaces.
Prerequisites: MA 243

MA 345 Differential Equations and Matrix Methods 4 Credits (4,0)
The study of the treatment of ordinary differential equations to include principle types of first and second order equations; methods of substitution on simple higher order equations; linear equations and systems of linear equations with constant coefficients; methods of undetermined coefficients and variation of parameters; Laplace transforms; series solutions; linear algebra and matrix methods of solutions; applications to physics and engineering.
Prerequisites: MA 243

MA 348 Numerical Analysis I 3 Credits (3,0)
Floating point arithmetic, error analysis, algorithms in interpolation, integration, differentiation, matrix algebra, approximation and solution of equations, use of numerical software packages.
Prerequisites: MA 325 or MA 345 and EGR 115

MA 350 Introduction to Partial Differential Equations 3 Credits (3,0)
Introduction to first order linear, quasi-linear, and nonlinear partial differential equations, with an introduction to numerical solutions; existence and uniqueness of solutions to second order equations, with emphasis on the heat, wave, and Laplace's equation. Uniform convergence with application to Fourier series and integrals. Green's functions, introduction to integro-differential equations. Difference equations.
Prerequisites: MA 345

MA 360 Mathematical Modeling & Simulation I 3 Credits (3,0)
A blended cyber-learning course in computational mathematics. Topics include matrix operations, linear and nonlinear optimization and interdisciplinary problems whose solutions heavily depend on mathematical modeling and simulation. Students meet teachers twice per week in virtual classes in problem help sessions and gain hands-on experience on how to use software tools such as MATLAB, Stella, Agentsheets, etc. to model and simulate team projects.

MA 399 Special Topics in Mathematics 1-6 Credit
Individual independent or directed studies of selected topics.

MA 404 Statistics and Research Methods 3 Credits (3,0)
Elements of probability theory including finite probability spaces, conditional probabilities, independence, correlation, Bayes Theorem, and Gaussian random variables. Statistical methods including contingency tables, regression, hypothesis testing. Experimental design. Ethical considerations in experimentation. Nonquantitative research methodologies. Numerical methods including the introduction of at least one computer-based statistics package.
Prerequisites: MA 112 or MA 241

MA 410 Linear Optimization 3 Credits (3,0)
An introduction to techniques for the solution and analysis of deterministic optimization models. Topics include the geometry of linear programming, the simplex method, duality theory, sensitivity analysis, and network flow models. Integer programming models and methods are introduced. The course emphasizes effective modeling of linear optimization problems and introduces the use of optimization packages and commercial solvers.
Prerequisites: MA 325 or MA 345

MA 412 Probability and Statistics 3 Credits (3,0)
Finite sample spaces; conditional probability and Bayes Theorem, discrete and continuous random variables and their functions; expected value, variance, and standard deviation; systematic study of the major discrete and continuous distributions; moment generating functions; hypothesis testing and estimation.
Prerequisites: MA 242

MA 413 Statistics 3 Credits (3,0)
An introduction to statistical techniques for analysis of data. Topics include sampling distributions and central limit theorem, estimation: maximum likelihood estimation, sufficient statistics, Bayes estimation, hypothesis testing, likelihood ratio test, Neyman-Pearson lemma, simple linear regression, ANOVA, multiple regression, data exploration and nonparametric methods. The course introduces the use of statistical packages.
Prerequisites: MA 243

MA 420 Nonlinear Optimization 3 Credits (3,0)
Modeling and analysis of nonlinear optimization problems. Topics include convex analysis, unconstrained and constrained optimization, duality theory, Lagrangian relaxation, Karush-Kuhn-Tucker conditions, and methods for solving nonlinear programs, including descent methods, Newton methods, conjugate gradient methods, subgradient optimization, and penalty and barrier methods.
Prerequisites: MA 243

MA 432 Linear Algebra 3 Credits (3,0)
Review of vector and matrix operations including matrix inverses, eigenvectors, and eigenvalues. Equations of lines and planes, vector spaces including basis and dimensions, linear transformations, change of basis, diagonalization of matrices, inner products and orthonormal bases, applications.
Prerequisites: MA 242

MA 441 Mathematical Methods for Engineering and Physics I 3 Credits (3,0)
Line and surface integrals; vector fields with the study of Green, Gauss, and Stokes Theorems; applications of vector field theory; Fourier series.
Prerequisites: MA 243

MA 442 Mathematical Methods for Engineering and Physics II 3 Credits (3,0)
The solution of linear differential equations with variable coefficients; study of the derivation, characteristics, and solutions of partial differential equations; Fourier series, Fourier transform, Laplace transform, and Green's function; applications in science and engineering.
Prerequisites: MA 441

MA 443 Complex Variables 3 Credits (3,0)
Algebra of complex numbers; complex functions, analytic functions; mapping by elementary functions; conformal mappings and their applications; additional topics may include complex integration, power series expansion.
Prerequisites: MA 441

MA 448 Numerical Solution of Differential Equations 3 Credits (3,0)
Numerical techniques for solving differential equations: initial value problem, Taylor series methods, Runge-Kutta methods and multistep methods; boundary value problem, shooting method; partial differential equations, finite difference method for the heat equation and wave equation. Efficient computational procedures, including the use of library and student-written procedures in Matlab/C/Fortran/Python.
Prerequisites: MA 345 and (MA 305 or EGR 115)

MA 453 High Performance Scientific Computing 3 Credits (3,0)
This course is an introduction to high performance computing in computational mathematics and sciences with practical applications. The course provides an overview of parallel computing and study of program efficiency on high performance computers. It concentrates on the two major parallelization paradigms: shared-memory parallelization with OpenMP and distributed-memory parallel programming with MPI. The main focus of the course will be on applications of parallel computing in the sciences (Engineering, Physics, Mathematics, etc.).
Prerequisites: MA 305 or MA 348

MA 488 Numerical Methods in Fluids 3 Credits (3,0)
Theory and applications of numerical methods in fluid mechanics: numerical methods for incompressible flows; primitive variable and vorticity stream function on formulation; and numerical treatment for inviscid and viscous flows, including restricted to incompressible flow. Numerical methods based on finite difference, finite volume, or finite element formulations.
Prerequisites: MA 442 and (MA 348 or MA 305)

MA 490 Capstone Project 3 Credits (3,0)
This course offers the student an opportunity to consolidate their knowledge of mathematics by investigating a computational problem in an application area consistent with their interest and experience. Students, typically working in teams, will develop mathematical paradigm that fits the problem and identify tools that might help solve it. They will then build and implement a mathematical model that contains critical elements of the problem and present both an oral and written report summarizing the work and possible extensions.
Prerequisites: MA 441 or DS 440

MA 499 Special Topics in Mathematics 1-6 Credit
Individual independent or directed studies of selected topics.