Mathematical Science

**MATH 1306** College Algebra for the Non-Scientist (3 semester credit hours) This course is intended for students NOT continuing on to precalculus or calculus. The course is designed to develop both abstract thinking and a practical approach to problem solving. The emphasis is on understanding rather than purely computational skills. Topics include logic, sets, the real numbers, linear equations and their applications, functions, and graphs. May not be used to satisfy major requirements for majors in the Schools of Natural Sciences and Mathematics or Management, or degree requirements for the School of Engineering and Computer Science. Not all MATH/STAT courses may be counted toward various degree plans. Please consult your degree plan to determine the appropriate MATH/STAT course requirements. Prerequisite: ALEKS score required. (3-0) S

**MATH 1314** (MATH 1314) College Algebra (3 semester credit hours) Topics chosen from areas such as equations and inequalities, rational expressions, exponents, radicals and logarithms, functions, and graphs. Exam section required for MATH 1314. May not be used to satisfy major requirements for majors in the Schools of Natural Sciences and Mathematics or Management, or degree requirements for the School of Engineering and Computer Science. Not all MATH/STAT courses may be counted toward various degree plans. Please consult your degree plan to determine the appropriate MATH/STAT course requirements. Prerequisite: ALEKS score required. (3-0) S

**MATH 1316** (MATH 1316) Trigonometry (3 semester credit hours) Angular measure, trigonometric functions, their properties; trigonometric identities, equations, and applications; trigonometric form of complex number and related topics. May not be used to satisfy major requirements for majors in the School of Natural Sciences and Mathematics or Management, or degree requirements for the School of Engineering and Computer Science. Not all MATH/STAT courses may be counted toward various degree plans. Please consult your degree plan to determine the appropriate MATH/STAT course requirements. Prerequisite: ALEKS score required or a grade of at least a C- in MATH 1314 or concurrent enrollment in MATH 1314. (3-0) S

**MATH 1325** (MATH 1325) Applied Calculus I (3 semester credit hours) Functions and graphs, differentiation, maxima and minima, exponential and logarithmic functions, integration, applications of integrals. May not be used to satisfy degree requirements for majors in the School of Engineering and Computer Science or major requirements in the School of Natural Sciences and Mathematics. Not all MATH/STAT courses may be counted toward various degree plans. Please consult your degree plan to determine the appropriate MATH/STAT course requirements. Cannot be used to replace MATH 2417 or MATH 2413. Prerequisite: ALEKS score required or a grade of at least a C- in MATH 1314. (3-0) S

**MATH 1326** Applied Calculus II (3 semester credit hours) Applications of differential equations, functions of several variables, least squares modeling, multiple integrals, infinite series. May not be used to satisfy degree requirements for BS majors in Schools of Engineering and Computer Science or Natural Sciences and Mathematics. Not all MATH/STAT courses may be counted toward various degree plans. Please consult your degree plan to determine the appropriate MATH/STAT course requirements. Cannot be used to replace MATH 2414 or MATH 2419. Prerequisite: A grade of at least a C- in MATH 1325. (3-0) S

**MATH 2306** Analytic Geometry (3 semester credit hours) Similarity, congruence, proofs (similarity transformations, rigid motions in the plane, proving geometric theorems, geometric constructions); Linear, quadratic, and other basic functions; Circles and basic areas; Right triangle trigonometry; Addition formulas;
Modeling geometry in the plane; Rectangular and polar coordinates; Conics; The principal axes theorem; Three dimensional space: lines and planes; Vectors in plane and space; Dot and cross product; Rectangular, cylindrical, and spherical coordinates; Parameterization of basic curves in plane and space; Elementary surfaces; Intersections of surfaces; Visualization; Examples of rigid motions in space; Volume formulas.

Prerequisite: ALEKS score required or a grade of at least a C- in MATH 1314 and MATH 1316. (3-0) S

MATH 2312 (MATH 2312) Precalculus (3 semester credit hours) Real numbers, subsets of real line, absolute value; algebra of functions, domain, range, composition, inverse; elements of analytical geometry including vectors in plane, conics, polar coordinates, translation and rotation of axes and related topics. Not all MATH/STAT courses may be counted toward various degree plans. Please consult your degree plan to determine the appropriate MATH/STAT course requirements. Prerequisite: ALEKS score required or a grade of at least a C- in MATH 1314 and MATH 1316. (3-0) S

MATH 2333 Matrices, Vectors, and Their Application (3 semester credit hours) Matrices, vectors, determinants, inverses, systems of linear equations, and applications. May not be used to satisfy degree requirements for majors in the School of Engineering and Computer Science or major requirements in the School of Natural Sciences and Mathematics. Cannot be used to replace MATH 2418. Not all MATH/STAT courses may be counted toward various degree plans. Please consult your degree plan to determine the appropriate MATH/STAT course requirements. Prerequisite: MATH 1314 or equivalent. (3-0) S

MATH 2370 Introduction to Programming with MATLAB (3 semester credit hours) Introduces the basic concepts of programming and problem solving using MATLAB. Topics include data types, data input/output, control structures, functions, scripts, debugging, data visualization techniques, symbolic computation, and basic algorithms. Programming projects related to mathematical and statistical applications and elementary numerical methods. Prerequisite: ALEKS score required or a grade of at least a C- in MATH 2312 or equivalent (3-0) S

MATH 2399 Research and Advanced Writing (3 semester credit hours) For students conducting independent research and scientific writing. Individual instruction course designed to develop skills for research and clear, precise and accurate scientific writing. Students will select the topic of the research from specific areas of mathematics. Subject and scope to be determined on an individual basis. Satisfies the School of Natural Sciences and Mathematics' advanced writing requirement. Prerequisites: Sophomore level standing in Mathematics and instructor consent required. (3-0) S

MATH 2413 (MATH 2413) Differential Calculus (4 semester credit hours) Course covers topics in differential calculus of functions of one variable; topics include limits, continuity, derivative, chain rule, implicit differentiation, mean value theorem, maxima and minima, curve sketching, derivatives of inverse trigonometric functions, antiderivative, substitution method, and applications. Three lecture hours and two discussion hours a week; a problem section required with MATH 2413, and will also be registered for exam section. Not all MATH/STAT courses may be counted toward various degree plans. Please consult your degree plan to determine the appropriate MATH/STAT course requirements. Prerequisite: ALEKS score required or a grade of at least a C- in MATH 2306 or MATH 2312. (3-2) S

MATH 2414 (MATH 2414) Integral Calculus (4 semester credit hours) Continuation of Math 2413. Course covers topics in integral calculus, sequences and series. Topics include techniques of integration, improper integrals, and applications. Polar coordinates, parametric equations, and arc length. Infinite sequences and series, tests for convergence, power series, radius of convergence and Taylor series. Three lecture hours and two discussion hours a week; registration in a problem section as well as the exam section is required with MATH 2414. Not all MATH/STAT courses may be counted toward various degree plans. Please consult your
degree plan to determine the appropriate MATH/STAT course requirements. Cannot be used to replace MATH 2419. Prerequisite: A grade of C- or better in either MATH 2417 or in MATH 2413 or equivalent. (3-2) S

**MATH 2415 (MATH 2415)** Calculus of Several Variables (4 semester credit hours) The course covers differential and integral calculus of functions of several variables. Topics include vector valued and scalar functions, partial derivatives, directional derivatives, chain rule, Lagrange multipliers, multiple integrals, double and triple integrals, the line integral, Green's theorem, Stokes' theorem, Divergence theorem. Three lecture hours and two discussion hours a week; problem section required with MATH 2415, and will also be registered for exam section. Not all MATH/STAT courses may be counted toward various degree plans. Please consult your degree plan to determine the appropriate MATH/STAT course requirements. Prerequisite: A grade of C- or better in MATH 2414. (3-2) S

**MATH 2417** Calculus I (4 semester credit hours) Functions, limits, continuity, differentiation; integration of function of one variable; logarithmic, exponential, and inverse trigonometric functions; techniques of integration, and applications. Three lecture hours and two discussion hours a week; problem section required with MATH 2417, and will also be registered for exam section. Not all MATH/STAT courses may be counted toward various degree plans. Please consult your degree plan to determine the appropriate MATH/STAT course requirements. Prerequisite: ALEKS score required or a grade of at least a C- in MATH 2306 or MATH 2312. (3-2) S

**MATH 2418 (MATH 2418)** Linear Algebra (4 semester credit hours) Introduces and provides models for application of the concepts of vector algebra. Topics include finite dimensional vector spaces and their geometric significance; representing and solving systems of linear equations using multiple methods, including Gaussian elimination and matrix inversion; matrices; determinants; linear transformations; quadratic forms; eigenvalues and eigenvectors; and applications in science and engineering. Three lecture hours and two discussion hours a week; problem section required with MATH 2418, and will also be registered for exam section. Not all MATH/STAT courses may be counted toward various degree plans. Please consult your degree plan to determine the appropriate MATH/STAT course requirements. Prerequisite: A grade of at least a C- in either MATH 2306 or MATH 2413 or MATH 2417. (3-2) S

**MATH 2419** Calculus II (4 semester credit hours) Continuation of MATH 2417. Improper integrals, sequences, infinite series, power series, parametric equations and polar coordinates, vectors, vector valued functions, functions of several variables, partial derivatives and applications, and multiple integration. Three lecture hours and two discussion hours a week; problem section required with MATH 2419, and will also be registered for exam section. Not all MATH/STAT courses may be counted toward various degree plans. Please consult your degree plan to determine the appropriate MATH/STAT course requirements. Prerequisite: A grade of at least a C- in MATH 2417. (3-2) S

**MATH 2420 (MATH 2420)** Differential Equations with Applications (4 semester credit hours) Ordinary differential equations, including linear equations, systems of equations, equations with variable coefficients, existence and uniqueness of solutions, series solutions, singular points, transform methods, and boundary value problems; application of differential equations to real-world problems. Three lecture hours and two discussion hours a week; problem section required with MATH 2420, and will also be registered for exam section. Not all MATH/STAT courses may be counted toward various degree plans. Please consult your degree plan to determine the appropriate MATH/STAT course requirements. Prerequisites: A grade of at least a C- in either MATH 2415 or in MATH 2419 or equivalent and a grade of at least a C- in MATH 2418 or equivalent. (3-2) S

**MATH 2451** Multivariable Calculus with Applications (4 semester credit hours) Vectors, matrices, vector
functions, partial derivatives, divergence, curl, Laplacian, multiple integrals, line and surface integrals, Green's, Stokes', and Gauss' theorems, and applications in physical sciences and engineering. Topics drawn from implicit function theorem, differential forms and vector fields. Three lecture hours and two discussion hours per week; problem section required with MATH 2451. Not all MATH/STAT courses may be counted toward various degree plans. Please consult your degree plan to determine the appropriate MATH/STAT course requirements. Prerequisites: A grade of at least a C- in either MATH 2415 or in MATH 2419 or equivalent and a grade of at least a C- in MATH 2418 or equivalent. (3-2) S

MATH 2V90 Topics in Mathematics - Level 2 (1-6 semester credit hours) Special topics in mathematics outside the normal course of offerings. May be repeated for credit as topics vary (9 semester credit hours maximum). Instructor consent required. ([1-6]-0) S

MATH 3301 Mathematics for Elementary and Middle School Teachers (3 semester credit hours) This course is intended to develop future teachers' depth of mathematical understanding by examining concepts in school mathematics from an advanced perspective. Topics include: numeration systems; arithmetic algorithms, prime factorization and other properties of the integers; proportional reasoning involving fractions and decimals; counting methods; and basic ideas of geometry and measurement. Problem solving is stressed. May not be used to satisfy: [1] undergraduate mathematics core requirement, [2] degree requirements by students in Mathematics, [3] electives, or [4] certification requirements in 8-12 mathematics. Prerequisite: MATH 1306 or MATH 1314 or equivalent. (3-0) S

MATH 3303 Introduction to Mathematical Modeling (3 semester credit hours) An introduction to construction, use, and analysis of empirical and analytical mathematical models. Emphasis on using appropriate technology with tools such as curve fitting, probability and simulation, difference and differential equations, and dimensional analysis. May not be used to satisfy mathematics requirements by students in Mathematics and may not be used to satisfy electives. Prerequisites: MATH 2418 and a grade of at least a C- in either MATH 2415 or in MATH 2419 or equivalent. (3-0) Y

MATH 3305 Foundations of Measurement and Informal Geometry (3 semester credit hours) An analysis, from an advanced perspective, of the basic concepts and methods of geometry and measurement. Topics include visualization, geometric figures and their properties; transformations and symmetry; congruence and similarity; coordinate systems; measurement (especially length, area, and volume); and geometry as an axiomatic system. Emphasis on problem solving and logical reasoning. May not be used to satisfy: [1] undergraduate mathematics core requirement, [2] degree requirements by students in Mathematics, [3] electives, or [4] certification requirements in 8-12 mathematics. Prerequisite: MATH 2312 or MATH 3301 or equivalent. (3-0) Y

MATH 3307 Mathematical Problem Solving for Teachers (3 semester credit hours) Development of the ability to solve mathematical problems and communicate their solutions through the study of strategies and heuristics. Practice in solving problems involving ideas from number theory, algebra, combinatorics and probability, etc. Communicating mathematics, logical reasoning, and connections between mathematical topics will be emphasized. May not be used to satisfy degree requirements for Mathematics majors. Prerequisites: MATH 2312 and (MATH 3305 or MATH 3321). (3-0) Y

MATH 3310 Theoretical Concepts of Calculus (3 semester credit hours) Mathematical theory of calculus. Limits, types of convergence, power series, differentiation, and Riemann integration. Prerequisite: A grade of at least a C- in either MATH 2415 or in MATH 2419 or equivalent. (3-0) S

MATH 3311 Abstract Algebra I (3 semester credit hours) Groups, rings, fields, vector spaces modules, linear transformations, and Galois theory. Prerequisites: A grade of at least a C- in either MATH 2415 or in MATH 24
or equivalent and a grade of at least C- in **MATH 2418** or equivalent. (3-0) S

**MATH 3312** Abstract Algebra II (3 semester credit hours) Continuation of **MATH 3311**. Prerequisite: **MATH 3311**. (3-0) Y

**MATH 3315** Discrete Mathematics and Combinatorics (3 semester credit hours) This course covers basic tools of enumerative combinatorics, equivalence relations, combinatorial proofs and recurrences, inclusion-exclusion, generating functions, and graphs and trees. Credit cannot be received for both courses, **CS 2305** and **MATH 3315**. Prerequisite: (**MATH 2417** or equivalent) or instructor consent required. (3-0) Y

**MATH 3315** Discrete Mathematics and Combinatorics (3 semester credit hours) This course covers basic tools of enumerative combinatorics, equivalence relations, combinatorial proofs and recurrences, inclusion-exclusion, generating functions, and graphs and trees. Credit cannot be received for both courses, **CS 2305** and **MATH 3315**. Prerequisite: (**MATH 2417** or equivalent) or instructor consent required. (3-0) Y

**MATH 3321** Geometry (3 semester credit hours) Elements of Euclidean, non-Euclidean, and projective geometry. Topics covered will be drawn from the following list: triangles and their distinguishing points, Euler line, nine point circle, extremum problems, circles and spheres, inversions, the circles of Apollonius, projective geometry, axioms of the projective plane, Desargues’ theorem, conics, elementary facts of the non-Euclidean geometries. Prerequisite: A grade of at least a C- in either **MATH 2306** or **MATH 2415** or **MATH 2419** or equivalent. (3-0) Y

**MATH 3323** Elementary Number Theory (3 semester credit hours) Divisibility of integers, prime numbers, the Euclidean algorithm, greatest common divisors, Bezout coefficients, the fundamental theorem of arithmetic, linear congruences, the Chinese remainder theorem, Euler’s totient function, polynomial congruences, Hensel’s lemma, order, primitive roots, quadratic reciprocity, primality testing, factorization techniques, public key encryption algorithms, and additional topics. Prerequisite: A grade of at least a C- in either **MATH 2414** or in **MATH 2418** or **MATH 2419**. (3-0) Y

**MATH 3351** Advanced Calculus (3 semester credit hours) The course covers the interplay of linear algebra, higher dimensional calculus, and geometry. Topics include vectors, coordinate systems, the elementary topology of Euclidean spaces and surfaces, the derivative as a linear map, the gradient, multivariate optimization, vector fields, vector differential operators, multiple integrals, General Stokes Theorem, and differential forms. Applications are given to geometry, science, and engineering. Basic topological intuition is developed. Prerequisites: (A grade of at least a C- in either **MATH 2415** or **MATH 2419** or equivalent) and a grade of at least a C- in **MATH 2418** or equivalent. (3-0) S

**MATH 3379** Complex Variables (3 semester credit hours) Geometry and algebra of complex numbers, functions of a complex variable, power series, integration, calculus of residues, conformal mapping. Prerequisites: (**MATH 2451** or **MATH 3351**) and **MATH 3310**. (3-0) S

**MATH 3380** Differential Geometry (3 semester credit hours) Curves and surfaces, multilinear algebra, alternating tensors, tangent vectors, tangent space, vector fields, differential forms; Curvature and torsion of curves, Riemannian metrics, curvature of surfaces, isometries, geodesics, Gauss map, First and Second Fundamental Forms, area on surfaces, Gauss-Bonnet Theorem, surfaces with constant negative curvature and elements of hyperbolic geometry. Prerequisites: (**MATH 2451** or **MATH 3351**) and **MATH 2418** and **MATH 2420** or equivalent courses. (3-0) Y

**MATH 3397** Mathematical Problem Solving (3 semester credit hours) Problem solving techniques including graphs, combinatorial techniques, induction, number theory, geometry and symmetry and heuristics. Students will learn to maintain good control of the problem-solving process, and will gain proficiency in presenting solutions in both oral and written form. Prerequisite: **MATH 2413** or **MATH 2417** or **MATH 3321**. (3-0) Y

**MATH 4301** Mathematical Analysis I (3 semester credit hours) Sets, real number system, metric spaces, real functions of several variables. Riemann-Stieltjes integration and other selected topics. Prerequisites: (**MATH
2451 or MATH 3351 and MATH 3310 (3-0) S

MATH 4302 Mathematical Analysis II (3 semester credit hours) Continuation of MATH 4301. Prerequisite: MATH 4301. (3-0) S

MATH 4332 Scientific Math Computing (3 semester credit hours) Topics covered include introduction to Unix shells, basic and advanced use of Matlab for mathematical and scientific problem solving. Course is conducted in a computer classroom and assignments include applications in numerical and statistical analysis, image processing, and signal processing. Prerequisites: A grade of at least a C- in either MATH 2415 or in MATH 2419 or equivalent and a grade of at least C- in MATH 2418 or equivalent. (3-0) S

MATH 4334 Numerical Analysis (3 semester credit hours) Solution of linear equations, roots of polynomial equations, interpolation and approximation, numerical differentiation and integration, solution of ordinary differential equations, computer arithmetic, and error analysis. Prerequisites: (MATH 2370 or CS 1324 or CS 1325 or CE 1337 or CS 1337) and (MATH 2418 and (MATH 2451 or MATH 3351). (Same as CS 4334) (3-0) Y

MATH 4341 Topology (3 semester credit hours) Elements of general topology, topological spaces, continuous functions, connectedness, compactness, completeness, separation axioms, and metric spaces. Prerequisites: (MATH 2451 or MATH 3351) and MATH 3310. (3-0) S

MATH 4355 Methods of Applied Mathematics (3 semester credit hours) Topics include some frequently used tools in applied mathematics: Matrix theory, Fourier series and transforms, and special functions as relevant to applications in engineering and the sciences. Prerequisites: MATH 2418 and MATH 2420 or instructor consent required. (3-0) R

MATH 4362 Partial Differential Equations (3 semester credit hours) This course presents a survey of classical and numerical methods for the solution of linear and nonlinear boundary value problems governed by partial differential equations. Modeling and application-related issues are included throughout. Prerequisites: MATH 2420 and (MATH 2451 or MATH 3351). (3-0) Y

MATH 4381 Structure of Modern Geometry (3 semester credit hours) The course is designed to familiarize students with the geometrical concepts which relate to two and three dimensional geometry and the mathematical techniques used in the study of geometry. The emphasis is both on the development of understanding of the concepts and the ability to use the concepts in proving theorems. The course includes study of axiom systems, transformational geometry, and an introduction to non-Euclidean geometries, supplemented by other topics as determined by the instructor. Prerequisite: A grade of at least a C- in MATH 2418 or equivalent. (3-0) Y

MATH 4390 Senior Research and Advanced Writing (3 semester credit hours) For students conducting independent research and scientific writing. Individual instruction course designed to develop skills for research and clear, precise and accurate scientific writing. Topics will vary from section to section depending upon the interests of the student, but will be selected from a specific area of mathematics. Subject and scope to be determined on an individual basis. Satisfies the School of Natural Sciences and Mathematics' advanced writing requirement. This course will retain core notation for a transition period - see http://go.utdallas.edu/core-curriculum-transition. Please consult advisors for more detailed information. Prerequisite: Senior level standing in Mathematics and instructor consent required. (3-0) S

MATH 4399 Senior Honors in Mathematics (3 semester credit hours) For students conducting independent research for honors theses or projects. Satisfies the School of Natural Sciences and Mathematics' advanced writing requirement. Instructor consent required. (3-0) S
**MATH 4475** Capstone Project (4 semester credit hours) This course is intended to provide hands-on experience in a data science project. Students will work in teams on projects and will be involved in formulating a relevant problem, collecting the requisite data, finding a solution, and developing the necessary computational tools. The deliverables will include a final project report that details these steps and presentation of the project. Prerequisites: **STAT 4355** and **CS 4375**. (Same as **CS 4475** and **STAT 4475**) (4-0) Y

**MATH 4V03** Independent Study in Mathematics (1-6 semester credit hours) Independent study under a faculty member's direction. Student must obtain approval from participating math sciences faculty member and the undergraduate advisor. May satisfy the School of Natural Sciences and Mathematics' advanced writing requirement if it has a major writing/report component. May be repeated for credit (9 semester credit hours maximum). Instructor consent required. ([1-6]-0) S

**MATH 4V91** Undergraduate Topics in Mathematics (1-9 semester credit hours) May be repeated for credit as topics vary (9 semester credit hours maximum). Instructor consent required. ([1-9]-0) S