MATHEMATICS (MAT)

NOTE: All prerequisites for Mathematics (MAT) courses must be completed with a grade of "C-" or better.

Mathematics (MAT) Courses

MAT 1023. College Algebra with Applications. (3-0) 3 Credit Hours.
Prerequisite: Satisfactory performance on a placement examination; students pursuing majors in the College of Science or in Engineering should not enroll in this course; students majoring in areas that require MAT 1214 Calculus I are encouraged to take MAT 1073 instead of MAT 1023. Topics include algebraic expressions; equations; inequalities over the real numbers; relations, functions, and graphs; polynomial and rational functions; systems of linear equations and inequalities; complex numbers; and matrices and determinants. A wide range of applications will be included in this course. (Formerly MTC 1023 and MAT 1063. Credit can be earned for only one of the following: MAT 1023, MTC 1023, MAT 1063, or MAT 1073 (formerly MTC 1073). NOTE: For the purpose of the Three-Attempt Rule, these courses are considered to be equivalent, and additional fees may be charged for the third or subsequent attempt to take any of these courses in any combination.) May apply toward the Core Curriculum requirement in Mathematics. Generally offered: Fall, Spring, Summer. Course Fees: LRC1 $12; LRS1 $46.20; STSI $21.60; DL01 $75.

MAT 1043. Introduction to Mathematics. (3-0) 3 Credit Hours. (TCCN = MATH 1332)
Prerequisite: Satisfactory performance on a placement examination; this course is designed primarily for the liberal arts major to satisfy the Core Curriculum Mathematics requirement. Topics may include logic; proofs; deductive and inductive reasoning; number theory; fundamentals of statistics; basic statistical graphs; causal connections; financial management; functions; linear graphs and modeling; exponential growth and decay; logarithms; fundamentals of probability; fundamentals of geometry; and basic ideas from trigonometry, calculus, and discrete mathematics. (Formerly MTC 1043. Credit cannot be earned for both MAT 1043 and MTC 1043.) May apply toward the Core Curriculum requirement in Mathematics. Generally offered: Fall, Spring, Summer. Course Fees: LRC1 $12; LRS1 $45; STSI $21; DL01 $75.

MAT 1053. Mathematics for Business. (3-0) 3 Credit Hours. (TCCN = MATH 1324)
Prerequisite: Satisfactory performance on a placement examination. This course is designed to prepare the student for MAT 1093 Precalculus and MAT 1214 Calculus I. Topics may include algebraic expressions; equations; inequalities over the real numbers; relations, functions, polynomial and rational functions; logarithmic and exponential functions; systems of linear equations and inequalities; matrices and determinants; complex numbers; sequences; series binomial expansion; mathematical induction; permutations, and combinations. (Formerly MAT 1073. Credit can be earned for only one of the following: MAT 1073, MTC 1073, MAT 1023 (formerly MAT 1063 and MTC 1023). NOTE: For the purpose of the Three-Attempt Rule, these courses are considered to be equivalent and additional fees may be charged for the third or subsequent attempt to take any of these courses in any combination.) May apply toward the Core Curriculum requirement in Mathematics. Generally offered: Fall, Spring, Summer. Course Fees: LRC1 $12; LRS1 $46.20; STSI $21.60; DL01 $75.

MAT 1093. Precalculus. (3-0) 3 Credit Hours. (TCCN = MATH 2312)
Prerequisite: MAT 1023, MAT 1053, or MAT 1073, or satisfactory performance on a placement examination. Exponential functions, logarithmic functions, trigonometric functions, complex numbers, DeMoivre's theorem, and polar coordinates. May apply toward the Core Curriculum requirement in Mathematics. Generally offered: Fall, Spring, Summer. Course Fees: DL01 $75; LRC1 $12; LRS1 $46.20; STSI $21.60.

MAT 1133. Calculus for Business. (3-0) 3 Credit Hours. (TCCN = MATH 1325)
Prerequisite: MAT 1023, MAT 1053, or MAT 1073 (with a grade of "C-" or better), or satisfactory performance on a placement examination. This course is the basic study of limits and continuity, differentiation of single and multivariable functions, optimization and graphing, and integration of elementary, single variable functions, with an emphasis on applications in business and economics. May apply toward the Core Curriculum requirement in Mathematics. (Formerly MAT 1033. Credit cannot be earned for both MAT 1033 and MAT 1133.) Generally offered: Fall, Spring, Summer. Course Fees: DL01 $75; LRC1 $12; LRS1 $46.20; STSI $21.60.

MAT 1153. Algebra for Scientists and Engineers. (1-4) 3 Credit Hours. (TCCN = MATH 1314)
Prerequisite: Satisfactory performance on a placement examination. This course is designed to prepare the student for MAT 1093 Precalculus and MAT 1214 Calculus I. Topics may include algebraic expressions; equations; inequalities over the real numbers; relations, functions, polynomial and rational functions; logarithmic and exponential functions; systems of linear equations and inequalities; matrices and determinants; complex numbers; sequences; series binomial expansion; mathematical induction; permutations, and combinations. (Formerly MAT 1073. Credit can be earned for only one of the following: MAT 1073, MTC 1073, MAT 1023 (formerly MAT 1063 and MTC 1023). NOTE: For the purpose of the Three-Attempt Rule, these courses are considered to be equivalent and additional fees may be charged for the third or subsequent attempt to take any of these courses in any combination.) May apply toward the Core Curriculum requirement in Mathematics. Generally offered: Fall, Spring, Summer. Course Fees: LRC1 $12; LRS1 $46.20; STSI $21.60; DL01 $75.

MAT 1073. Algebra for Scientists and Engineers. (1-4) 3 Credit Hours. (TCCN = MATH 1314)
Prerequisite: Satisfactory performance on a placement examination. This course is designed to prepare the student for MAT 1093 Precalculus and MAT 1214 Calculus I. Topics may include algebraic expressions; equations; inequalities over the real numbers; relations, functions, polynomial and rational functions; logarithmic and exponential functions; systems of linear equations and inequalities; matrices and determinants; complex numbers; sequences; series binomial expansion; mathematical induction; permutations, and combinations. (Formerly MAT 1073. Credit can be earned for only one of the following: MAT 1073, MTC 1073, MAT 1023 (formerly MAT 1063 and MTC 1023). NOTE: For the purpose of the Three-Attempt Rule, these courses are considered to be equivalent and additional fees may be charged for the third or subsequent attempt to take any of these courses in any combination.) May apply toward the Core Curriculum requirement in Mathematics. Generally offered: Fall, Spring, Summer. Course Fees: LRC1 $12; LRS1 $46.20; STSI $21.60; DL01 $75.

MAT 1153. Essential Elements in Mathematics I. (3-0) 3 Credit Hours. (TCCN = MATH 1350)
Prerequisite: MAT 1023 or MAT 1073. Numeration systems; properties of the systems of whole numbers, integers, rational numbers, and real numbers; problem solving; logic. May not be applied toward a major in mathematics. (Formerly MAT 1143. Credit cannot be earned for both MAT 1153 and MAT 1143.) Generally offered: Fall, Spring, Summer. Course Fees: LRS1 $46.20; MFSM $30; STSI $21.60; DL01 $75.

MAT 1163. Essential Elements in Mathematics II. (3-0) 3 Credit Hours. (TCCN = MATH 1351)
Prerequisite: MAT 1153. Algebra, statistics and probability; geometric shapes; measurement; coordinate and transformational geometry. May not be applied toward a major in mathematics. Generally offered: Fall, Spring, Summer. Course Fees: LRS1 $46.20; MFSM $30; STSI $21.60; DL01 $75.
MAT 1193. Calculus for the Biosciences. (3-0) 3 Credit Hours. (TCCN = MATH 2413)
Prerequisite: MAT 1093 or an equivalent course or satisfactory performance on a placement examination. An introduction to calculus is presented using discrete-time dynamical systems and differential equations to model fundamental processes important in biological and biomedical applications. Specific topics to be covered are limits, continuity, differentiation, antiderivatives, definite and indefinite integrals, the fundamental theorem of calculus, differential equations, and the phase-plane. (Formerly MAT 1194. Same as MAT 1214. Credit can be earned for only one of the following: MAT 1193, MAT 1194, or MAT 1214.) May apply toward the Core Curriculum requirement in Mathematics. Generally offered: Fall, Spring, Summer. Course Fees: LRS1 $46.20; STSI $21.60; DL01 $75; LRC1 $12; LRS1 $46.20; STSI $21.60.

MAT 1214. Calculus I. (4-0) 4 Credit Hours. (TCCN = MATH 2413)
Prerequisite: MAT 1093 or an equivalent course or satisfactory performance on a placement examination. An introduction to the concepts of limit, continuity and derivative, mean value theorem, and applications of derivatives such as velocity, acceleration, maximization, and curve sketching, introduction to the Riemann integral and the fundamental theorem of calculus. (Same as MAT 1214 and MAT 1193. Credit can be earned for only one of the following: MAT 1214 or MAT 1193 (formerly MAT 1194.)) May apply toward the Core Curriculum requirement in Mathematics. Generally offered: Fall, Spring, Summer. Course Fees: DL01 $100; LRC1 $16; LRS1 $61.60; STSI $28.80.

MAT 1224. Calculus II. (4-0) 4 Credit Hours. (TCCN = MATH 2414)
Prerequisite: MAT 1193 or MAT 1214. Methods of integration, applications of the integral, sequences, series, and Taylor expansions. (Formerly MAT 1223. Credit cannot be earned for both MAT 1224 and MAT 1223.) Generally offered: Fall, Spring, Summer. Course Fees: LRS1 $61.60; STSI $28.80; DL01 $100.

MAT 1313. Algebra and Number Systems. (3-0) 3 Credit Hours.
Corequisite: MAT 1214. Basic logic and proofs. Properties of integer numbers, mathematical induction, the fundamental theorem of arithmetic, the infinitude of primes, modular arithmetic, rational and irrational numbers, complex numbers, functions, polynomials, and the binomial theorem. Generally offered: Fall, Spring. Course Fees: LRS1 $46.20; STSI $21.60.

MAT 2113. Functions and Modeling. (3-0) 3 Credit Hours.
Prerequisite: MAT 1093 or consent of instructor and admission to the UTeachSA teacher preparation program. In-depth study of concepts needed to teach secondary school mathematics at various levels. Emphasizes the development of the concept of function, exploring function patterns in data sets, and the connections between the main topics of mathematics associated with a secondary school curriculum. Use of appropriate technology is explored. May not be applied toward the Mathematics Concentration of the B.S. degree in Mathematics. (Same as UTE 2113. Credit cannot be earned for both MAT 2113 and UTE 2113.) Course Fees: LRS1 $46.20; STSI $21.60; DL01 $75.

MAT 2214. Calculus III. (4-0) 4 Credit Hours. (TCCN = MATH 2415)
Prerequisite: MAT 1224. Vectors, functions of several variables, partial derivatives, line, surface and volume integrals, Green’s, Stokes’ and the Divergence theorems. (Formerly MAT 2213. Credit cannot be earned for both MAT 2214 and MAT 2213.) Generally offered: Fall, Spring, Summer. Course Fees: LRS1 $61.60; STSI $28.80; DL01 $100.

MAT 2233. Linear Algebra. (3-0) 3 Credit Hours. (TCCN = MATH 2318)
Prerequisite: MAT 1224 or EGR 2323. Vector spaces and matrix algebra, matrices and determinants, characteristic values of matrices, and reduction to canonical forms. Emphasis on applications. Generally offered: Fall, Spring, Summer. Course Fees: LRS1 $46.20; STSI $21.60; DL01 $75.

MAT 2313. Combinatorics and Probability. (3-0) 3 Credit Hours.
Prerequisite: MAT 1224. Introduction to combinatorics and graph theory; discrete and conditional probability; random variables and pdfs. Generally offered in Fall. Course Fees: LRS1 $46.2; STSI $21.6; DL01 $72.

MAT 3013. Foundations of Mathematics. (3-0) 3 Credit Hours.
Prerequisite: MAT 1214. Development of theoretical tools for rigorous mathematics. Topics may include mathematical logic, propositional and predicate calculus, set theory, functions and relations, cardinal and ordinal numbers, Boolean algebras, and construction of the natural numbers, integers, and rational numbers. Emphasis on theorem proving. (Formerly MAT 2243. Credit cannot be earned for MAT 3013 and MAT 2243.) Generally offered: Fall, Spring, Summer. Differential Tuition: $150. Course fee: DL01 $75.

MAT 3023. Perspectives on Science and Mathematics. (3-0) 3 Credit Hours.
Prerequisite: MAT 1193, MAT 1214, STA 1053, or consent of instructor. An examination of important episodes in the history of mathematics and science that illustrate the nature of scientific inquiry and convey that scientific and mathematical concepts are not static. Topics may include Galileo’s conflict with the Catholic Church, Isaac Newton’s formulation of the laws of motion and invention of calculus, Charles Darwin’s proposal of the theory of evolution by natural selection, the development of the atomic bomb, and the discovery of the double helix structure of DNA, or others chosen by the instructor. May not be applied toward the Mathematics Concentration of the B.S. degree in Mathematics. (Same as UTE 3023. Credit cannot be earned for both MAT 3023 and UTE 3023. Credit cannot be earned for both MAT 3023 and MAT 4123.) Differential Tuition: $150.

MAT 3103. Data Analysis and Interpretation. (3-0) 3 Credit Hours.
Prerequisite: MAT 1093 or consent of instructor. Measurement, sampling, summarizing and displaying data, types of data, inferential methods, nonparametric methods, qualitative research designs and methods, interpreting research results, and research design. Applications to research techniques in school-based settings will be emphasized. May not be applied toward the Mathematics Concentration of the B.S. degree in Mathematics. Generally offered: Fall, Spring, Summer. Differential Tuition: $150. Course fee: DL01 $75.

MAT 3123. Fundamentals of Geometry. (3-0) 3 Credit Hours.
Prerequisite: MAT 1093 or consent of instructor. A survey of geometric concepts, including axiomatic development of advanced Euclidean geometry, coordinate geometry, non-Euclidean geometry, three-dimensional geometry, and topology. May not be applied toward the Mathematics Concentration of the B.S. degree in Mathematics. Generally offered: Fall, Spring. Differential Tuition: $150.

MAT 3213. Foundations of Analysis. (3-0) 3 Credit Hours.
Prerequisites: MAT 1224 and MAT 3013. Axiomatic definition of real numbers, including order properties and completeness; infinite sequences and their convergence; basic notions related to series and their convergence; functions and function limits. Introduction to topology of the real line. Emphasis on theorem proving. Generally offered: Fall, Spring, Summer. Differential Tuition: $150. Course fee: DL01 $75.
MAT 3223. Complex Variables. (3-0) 3 Credit Hours.
Prerequisites: MAT 2214 and MAT 3213. An introduction to complex variables, including elementary functions, line integrals, power series, residues and poles, and conformal mappings. Generally offered: Spring. Differential Tuition: $150.

MAT 3233. Modern Algebra. (3-0) 3 Credit Hours.
Prerequisite: MAT 3013. Topics will include the development of groups, integral domains, fields, and number systems, including the complex numbers. Divisibility, congruences, primes, perfect numbers, and some other problems of number theory will be considered. Generally offered: Fall, Spring, Summer. Differential Tuition: $150.

MAT 3273. Applied Mathematics for Sciences and Engineering. (3-0) 3 Credit Hours.
Prerequisite: MAT 2214 or MAT 3613 or consent of instructor. Mathematical applications in biology, physics, engineering or other scientific disciplines. Topics may employ techniques of complex analysis, harmonic analysis, Fourier series, Fourier transforms, and partial differential equations. Differential Tuition: $150.

MAT 3313. Logic and Computability. (3-0) 3 Credit Hours.
Prerequisites: MAT 1214 and MAT 3013. Recursive functions, Turing computability, insolvability, decidability, completeness and compactness of first order logic. Generally offered: Spring. Differential Tuition: $150.

MAT 3613. Differential Equations I. (3-0) 3 Credit Hours.
Prerequisite: Completion of or concurrent enrollment in MAT 2233. Basic notions of differential equations, solution of first-order equations and linear equations with constant coefficients, nth-order initial value problems, Laplace transforms, and may include additional topics such as power series solutions of differential equations, linear systems, and stability. Generally offered: Fall, Spring, Summer. Differential Tuition: $150. Course fee: DL01 $75.

MAT 3623. Differential Equations II. (3-0) 3 Credit Hours.

MAT 3633. Numerical Analysis. (3-0) 3 Credit Hours.
Prerequisites: MAT 2233, MAT 3213, and one of the following: CS 1063, CS 1714, or CS 2073. Solution of linear and nonlinear equations, curve-fitting, and eigenvalue problems. Generally offered: Fall, Spring. Differential Tuition: $150. Course fee: DL01 $75.

MAT 3653. Stochastic Calculus. (3-0) 3 Credit Hours.

MAT 4113. Computer Mathematical Topics. (3-0) 3 Credit Hours.
Prerequisite: MAT 1214. Mathematical topics from algebra, Euclidean and non-Euclidean geometry, number theory, and probability and statistics will be investigated using Geometer's Sketchpad and a variety of Web-based mathematics resources. Course will also include the application of software to the solution of a variety of geometric and algebraic problems. May not be applied toward the Mathematics Concentration of the B.S. degree in Mathematics. Generally offered: Spring, Summer. Differential Tuition: $150.

MAT 4123. History of Mathematics. (3-0) 3 Credit Hours.
Prerequisites: MAT 3233 or MAT 4233, and either MAT 3123 or MAT 4263. Selected subjects in mathematics developed through historical perspectives and biographies. May not be applied toward the Mathematics Concentration of the B.S. degree in Mathematics. (Same as UTE 3023. Credit cannot be earned for both UTE 3023 and MAT 4123.) Generally offered: Spring, Summer. Differential Tuition: $150. Course fee: DL01 $75.

MAT 4213. Real Analysis I. (3-0) 3 Credit Hours.
Prerequisite: MAT 3213. Continuous functions, uniform continuity; theory of differentiation; applications of the derivative to properties of functions; antiderivatives; Riemann integral; connection between differentiation and integration. Generally offered: Fall, Spring, Summer. Differential Tuition: $150. Course fee: DL01 $75.

MAT 4223. Real Analysis II. (3-0) 3 Credit Hours.
Prerequisite: MAT 4213. Lebesgue integral on the real line; n-dimensional spaces; vectors; calculus of functions of several variables; multidimensional integration. Generally offered: Fall, Spring. Differential Tuition: $150. Course fee: DL01 $75.

MAT 4233. Modern Abstract Algebra. (3-0) 3 Credit Hours.
Prerequisites: MAT 2233 and MAT 3013. Basic properties and examples of semigroups, monoids, and groups, detailed study of permutation, dihedral, and congruence groups, cyclic groups, normal subgroups, quotient groups, homomorphism, isomorphism theorems, direct products of groups, The Sylow Theorems, rings and fields and their basic properties, ideals, polynomial rings. Generally offered: Spring. Differential Tuition: $150.

MAT 4243. Topology. (3-0) 3 Credit Hours.

MAT 4253. Modern Analysis II. (3-0) 3 Credit Hours.
Prerequisites: MAT 3223 and one of the following: MAT 3253, or MAT 4223. A continuation of MAT 4223. May not be applied toward the Mathematics Concentration of the B.S. degree in Mathematics. Generally offered: Spring, Summer. Differential Tuition: $150. Course fee: DL01 $75.

MAT 4303. Capstone Course for Mathematics. (3-0) 3 Credit Hours.
Prerequisites: Consent of instructor or one each from MAT 3123 or MAT 4263, MAT 3223 or MAT 4233, and MAT 4113. This course is for any interested mathematics major, particularly for those students who intend to pursue secondary certification in Mathematics. The goals of the course are to enable students to build connections among the mathematical areas they have studied and between undergraduate mathematics and high school mathematics, to develop their understanding of mathematics as an integrated discipline, and to strengthen their oral and written communication skills in mathematics. May not be applied toward the Mathematics Concentration of the B.S. degree in Mathematics. Generally offered: Fall, Spring. Differential Tuition: $150. Course fee: DL01 $75.
MAT 4333. Probability and Computing. (3-0) 3 Credit Hours.
Prerequisites: CS 3333 or MAT 2313. May include moments of random
variables: randomized mincut algorithm, Chebyshev and Markov
inequalities, sampling estimator for mean. Basic Concentration
Inequalities: Chernoff and Hoeffding inequalities; parameter estimation
and set balancing. Discrete probabilistic structures: Bucket sort
algorithm, Poisson approximation, Lovasz local Lemma, independent
set search. The Gaussian: Moment Generating Functions, Central
Limit Theorem, JL dimensionality reduction lemma. Markov Chains
and Random Walks: Stationary Distributions, and randomized 3-SAT
algorithm, Entropy Function: Information and Compression. Same as CS
4333. Credit cannot be earned for both CS 4333 and MAT 4333. Generally
offered in Spring. Differential Tuition: $150.

MAT 4343. Introduction to Optimization. (3-0) 3 Credit Hours.
Prerequisites: (MAT 2214 and MAT 2233) or EGR 3323 or (MAT 1224
and CS 3333). May include Discrete, Continuous, Linear, and non-Linear
optimization. Optimality conditions, Lagrange multipliers, duality theory.
Applications of linear programming in computer science and discrete
optimization. Gradient descent and Newton iteration (i.e., RST and
second order methods), trust region methods, and conjugate gradient.
Applications of RST and second order methods to engineering. Same
as CS 4303. Credit cannot be earned for both CS 4303 and MAT 4343.
Generally offered in Fall. Differential Tuition: $150.

MAT 4353. Mathematical Foundations of Cryptography. (3-0) 3 Credit
Hours.
Prerequisite: MAT 3233 or MAT 4233 or consent of instructor.
Congruences and residue class rings, Fermat’s Little Theorem, the Euler
phi-function, the Chinese Remainder Theorem; complexity; symmetric-key
cryptosystems; cyclic groups, primitive roots, discrete logarithms, one-
way functions; public-key cryptosystems (Diffie-Hellman key exchange,
RSA, Rabin, El Gamal); digital signatures; and other groups (finite fields,
Course fee: DL01 $75.

MAT 4803. Statistical Quality Control. (3-0) 3 Credit Hours.
Prerequisites: MAT 1224 and STA 3003 or STA 3513. Statistical methods
are introduced in terms of problems that arise in manufacturing and their
applications to the control of manufacturing processes. Topics include
control charts and acceptance sampling plans. (Same as STA 4803.
Credit cannot be earned for both MAT 4803 and STA 4803.) Differential
Tuition: $150.

MAT 4913. Independent Study. (0-0) 3 Credit Hours.
Prerequisites: Permission in writing (form available) from the instructor,
the student’s advisor, the Department Chair, and the Dean of the College
in which the course is offered. Independent reading, research, discussion,
and/or writing under the direction of a faculty member. May be repeated
for credit, but not more than 6 semester credit hours, regardless of
discipline, will apply to a bachelor’s degree. Differential Tuition: $150.

MAT 4953. Special Studies in Mathematics. (3-0) 3 Credit Hours.
Prerequisite: Consent of instructor. An organized course offering the
opportunity for specialized study not normally or not often available as
part of the regular course offerings. May be repeated for credit when
the topics vary, but not more than 6 semester credit hours, regardless of
discipline, will apply to a bachelor’s degree. Generally offered: Fall, Spring,

MAT 4993. Honors Research. (0-0) 3 Credit Hours.
Prerequisites: Enrollment limited to candidates for College Honors during
their last two semesters; approval by the College Honors Committee.
Supervised research and preparation of an honors thesis. May be
repeated once with approval. Differential Tuition: $150.