MATHEMATICS (MATH)

MATH 5300. Mathematics Internship. 3 Hours.
Students engage in a supervised work environment that provides applied experience in fields related to the mathematical sciences. This work may take place within a public, non-profit, or private organization. Under the supervision of a faculty internship coordinator, students will apply mathematical theory and techniques learned in the classroom to real world applications, gain practical skills like software coding and applied analysis, and be introduced to professional networking opportunities for their future careers. Students are required to document their completion of 240 hours of internship experience in the coordinated work environment.
Prerequisite: Departmental Approval.

MATH 5360. Special Topics. 3 Hours.
Topics and courses are selected to suit individual needs of students. Methods of independent study and research are stressed. The course may be repeated for additional credit.
Prerequisite: Consent of program coordinator.

MATH 5361. Theory and Applications Of Probability. 3 Hours.
Topics include probability axioms and properties, conditional probability, random variables, probability distributions, moment generating functions, laws of large numbers, and the Central Limit Theorem. Also listed as STAT 5361.
Prerequisite: STAT 4372 (or equivalent) or consent of the instructor.

MATH 5365. Introductory Analysis. 3 Hours.
Students engage in a more thorough treatment of the material traditionally considered in elementary calculus. Topics may include sets, functions, properties of the real number system and sequences. NOTE: Students who have taken Math 4361 may not take MATH 5365.
Prerequisite: Graduate Standing.

MATH 5366. Elementary Analysis. 3 Hours.
Students study limits, continuity, differentiation, Riemann integration, infinite series and sequences, and series of functions. NOTE: Students who have taken Math 4366 may not take MATH 5366.
Prerequisite: Graduate Standing and MATH 4365 or MATH 5365.

MATH 5370. Fourier Analysis & Application. 3 Hours.
This course is a study of applied harmonic analysis. Topics include Fourier analysis, wavelet analysis, and applications of these topics.
Prerequisite: MATH 4366 or MATH 5388 or the consent of the instructor.

MATH 5375. Partial Differential Equations. 3 Hours.
Students solve problems involving partial differential equations from the natural sciences. Topics may include derivation of the heat/diffusion and wave equations, the method of separation of variables to solve the heat, wave, and Laplace equations on finite domains, Fourier series, Sturm-Liouville eigenvalue problems, the Fourier transform method to solve equations on infinite domains, the method of characteristics, and d'Alembert's solution of the wave equation. NOTE: Students who have taken MATH 4375 may not take MATH 5375.
Prerequisite: Graduate Standing.

MATH 5377. Algebraic Structures. 3 Hours.
Students study basic structures of abstract algebra: groups, rings, and fields. Topics may include elementary number theory, equivalence relations, groups, homomorphisms, cosets, Cayley's Theorem, symmetric groups, rings, polynomial rings, quotient fields, principal ideal domains, and Euclidean domains. Note: Students who have taken Math 4377 may not take MATH 5377.
Prerequisite: Graduate Standing.

MATH 5380. Research Project In Mathematics Education. 3 Hours.
In this course, the student will develop a project based on one of the core areas (Algebra, Geometry, Analysis, or Probability and Statistics) appropriate for use in teaching. This course is a capstone for candidates pursuing the degree of MA of Mathematics.
Prerequisite: MATH 5386, MATH 5387, MATH 5388, MATH 5389.

MATH 5381. Algebra: Structures and Applications. 3 Hours.
This course includes the study of algebraic structures (such as groups, rings, integral domains, and fields) and their properties, and activities and concepts related to the algebra of real numbers that are applicable to middle school teachers. The course is designed for in-service middle school mathematics teachers.

MATH 5382. Discrete Mathematics for Teachers. 3 Hours.
This course will include a study of graph theory, combinatorics and recursion, social choice and apportionment, algorithms, and iteration, with an emphasis on real-world problem solving applications and mathematical connections to the school curriculum. This course is specifically designed for middle and high school teachers, with a mathematics specialization, obtaining a Master's Degree in Education with a minor in mathematics.
Prerequisite: Middle or secondary school mathematics certification, or equivalent.

MATH 5383. Seminar in Geometry and Measurement for Teachers. 3 Hours.
This course will include a study of congruency, similarity, transformations, coordinate geometry, and measurement. It is specifically designed for teachers with a mathematics specialization who wish to obtain the master's degree in education with a minor in mathematics.
Prerequisite: Middle school mathematics certification and MATH 3383 or equivalent.

MATH 5384. Seminar in Mathematical Systems for Teachers. 3 Hours.
This course will include a study of the development of the natural number system, the development of the integers, the development of the rational number system, and the development of the real number system. It is specifically designed for teachers with a mathematics specialization who wish to obtain the master's degree in education with a minor in mathematics.
Prerequisite: Middle school mathematics certification and MATH 3384 or equivalent.

MATH 5385. Seminar in Number Theory and Proportionality for Teachers. 3 Hours.
This course includes topics from arithmetic, algebra, geometry, number theory and other mathematical areas at a level appropriate for junior high school teachers.
Prerequisite: Consent of instructor.

MATH 5386. Concepts in Modern Algebra. 3 Hours.
This course consists of a survey of several abstract algebraic systems including groups, rings, integral domains, and fields.
Prerequisite: Certification in secondary school mathematics and MATH 3377 or equivalent.

MATH 5387. Transformational Geometry. 3 Hours.
This course is a study of topics in geometry including constructions and transformations.
Prerequisite: Certification in secondary school mathematics and MATH 3363 or equivalent.

MATH 5388. Concepts in Analysis. 3 Hours.
This course includes topics from set theory, number systems, functions, real sequences, limits, continuity, differentiation and integration.
Prerequisite: Certification in secondary school mathematics and MATH 1430 or equivalent.

MATH 5389. Concepts in Probability and Statistics. 3 Hours.
This course includes topics from probability theory, distribution functions, descriptive statistics, and inferential statistics.
Prerequisite: Certification in middle or secondary school mathematics and MATH 3379 or equivalent.

MATH 5395. Digital Image Processing. 3 Hours.
The emphasis of this course is on the analysis of digital image processing algorithms used for solving problems in areas such as image enhancement and restoration, image registration, pattern recognition, and image segmentation.
Prerequisite: MATH 3377 and programming experience.

MATH 5396. Optimization. 3 Hours.
The emphasis of this course is on modern algorithms and computational methods needed for solving optimization problems. Applications to current industrial problems will be given, and the theory of operations research will be developed.
Prerequisite: MATH 3377 and MATH 2440, or consent of instructor.

MATH 5397. Discrete Mathematics. 3 Hours.
Discrete structures are emphasized in this course, which includes a study of combinatorics, graph theory, and number theory. The applications of these structures in computers and communications will be highlighted.
Prerequisite: MATH 4377 or MATH 5386 or equivalent.

MATH 6060. Independent Study. 1-3 Hours.
Students independently pursue a specific topic in advanced mathematics under a faculty member's supervision. The problems addressed in the course will be mutually selected and approved by the student and a mathematics faculty member. A thorough development of necessary axioms, definitions and properties from any related coursework will be reviewed before students are guided to extend those elements towards the main results from the chosen topic. These results may be practical applications of prior coursework and/or theoretical foundations of an advanced topic, specific to the students' individual needs and goal. Variable Credit (1 to 3).
Prerequisite: Consent of instructor.

MATH 6099. Research and Thesis. 1-3 Hours.
Students complete and successfully defend their thesis. Variable Credit (1-3). Course Equivalents: MATH 6399 .

MATH 6332. Introduction To Topology. 3 Hours.
This course is a rigorous introduction to point set topology. Topics include continuity, connectedness, compactness, metrization theorems, separation theorems, and the Tychonoff theorem.
Prerequisite: MATH 3300 or equivalent.

MATH 6333. Foundations Of Analysis I. 3 Hours.
This course is the first half of the analysis sequence. The analysis sequence includes topics from advanced multivariate calculus, normed linear spaces, measure theory, including Lebesgue and Borel measures, measurable functions, Lebesgue integration, and spaces of integrable functions.
Prerequisite: MATH 4361 and MATH 4366, equivalent, or consent of instructor.

MATH 6334. Foundations Of Analysis II. 3 Hours.
This course is the second half of the analysis sequence. The analysis sequence includes topics from advanced multivariate calculus, normed linear spaces, measure theory, including Lebesgue and Borel measures, measurable functions, Lebesgue integration, and spaces of integrable functions.
Prerequisite: MATH 6333 or consent of instructor.

MATH 6335. Algebra I. 3 Hours.
This course is in the first half of the algebra sequence. The algebra sequence will include Group and Ring theory. Special topics include groups, group actions, the Sylow Theorems, rings, modules, fields, field extensions, and an introduction to Galois Theory.
Prerequisite: MATH 4377 or equivalent.

MATH 6336. Algebra II. 3 Hours.
This course is the second half of the algebra sequence. The algebra sequence will include Group and Ring theory. Specific topics include groups, group actions, the Sylow Theorems, rings, modules, fields, field extensions, and an introduction to Galois Theory.
Prerequisite: MATH 6335 (Algebra I) or equivalent.

MATH 6340. Algebraic Geometry. 3 Hours.
This course will provide an introduction to algebraic geometry emphasizing both classical theory and the practical aspects of computations with polynomial ideals using Groebner bases. Topics include Groebner bases, affine varieties, morphisms and rational maps, elimination theory, the Nullstellensatz, primary decomposition, projective varieties, Grassmannians, and Hilbert Functions.
Prerequisite: Math 6336.

MATH 6342. Algebraic Topology. 3 Hours.
An introduction to the concepts of homotopy and homology theories. The following topics will be included: The fundamental group, classification of surfaces, higher homotopy groups, cellular and/or simplicial homology.
Prerequisite: MATH 6332.

MATH 6352. Differential Geometry. 3 Hours.
This course examines the local and global geometric and topological properties of curves and surfaces in 3-dimensional Euclidean space. Topics will include curvature and torsion of space curves, mean and Guassian curvature of surfaces, and the Gauss-Bonnet theorem. In addition, the course will also examine smooth Riemannian manifolds, the curvature tensor, geodesics, and applications such as surfaces of constant mean curvature.

MATH 6360. Special Topics In Mathematics. 3 Hours.
Topics and courses are selected to suit the individual needs of students. Methods of independent study and research are stressed. The course may be repeated for additional credit. Prerequisite: Consent of program coordinator.

MATH 6361. Mathematical Logic. 3 Hours.
Students examine logical metatheory and meta-mathematics, which is the field at the intersection of mathematics and logic that investigates logical reasoning with mathematical methods. Topics include completeness and soundness proofs for first-order predicate logic and its extensions, the formal theory of deduction, and fundamental Gödel completeness theorem and related results. The compactness theorem is established, coordinating semantics and deduction, meaning, and consequence.
Prerequisite: MATH 3300.

MATH 6367. History of Advanced Mathematics. 3 Hours.
This course examines the history of the development of modern mathematics, from the discovery of calculus, through the industrial revolution, into the modern age of computers and digital technology. Emphasis will be placed on the applications of calculus and the abstraction of geometry, analysis, and algebra which followed.
Prerequisite: Math 4367 or departmental approval.

MATH 6368. Numerical Linear Algebra. 3 Hours.
This course is a study of vector spaces and matrices. Topics include solving linear systems, least square methods, eigenvalue and eigenvector theory, and applications of these topics.
Prerequisite: MATH 3377 or consent of instructor.

MATH 6373. Applied Analysis. 3 Hours.
This course studies properties of normed spaces and functions defined on normed spaces. Special emphasis is placed on Euclidean n-space. Topics include limits, continuity, differentiation, and integration.
Prerequisite: MATH 4366 or MATH 5388 or consent of the instructor.

MATH 6376. Foundations of Applied Mathematics. 3 Hours.
This course provides a comprehensive presentation of the standard methods of applied mathematics that are used when solving problems posed in engineering and science. Topics may include finite dimensional vector spaces, function spaces, integral equations, differential operators, calculus of variations, complex variable theory, transform and spectral theory, ordinary and partial differential equations, bifurcation theory, nonlinear waves, and asymptotic expansions, and perturbation theory.
Prerequisite: MATH 3376 and MATH 3377 or their equivalents.

MATH 6377. Abstract Algebra. 3 Hours.
Algebraic structure is emphasized in this course, which includes a study of groups, rings, fields, and their applications in coding theory and cryptography.
Prerequisite: MATH 4377 or MATH 5386 or consent of instructor.

MATH 6379. Functions Of Complex Variable. 3 Hours.
Included in this course are studies of the complex number system, analytic functions, integration theory and the calculus of residues. Additional topics of special interest to the class may be included.
Prerequisite: MATH 2440 or consent of instructor.

MATH 6380. Research Methods in Mathematics. 3 Hours.
Students work on a specific research topic under a faculty member's supervision. The specific topic will be chosen from current trends and future directions of an active field of mathematics. The course content will vary based upon the topic the student and the mentoring faculty member choose. Regular meetings with other students in the course will focus on expected elements of the research paper and presentation that are required for successful completion of the course.
Prerequisite: Consent of instructor.

MATH 6381. Connections: Algebra, Trigonometry, Combinatorics. 3 Hours.
Students examine topics that span the fields of algebra of polynomials, complex numbers, trigonometry, and combinatorics. The course goal is to develop an in-depth understanding of the connections among these branches of mathematics, and how knowledge of one branch applies in the others.

MATH 6382. Issues in Undergraduate Math Education. 3 Hours.
Students study pedagogical issues related to undergraduate mathematics education. Topics may include national and Texas perspectives on pedagogical issues with respect to undergraduate mathematics education, designing an effective mathematics course and class (in face-to-face, online, and hybrid platforms), establishing a productive mathematics learning environment, using active learning techniques, promoting higher-order thinking, and assessing to inform instruction and promote learning.

MATH 6385. Advanced Mathematical Problem Solving. 3 Hours.
Students study advanced mathematical problem-solving processes and strategies and practice their learning by solving real-world problems to prepare them for their individualized end-of-program capstone research projects. Students will explore how to design, conduct, carry out, and report on a problem-solving project in a selected content area. Topics may include advanced concepts in algebra, geometry, financial mathematics, and calculus, including functions, graphs, complex numbers, and number systems.
Prerequisite: Graduate Standing.

MATH 6386. Number Theory. 3 Hours.
Students examine elementary properties of the ring of integers. Topics include concepts, algorithms, and proofs of fundamental results of modular arithmetic, the distribution of prime numbers, unique factoring, and modern applications of these ideas.
Prerequisite: Graduate Standing.

MATH 6387. Concepts in Linear Algebra. 3 Hours.
Students learn advanced topics in Linear Algebra with an emphasis on abstract vector spaces and proof. Topics include vector spaces, linear maps, eigenvalues, eigenvectors, invariant subspaces, inner product spaces, and complex vector spaces.
Prerequisite: MATH 3377, or equivalent.

MATH 6394. Scientific Computation. 3 Hours.
Topics include solutions of equations, approximation and interpolation, numerical differentiation and integration, the fast Fourier transform, and numerical simulation. Also listed as COSC 6321.
Prerequisite: MATH 2440 and some programming experience, or consent of instructor.

MATH 6398. Research And Thesis. 3 Hours.
This course includes a study of research concepts in mathematics, identification of an appropriate thesis problem, presentation of a thesis prospectus, and the preparatory work and research leading to the completion of the thesis. Study must be supervised by a member of the graduate mathematics faculty.