Math/Computer Science Building Room 470
T: 512.245.2551 F: 512.245.3425
www.math.txstate.edu (https://www.math.txstate.edu/)

The study of mathematics is more than four thousand years old and comprises an enormous body of knowledge. Mathematics remains a very active area of research, continually giving rise to new theories and questions. The knowledge accumulated and the questions considered concern mathematics and its many applications.

Mathematics is a fundamental skill required at some minimal level of all educated people and required in-depth in many professions. The teaching objective of our department includes the development of reasoning and computational skills and the preparation of students for careers requiring a significant mathematical background.

Centers for Excellence

Mathworks, a center for innovation in mathematics and math education, designs and hosts programs for elementary, middle, and high school students, researches and develops math curriculum, and provides professional development for prospective and practicing teachers. Mathworks received the 2001 Star Award for Closing the Gaps from the Texas Higher Education Coordinating Board and the 2007 Siemens Founders Award.

Majors

The department offers a Bachelor of Science with a major in Mathematics, a Bachelor of Science with a major in Applied Mathematics, and a Bachelor of Arts with a major in Mathematics. Students majoring in Mathematics can obtain teacher certification in mathematics, grades 7-12, through a double major with a Bachelor of Science in Mathematics Education.

A student majoring in one of the programs offered by the Department of Mathematics who wishes to minor in a different program within the department must take **18 hours** of math courses in addition to, and not duplicated by, those courses are taken to satisfy the requirements of the Mathematics or Applied Mathematics Major programs. The 18 additional hours must be taken from the courses listed as electives for the desired minor.

Bachelor of Arts (B.A.)

- Major in Mathematics (http://mycatalog.txstate.edu/undergraduate/science-engineering/mathematics/mathematics-ba/)

Bachelor of Science (B.S.)

- Major in Applied Mathematics (http://mycatalog.txstate.edu/undergraduate/science-engineering/mathematics/applied-bs/)
- Major in Mathematics (http://mycatalog.txstate.edu/undergraduate/science-engineering/mathematics/mathematics-bs/)
- Major in Mathematics (Secondary Education; Teacher Certification in Mathematics, Grades Seven through Twelve, with Double Major in B.S. Education) (http://mycatalog.txstate.edu/undergraduate/science-engineering/mathematics/mathematics-teacher-certification-grades-7-12-bs/)

Minors

- Applied Mathematics (http://mycatalog.txstate.edu/undergraduate/science-engineering/mathematics/applied-minor/)

- Mathematics (http://mycatalog.txstate.edu/undergraduate/science-engineering/mathematics/mathematics-minor/)
- Second Teaching Field in Mathematics (Grades 7-12) (http://mycatalog.txstate.edu/undergraduate/science-engineering/mathematics/second-teaching-field-mathematics/)

Courses in Mathematics (MATH)

MATH 1101. Math Education Intervention.
Students benefit from innovative, research-based approaches for learning mathematics, and this course will deliver supplemental mathematical instruction as one such intervention. Students will be assessed using college readiness indicators or other information to determine individualized approaches. The course is designed for students in 1000 level mathematics courses who feel they would benefit from additional course based support. Prerequisite: Departmental Approval. Corequisite: MATH 1312 or MATH 1315 or MATH 1316 or MATH 1319.
1 Credit Hour. 0 Lecture Contact Hours. 24 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Credit/No Credit

MATH 1300. Elementary Algebra.
This course is designed to review and strengthen basic mathematical skills. Topics may include number concepts, computation, elementary algebra, geometry, and mathematical reasoning. The credit earned for this course does not count toward any degree offered at this university.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Developmental/Remedial|Dif Tui- Science & Engineering
Grade Mode: Developmental

MATH 1311. Intermediate Algebra.
This preparatory course for college algebra includes linear equations and inequalities, rational expressions, exponents and radicals, quadratics and word problems. This course is designed for students who've graduated from high school with no more than the minimum mathematics requirements or for students who've been away from mathematics for years. Prerequisites: TSI Assessment Test Score of 345 or more.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Developmental/Remedial|Dif Tui- Science & Engineering|Lab Required
Grade Mode: Developmental

MATH 1312. College Statistics and Algebra.
Algebra (as used in elementary statistics) is studied, including linear and quadratic equations, inequalities, functions and their graphs, logarithms, systems of equations, and applications of mathematics. Emphasis is made on statistical concepts, such as least squares regression, distributions confidence intervals, & hypothesis testing. This course is not intended to substitute for MATH 1315 as a prerequisite. Prerequisite: College Readiness in Mathematics according to the TSI regulations.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Mathematics Core 020|Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 1315. College Algebra.
Course topics include linear and quadratic equations, inequalities, functions, exponentials and logarithms, systems of equations using matrices, applications, and other college algebra topics as time permits. Prerequisite: College Readiness in Mathematics according to the TSI regulations.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Mathematics Core 020|Dif Tui- Science & Engineering
Grade Mode: Standard Letter
TCCN: MATH 1314

MATH 1316. Survey of Contemporary Mathematics.
This course is a study of the uses of mathematics in society today. Emphasis is on concepts rather than technical details. Prerequisite: College Readiness in Mathematics according to TSI regulations.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Mathematics Core 020|Dif Tui- Science & Engineering
Grade Mode: Standard Letter
TCCN: MATH 1332

MATH 1317. Plane Trigonometry.
This course covers right triangles, radian and degree measures, trigonometric functions and their graphs, trigonometric identities, including multiple and half-angle identities, inverse trigonometric functions, trigonometric equations, general triangles, and complex numbers. Prerequisite: [MATH 1315 with a grade of "C" or better] or [Accuplacer College Mathematics score of 86 or better] or [Compass College Algebra score of 46 or better] or [Next-Generation Advanced Algebra and Functions Test of 263 or better].
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Mathematics Core 020|Dif Tui- Science & Engineering
Grade Mode: Standard Letter
TCCN: MATH 1316

MATH 1319. Mathematics for Business and Economics I.
Topics from college algebra and finite mathematics applied to business and economics are covered, including applications of equations and inequalities, simple and compound interest, and annuities. Prerequisite: College Readiness in Mathematics according to the TSI regulations.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Mathematics Core 020|Dif Tui- Science & Engineering
Grade Mode: Standard Letter
TCCN: MATH 1324

MATH 1329. Mathematics for Business and Economics II.
This course covers topics from finite mathematics and elementary differential calculus applied to business and economics. Prerequisite: [MATH 1315 or MATH 1319 with a grade of "C" or better] or [ACT Mathematics score of 27 or better] or [SAT Math Section score of 600 or better] or [Accuplacer College Mathematics score of 86 or better] or [Compass College Algebra score of 46 or better] or [Next-Generation Advanced Algebra and Functions Test of 263 or better].
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Mathematics Core 020|Dif Tui- Science & Engineering
Grade Mode: Standard Letter
TCCN: MATH 1325

MATH 2311. Principles of Mathematics I.
This course is intended to build and reinforce a foundation in fundamental mathematics concepts and skills for teaching. It includes the conceptual development of the base ten numeration system, the structure and properties of the various number systems and operations, and number theory. All topics are explored with an emphasis on problem-solving and critical thinking. Prerequisite: MATH 1312 or MATH 1315 or MATH 1319 or MATH 2321 or MATH 2417 any with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter
TCCN: MATH 1350

MATH 2312. Informal Geometry.
As a continuation of MATH 2311, this course builds and reinforces a foundation in fundamental mathematical concepts and skills. It includes the concepts of geometry, measurement, probability, and statistics with an emphasis on geometry and measurement as well as problem-solving and critical thinking. Prerequisite: MATH 2311 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter
TCCN: MATH 1351

MATH 2321. Calculus for Life Sciences I.
This course studies exponential, logarithmic, and trigonometric functions and their applications, limits, derivatives, indefinite and definite integrals, and the Fundamental Theorem of Calculus. Applications from the life sciences receive particular emphasis. Prerequisite: [MATH 1315 or MATH 1319 or MATH 1329 or MATH 2417 with a grade of "C" or better] or [ACT Mathematics score of 24 or better] or [SAT Math Section score of 550 or better] or [Accuplacer College Mathematics score of 86 or better] or [Compass College Algebra score of 46 or better] or [Next-Generation Advanced Algebra and Functions Test of 263 or better].
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Mathematics Core 020|Dif Tui- Science & Engineering
Grade Mode: Standard Letter
TCCN: MATH 2313

MATH 2328. Elementary Statistics.
This course is an algebra-based introduction to descriptive statistics, the interpretation of data, random sampling, design of experiments, probability, and the Central Limit Theorem. Inferential statistics topics include the foundational concepts for confidence intervals and hypothesis testing for simple experiments. Prerequisite: [MATH 1312 or MATH 1315 or MATH 1319 with a grade of "C" or better] or [MATH 1329 or 2321 or MATH 2417 or MATH 2471 with a grade of "D" or better] or [ACT Mathematics score of 24 or better] or [SAT Math Section score of 550 or better] or [Next-Generation Advanced Algebra and Functions Test of 263 or better].
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter
TCCN: MATH 1342

MATH 2331. Calculus for Life Science II.
This course is an extension of MATH 2321 and includes techniques and applications of integration, differential equations, probability, and discrete and continuous distributions. Prerequisite: MATH 2321 with a grade of "C" or better or MATH 2471 with a grade of "D" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 2358. Discrete Mathematics I.
This course is a study of discrete mathematical structures commonly encountered in computing hardware and software are studied. Topics include logic, functions, elementary set theory, proof techniques, mathematical induction, numeric sequences, elementary number theory, and graph theory. Prerequisite: [MATH 1315 or MATH 1329 with a grade of "C" or better] or [MATH 2417 or MATH 2471 with a grade of "D" of better].
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter
TCCN: MATH 2305

MATH 2393. Calculus III.
The course topics include vectors and the geometry of space, functions of several variables, vector-valued functions, partial derivatives, extreme values, multiple integrals, vector fields, line and surface integrals, Green's Theorem, Stokes' Theorem, the Divergence Theorem, and applications of the preceding in the sciences. Prerequisite: MATH 2472 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter
TCCN: MATH 2315

MATH 2417. Pre-Calculus Mathematics.
This course is a survey of functions, trigonometry, analytic geometry, sequences, and series. Students' algebraic skills are reinforced throughout the course. Prerequisites: [MATH 1315 or MATH 1319 with a grade of C or better] or [ACT Mathematics score of 25 or better] or [SAT Math Section score of 550 or better] or [Accuplacer College Mathematics score of 86 or better] or [Compass College Algebra score of 46 or better] or [Next-Generation Advanced Algebra and Functions Test of 263 or better].
4 Credit Hours. 2 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Mathematics Core 020|Dif Tui- Science & Engineering|Lab Required
Grade Mode: Standard Letter
TCCN: MATH 2412

MATH 2471. Calculus I.
This first course in differential and integral calculus covers limits and continuity, functions and graphing, derivatives, integrals, and applications of calculus to science, engineering, and other technical fields. Prerequisites: [MATH 2417 with a grade of C or better] or [ACT Mathematics score of 27 or better] or [SAT Math Section score of 600 or better] or [Accuplacer College Mathematics score of 103 or better] or [Compass Trigonometry score of 46 or better] or [Next-Generation Advanced Algebra and Functions Test score of 276 or better].
4 Credit Hours. 2 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Mathematics Core 020|Dif Tui- Science & Engineering|Lab Required
Grade Mode: Standard Letter
TCCN: MATH 2413

MATH 2472. Calculus II.
This course continues the study of differential and integral calculus from MATH 2471. The topics include techniques of integration, improper integrals, parametric equations and polar coordinates, applications of calculus, sequences and series, and an introduction to partial derivatives. (MULP) Prerequisite: MATH 2471 with a grade of "C" or better.
4 Credit Hours. 2 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Component Area Core 090|Mathematics CAO 092|Dif Tui- Science & Engineering|Lab Required
Grade Mode: Standard Letter
TCCN: MATH 2414

MATH 2473. Integral Calculus with Multivariables and Series.
This course is a continuation of differential and integral calculus. Select topics from Calculus II and Calculus III are covered including methods of integration, sequences and series, and introduction to partial derivatives. Prerequisite: MATH 2471 with a grade of "C" or better.
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Component Area Core 090|Mathematics CAO 092|Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 3305. Introduction to Probability and Statistics.
This is a calculus-based probability and statistics course. Topics include probability, conditional probability, discrete and continuous random variables, univariate and multivariate distributions of random variables, mathematical expectations, and moment-generating functions. Prerequisite: MATH 2472 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 3306. Introduction to Statistical Methods.
This is a calculus-based probability and statistics course. Topics include probability, conditional probability, discrete and continuous random variables, univariate and multivariate distributions of random variables, mathematical expectations, and moment-generating functions. Prerequisite: MATH 2472 with a grade of "C" or better; 2.75 overall GPA.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 3315. Foundations of Geometry.
In this course students seeking teacher certification will study Euclidean Geometry and will be introduced to non-Euclidean Geometries. Dynamic geometry software and historical aspects of geometry will be integrated into the course. This course may not be applied to a minor in mathematics. Prerequisite: MATH 2321 or MATH 2471 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 3323. Differential Equations.
In this course various methods of solving common types of ordinary differential equations are studied. Students learn the conditions under which solutions to first-order and second-order ordinary differential equations exist and are unique. Applications to science, engineering, and technology receive emphasis throughout the course. Prerequisite: MATH 2472 or MATH 2473 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 3325. Number Systems.
In this course, students construct the natural numbers algebraically, establishing the basic vocabulary and proof techniques of abstract algebra and the structural properties of the natural, integral, rational, real, and complex number systems. Corequisite: MATH 2471 with a grade of "D" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 3330. Introduction to Advanced Mathematics.
This course introduces fundamental methods of proof and the core language of modern mathematics. Topics include the theory of sets, logic, relations, functions, the cardinality of sets, and related subjects. Prerequisite: MATH 2471 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 3348. Deterministic Operations Research.
This course provides a broad overview of deterministic operations research techniques. Linear programming, including the simplex method, duality, and sensitivity analysis, will be covered. Further selected topics are integer programming, dynamic programming, scheduling models, game theory, and associated topics. Prerequisite: MATH 2472 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 3376. Applied Linear Algebra.
This course covers linear algebra and matrix theory while considering their computational aspects. Topics include a variety of methods for solving systems and related properties. Emphasis is placed on topics useful in civil engineering, applied mathematics, and other disciplines, serving as a preparatory course for the finite element method. Prerequisite: MATH 2472 or MATH 2473 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 3377. Linear Algebra.
An introductory course in linear algebra covering systems of linear equations, vector spaces, linear transformations, matrices, and additional topics as time permits. Mathematical proofs are an essential part of this course. Prerequisite: MATH 2472 with a grade of "C" or higher.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 3380. Analysis I.
This is a course covering the introduction to the theory of real functions. Topics include limits, continuity, derivatives, and associated topics. Prerequisite: MATH 3330 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 3383. Numerical Analysis I.
This course focuses on basic numerical methods in mathematics to solve functional problems in fields such as engineering and applied sciences. This course covers instructions in computer arithmetic, solutions of equations, interpolation, numerical differentiation/integration, and applications to scientific and industrial applications. Prerequisite: MATH 2472 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 3398. Discrete Mathematics II.
This course continues the studies in Discrete Math I, topics include combinatorics, countability and counting arguments, discrete probability, relations, recursion and recurrence, generating functions, algorithms, and growth of functions. Prerequisite: MATH 2358 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 4302. Principles of Mathematics II.
Algebraic reasoning and probability with selected topics from quantitative reasoning, measurement, statistics, and geometry are integrated with middle school pedagogical practices such as inquiry-based learning and the use of technology. Appropriate correlated lessons, writing components, and culturally responsive teaching are incorporated. (WI) Prerequisite: MATH 2312 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering|Writing Intensive
Grade Mode: Standard Letter

MATH 4303. Capstone Mathematics for Middle School Teachers.
A rigorous, integrated, analytical perspective of mathematical topics; quantitative reasoning, geometry and measurement, probability and statistics, number theory, and algebraic reasoning. This course may not be applied to a mathematics minor. Must be taken before student teaching. Prerequisite: [MATH 2331 or MATH 2472] and MATH 3315 with grades of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 4304. Capstone Mathematics for Secondary Teachers (of Mathematics).
Basic concepts underlying algebra, geometry, trigonometry, and calculus are taught from an advanced standpoint, including historical, philosophical, and cultural significance. This course may not be applied to a minor in mathematics. Must be taken before student teaching. Prerequisite: MATH 3315 and [MATH 2331 or MATH 2472] with grades of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 4305. Advanced Probability and Statistics.
This mathematical statistics course focuses on statistical inferences and data analysis. Topics include functions of random variables and their distributions, the Central Limit Theorem, point estimators and their properties, concepts and applications of interval estimation of population parameters, and the theory and applications of statistical tests of hypotheses. Prerequisite: MATH 3305 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 4306. Fourier Series and Boundary Value Problems.
Advanced solution methods for ordinary differential equations and partial differential equations are studied, focusing on series approximations and Fourier series solutions. Applications of boundary value problems typical of scientific applications are studied. Prerequisite: MATH 3323 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 4307. Modern Algebra.
This course covers structures, structure-preserving functions, and other fundamental concepts of modern algebra, emphasizing group theory. Prerequisite: MATH 3330 and [MATH 3325 or MATH 3377] both with grades of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 4311. Introduction to the History of Mathematics.
This course is a survey of the development of major mathematical topics, including geometry, algebra, calculus, and advanced mathematics. Philosophical and cultural aspects will be integrated with the structure, theorems, and applications of mathematics. (WI) Prerequisite: MATH 3315 and [MATH 2331 or MATH 2472] both with grades of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering|Writing Intensive
Grade Mode: Standard Letter

MATH 4315. Analysis II.
A continuation of MATH 3380, this course's topics include differentiation, integration, series, and sequences of functions, and associated topics. Prerequisite: MATH 3380 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 4327. Introduction to Complex Analysis and Its Applications.
This course introduces topics in the theory of functions of a complex variable (contour integrals, series, residues of analytic functions, and conformal mappings) with engineering and science applications. These include solving boundary value problems, locating zeros of analytic functions, analyzing two-dimensional heat and fluid flows, and calculating inverse Laplace transforms. Prerequisite: MATH 2393 and MATH 3323 both with grades of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 4330. General Topology.
In this course, students study the concepts of convergence, continuity, compactness, connectedness, and fixed points in topological spaces, particularly in metric spaces. Prerequisite: MATH 3330 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 4336. Studies in Applied Mathematics.
This course covers selected topics including Laplace transforms, complex variables, advanced calculus for applications, calculus of variations, integral and differential equations, vector analysis, and other topics from applied mathematics. It may be repeated once for credit with a different topic. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 4337A. Topological Data Analysis.
This research-based course introduces students to computational topology and topological data analysis. In addition to studying existing data studies from the recent scientific literature, students will also analyze a data set they have personally chosen. Students will present their progress and results both orally and in writing. Prerequisite: MATH 3377.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics|Writing Intensive
Grade Mode: Standard Letter

MATH 4337B. Research in Discrete Mathematics.
This course is an introduction to creative mathematical activities. It provides an opportunity to perform research in discrete mathematics, as well as to learn how to present mathematical results both orally and in writing. These skills are essential for those students continuing into graduate studies. Prerequisite: Texas State GPA 3.25; MATH 2358. Corequisite: MATH 3398.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics|Writing Intensive
Grade Mode: Standard Letter

MATH 4337C. Numerical Methods for Ordinary Differential Equations.
This research-based course has students investigate known methods of numerically solving ordinary differential equations (Runge-Kutte, Adams, Predictor-Corrector, etc.). Students will research the effect of variations on these methods by implementing their algorithm modifications in mathematical software and reporting on their results. Prerequisite: MATH 2472 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics|Writing Intensive
Grade Mode: Standard Letter

MATH 4337D. Topics in Topology and Algebra.
This course introduces students to modern research methods in topology and algebra. Specific topics will vary based on student interest and input, but the basic concepts and methods of algebraic topology (homology and cohomology groups, homotopy groups), homotopy theory, and simplicial methods form the backbone of this course. Prerequisite: MATH 3330 with a grade of "C" or better and a minimum 2.0 Texas State GPA.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics
Grade Mode: Standard Letter

MATH 4337H. Undergraduate Research in Topology and Artificial Neural Networks.
The course will introduce the mathematics behind Artificial Neural Networks (ANN) with an eye towards applying topology to study ANN's. Topics include general machine learning concepts, feedforward neural networks, the gradient descent algorithm, the universal approximation theorem, convolutional neural networks, topology, and VC dimension. Students will customize a basic artificial neural network written in Python through hands-on projects. Prerequisite: MATH 2471 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

MATH 4350. Introduction to Combinatorics.
This course presents fundamental combinatorial concepts, including standard techniques and methods of proof specific to the field. Topics include advanced counting, generating functions, linear and nonlinear recurrence relations, combinatorial designs. Applications of the topics will be explored as time permits. Prerequisite: MATH 2472 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 4383. Numerical Analysis II.
This course focuses on various mathematical and computational methods in modeling, analyzing, and simulating scientific and engineering problems. Topics include approximation, optimization, differential equations, scientific computation, and scientific and industrial applications. Prerequisite: MATH 3383 and MATH 3323 both with a grades of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 4393. Introduction to Finite Element Methods.
This course introduces weak formulations of the partial differential equations and the finite element approximation of this weak form. Theory and computations are balanced. Topics include finite element methods for approximating solutions of partial differential equations and related properties. Emphasis topics are in civil engineering, applied mathematics, and related disciplines. Prerequisite: [MATH 3376 or MATH 3377] and MATH 3383 both with grades of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter