MASTER OF SCIENCE (M.S.) MAJOR IN MATHEMATICS (APPLIED MATHEMATICS CONCENTRATION THESIS OPTION)

Program Overview

Texas State offers opportunities to work with outstanding faculty in a collegial atmosphere where mathematicians and mathematics educators collaborate closely. The multi-faceted program offers a strong foundation and research opportunities in mathematics, applied math, and mathematics education, preparing students for further graduate study, teaching, or industry positions. The M.S. in mathematics prepares students with the applied mathematical knowledge and critical thinking abilities needed to pursue doctoral degrees, teaching careers or leadership positions in industry.

Application Requirements

Application requirements consist of institutional and program requirements for applicable semesters of entry during the current academic year. Additional information and changes to admission requirements for semesters other than the current academic year can be found on The Graduate College's website (http://www.gradcollege.txstate.edu/).

Unless otherwise noted on The Graduate College program page, AI tools can only be used to correct spelling and grammar errors in application materials.

Institutional Requirements

Institutional requirements are the minimum standards for admission to any graduate program at Texas State. These include:

- Completed online application
- Nonrefundable application fee
  - Degree Programs (Doctoral and Master's)
    - $55 fee, or
    - $90 for applications with international credentials
  - Post-Baccalaureate Programs (Certificate, Certification, Non-Degree, and Visiting)
    - $20 fee, or
    - $60 for applications with international credentials
- Official transcripts from each institution where course credit was granted. Final transcripts showing degree completion are required before the student may register for their second term of enrollment.
- GPA requirements (a higher GPA may be listed in the Program Requirements)
  - Doctoral programs require a 3.00 overall GPA or a 3.00 GPA in your last 60 hours (https://www.gradcollege.txst.edu/admissions/policy.html#gpa) of undergraduate course work (plus any completed graduate courses).
  - Master's and Specialist programs require a 2.75 overall GPA or a 2.75 GPA in your last 60 hours (https://www.gradcollege.txst.edu/admissions/policy.html#gpa) of undergraduate course work (plus any completed graduate courses).
  - Post-Baccalaureate programs require a 2.50 overall GPA or a 2.50 GPA in your last 60 hours (https://www.gradcollege.txst.edu/admissions/policy.html#gpa) of undergraduate course work (plus any completed graduate courses).
- Baccalaureate degree from a regionally accredited university. (Non-U.S. degrees must be equivalent to a four-year U.S. Bachelor's degree. In most cases, three-year degrees are not considered. Visit our International FAQs (https://www.gradcollege.txst.edu/international/faqs.html) for more information.)

Approved English Proficiency Exam Scores

Applicants are required to submit an approved English proficiency exam score that meets the minimum requirements below unless they have earned a bachelor's degree or higher from a regionally accredited U.S. institution or the equivalent from a country on our exempt countries list (http://www.gradcollege.txstate.edu/international/language.html#waiver). Some programs may restrict acceptable tests or require higher scores than the institutional scores; this will be noted in the Program Requirements.

- official TOEFL iBT scores required with a 78 overall if taken on or before January 21, 2026
- official TOEFL iBT scores required with a 4 overall if taken after January 21, 2026
- official PTE scores required with a 52 overall
- official IELTS (academic) scores required with a 6.5 overall and minimum individual module scores of 6.0
- official Duolingo scores required with a 110 overall
- official TOEFL Essentials scores required with an 8.5 overall
- official Texas State Intensive English Program score of 90% or higher in the highest-level course (level 5)

The institution does **not** offer admission if the scores above are not met.

- completed online application
- $55 nonrefundable application fee

  or

- $90 nonrefundable application fee for applications with international credentials
- baccalaureate degree in mathematics or a related field from a regionally accredited university (Non-U.S. degrees must be equivalent to a four-year U.S. Bachelor's degree. In most cases, three-year degrees are not considered. Visit our International FAQs (https://www.gradcollege.txst.edu/international/faqs.html) for more information.)
- official transcripts from **each institution** where course credit was granted
- a 2.75 overall GPA or a 2.75 GPA in the last 60 hours of undergraduate course work (plus any completed graduate courses)
- GRE not required
- resume/CV
- statement of purpose

- three letters of recommendation addressing the substance and quality of the student's preparation for graduate study

Approved English Proficiency Exam Scores

Applicants are required to submit an approved English proficiency exam score that meets the minimum program requirements below unless they have earned a bachelor's degree or higher from a regionally accredited U.S. institution or the equivalent from a country on our exempt countries list (http://www.gradcollege.txstate.edu/international/language.html#waiver).

- official TOEFL iBT scores required with a 78 overall
- official PTE scores required with a 52
- official IELTS (academic) scores required with a 6.5 overall and minimum individual module scores of 6.0
- official Duolingo Scores required with a 110 overall
- official TOEFL Essentials scores required with an 8.5 overall

This program does **not** offer admission if the scores above are not met.

Degree Requirements

The Master of Science (M.S.) degree with a major in Mathematics concentration in applied mathematics requires 30 semester credit hours, including a thesis. Students who do not have the appropriate background course work may be required to complete leveling courses.

Course Requirements

Code	Title	Hours
Required Courses		
MATH 5301	Partial Differential Equations	3
MATH 5312	Functions of a Complex Variable	3
MATH 5319	The Theory of Integration	3
MATH 5340	Scientific Computation	3
MATH 5360	Mathematical Modeling	3
MATH 5373	Theory of Functions of Real Variables	3
MATH 5374	Numerical Linear Algebra	3
MATH 5393	Numerical Optimization	3
Thesis		
MATH 5399A	Thesis	3
Choose a minimum of 3 hours from the following:		3
MATH 5199B	Thesis	
MATH 5299B	Thesis B	
MATH 5399B	Thesis	
MATH 5599B	Thesis	
MATH 5999B	Thesis	
Total Hours		**30**

Comprehensive Examination Requirement

All candidates for graduate degrees must pass a comprehensive examination consisting of three parts. A student may fail up to two times on one or more of the three parts of the comprehensive exam. After failing any given part of the comprehensive exam twice, a student will then be advised to retake the course(s). Provided they earn at least a C in each retaken class, they will then be permitted one final attempt at passing the corresponding part(s) of the comprehensive exam.

Students who do not successfully complete the requirements for the degree within the timelines specified will be dismissed from the program.

If a student elects to follow the thesis option for the degree, a committee to direct the written thesis will be established. The thesis must demonstrate the student's capability for research and independent thought. Preparation of the thesis must be in conformity with the *Graduate College Guide to Preparing and Submitting a Thesis or Dissertation*.

Thesis Proposal (http://www.gradcollege.txstate.edu/docs/Thesis_Diss_Guide.pdf)

The student must submit an official Thesis Proposal Form (http://www.gradcollege.txstate.edu/forms.html) and proposal to his or her thesis committee. Thesis proposals vary by department and discipline. Please see your department for proposal guidelines and requirements. After signing the form and obtaining committee members' signatures, the graduate advisor's signature if required by the program and the department chair's signature, the student must submit the Thesis Proposal Form with one copy of the proposal attached to the dean of The Graduate College for approval before proceeding with research on the thesis. If the thesis research involves human subjects, the student must obtain exemption or approval from the Texas State Institutional Review Board prior to submitting the proposal form to The Graduate College. The IRB approval letter should be included with the proposal form. If the thesis research involves vertebrate animals, the proposal form must include the Texas State IACUC approval code. It is recommended that the thesis proposal form be submitted to the dean of The Graduate College by the end of the student's enrollment in 5399A. Failure to submit the thesis proposal in a timely fashion may result in delayed graduation.

Thesis Committee

The thesis committee must be composed of a minimum of three approved graduate faculty members.

Thesis Enrollment and Credit

The completion of a minimum of six hours of thesis enrollment is required. For a student's initial thesis course enrollment, the student will need to register for thesis course number 5399A. After that, the student will enroll in thesis B courses, in each subsequent semester until the thesis is defended with the department and approved by The Graduate College. Preliminary discussions regarding the selection of a topic and assignment to a research supervisor will not require enrollment for the thesis course.

Students must be enrolled in thesis credits if they are receiving supervision and/or are using university resources related to their thesis work. The number of thesis credit hours students enroll in must reflect the amount of work being done on the thesis that semester. It is the responsibility of the committee chair to ensure that students are making adequate progress toward their degree throughout the thesis process. Failure to register for the thesis course during a term in which supervision is received may result in postponement of graduation. After initial enrollment in 5399A, the student will continue to enroll in a thesis B course as long as it takes to complete the thesis. Thesis projects are by definition original and individualized projects. As such, depending on the topic, methodology, and other factors, some projects may take longer than others to complete. If the thesis requires work beyond the minimum number of thesis credits needed for the degree, the student may enroll in

additional thesis credits at the committee chair's discretion. In the rare case when a student has not previously enrolled in thesis and plans to work on and complete the thesis in one term, the student will enroll in both 5399A and 5399B.

The only grades assigned for thesis courses are PR (progress), CR (credit), W (withdrew), and F (failing). If acceptable progress is not being made in a thesis course, the instructor may issue a grade of F. If the student is making acceptable progress, a grade of PR is assigned until the thesis is completed. The minimum number of hours of thesis credit ("CR") will be awarded only after the thesis has been both approved by The Graduate College and released to Alkek Library.

A student who has selected the thesis option must be registered for the thesis course during the term or Summer I (during the summer, the thesis course runs ten weeks for both sessions) in which the degree will be conferred.

Thesis Deadlines and Approval Process

Thesis deadlines are posted on The Graduate College (http://www.gradcollege.txstate.edu/) website under "Current Students." The completed thesis must be submitted to the chair of the thesis committee on or before the deadlines listed on The Graduate College website.

The following must be submitted to The Graduate College by the thesis deadline listed on The Graduate College website:

1. The Thesis Submission Approval Form bearing original (wet) and/or electronic signatures of the student and all committee members.
2. One (1) PDF of the thesis in final form, approved by all committee members, uploaded in the online Vireo submission system.

After the dean of The Graduate College approves the thesis, Alkek Library will harvest the document from the Vireo submission system for publishing in the Digital Collections database (according to the student's embargo selection). **NOTE: MFA Creative Writing theses will have a permanent embargo and will never be published to Digital Collections.**

While original (wet) signatures are preferred, there may be situations as determined by the chair of the committee in which obtaining original signatures is inefficient or has the potential to delay the student's progress. In those situations, the following methods of signing are acceptable:

- signing and faxing the form
- signing, scanning, and emailing the form
- notifying the department in an email from their university's or institution's email account that the committee chair can sign the form on their behalf
- electronically signing the form using the university's licensed signature platform.

If this process results in more than one document with signatures, all documents need to be submitted to The Graduate College together.

No copies are required to be submitted to Alkek Library. However, the library will bind copies submitted that the student wants bound for personal use. Personal copies are not required to be printed on archival quality paper. The student will take the personal copies to Alkek Library and pay the binding fee for personal copies.

Master's level courses in Mathematics: MATH (http://mycatalog.txstate.edu/graduate/science-engineering/mathematics/mathematics-appliedmath-thesis-ms/#MATH)

Courses Offered

Mathematics (MATH)

MATH 5111. Graduate Assistant Training.
This course is concerned with techniques used in the teaching of mathematics and prepares graduate teaching and instructional assistants for responsibilities in collegiate mathematics instruction. Topics include classroom management, communication with students, grading practices, academic integrity, equitable and professional teaching practices, and strategies for supporting student learning in undergraduate mathematics courses. Emphasis is placed on effective instructional preparation, professional expectations, and reflective development as a teaching assistant. This course is required as a condition of employment for graduate teaching and instructional assistants, does not earn graduate degree credit, and may be repeated with different emphasis.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Graduate Assistantship|Exclude from Graduate GPA
Grade Mode: Leveling/Assistantships

MATH 5199B. Thesis.
This course provides students with the opportunity to conduct an independent, original research project under the supervision of a faculty advisor. Students formulate a research question, engage with relevant scholarly literature, and apply appropriate methods to investigate a focused topic within mathematics, mathematics education, or a closely related field. Emphasis is placed on rigorous reasoning, clear exposition, and adherence to disciplinary standards for scholarship. The course culminates in the completion of a written thesis that demonstrates the student's ability to conduct sustained inquiry and communicate results effectively.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

MATH 5290. Teaching Geometry through Problem Solving and Discovery Learning.
This course investigates the problem-solving heuristics embedded in the secondary school geometry curriculum and explores how to implement problem solving in geometry classrooms. This course also examines the unique "Hungarian style" method of discovery learning in mathematics, developed for students aged 12-18. The method referred to as the Pósa Method is similar to inquiry based learning with an emphasis on problem solving.
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 5299B. Thesis B.
This course provides students with the opportunity to conduct an independent, original research project under the supervision of a faculty advisor. Students formulate a research question, engage with relevant scholarly literature, and apply appropriate methods to investigate a focused topic within mathematics, mathematics education, or a closely related field. Emphasis is placed on rigorous reasoning, clear exposition, and adherence to disciplinary standards for scholarship. The course culminates in the completion of a written thesis that demonstrates the student's ability to conduct sustained inquiry and communicate results effectively.
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

MATH 5301. Partial Differential Equations.
This course covers topics that include the derivation and classification of partial differential equations, vector and tensor methods, and first#order equations. The course studies wave equations, vibrations, and normal modes, with emphasis on Fourier series and Fourier integrals. Classical solution techniques such as Cauchy's method, characteristics, Green's functions, potential theory, and boundary#value problems are developed in detail. Additional methods, including Riemann–Volterra techniques, are introduced to analyze initial# and boundary#value problems. Analytical reasoning and mathematical rigor are emphasized throughout. Prerequisite: MATH 3323 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MATH 5303. History of Mathematics.
This course studies the development of mathematics and the accomplishments of mathematicians who contributed to its progress across cultures and historical periods. Topics include the emergence of major mathematical ideas, the historical development of algebra, geometry, calculus, and other significant areas, original and secondary historical sources, and the cultural and philosophical settings in which mathematics evolved. Emphasis is placed on historical interpretation, mathematical communication, understanding mathematics as an evolving human endeavor, and connections between earlier developments, contemporary mathematical thought, and the teaching and learning of mathematics. Cannot be used on a degree plan for M.S. degree.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MATH 5307. Modern Algebra.
This course provides a graduate level introduction to the fundamental structures of modern algebra. Students study groups, rings, fields, and related algebraic systems as needed with an emphasis on axiomatic development, structural properties, and proof techniques. Topics may include homomorphisms, quotient structures, polynomial rings, field extensions, and classical theorems central to algebraic reasoning. The course highlights methods for analyzing abstract structures, constructing examples, and formulating rigorous arguments. This course supports the development of advanced mathematical maturity and prepares students for further study in algebra and related disciplines. Material will be adapted to the needs of the class. Prerequisite: MATH 5384 with a grade of "B" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MATH 5311. Foundations of Differential Equations.
This course provides a foundational study of differential equations, operator spaces, and related core mathematical topics. Students examine classical and modern approaches to these structures while exploring how recent developments contribute to contemporary mathematical analysis. Emphasis is placed on understanding theoretical frameworks, evaluating methods using clear mathematical reasoning, and investigating the logical relationships among differential operators and function spaces. Students are supported in conducting independent, evidence based inquiry that allows them to form their own interpretations grounded in mathematical argumentation. Prerequisite: MATH 5382 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MATH 5312. Functions of a Complex Variable.
This course studies modern developments in the theory of functions of a complex variable. Topics may include analytic functions, contour integration, the Cauchy integral theorem and formula, Laurent series, residues, conformal mappings, and related core results of complex function theory. Additional topics may include Riemann surfaces, differential forms, and the Riemann-Roch theorem, with attention to how local complex-analytic methods connect to global structures in topology, geometry, and algebra. Emphasis is placed on rigorous reasoning, conceptual understanding, and the role of complex analysis in advanced mathematical theory. Prerequisite: MATH 5382 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MATH 5313. Field Theory.
This course studies field theory with emphasis on separable extensions and Galois theory. Topics include field extensions, polynomial rings, splitting fields, algebraic and transcendental extensions, automorphism groups, and the structure of Galois correspondences. Related algebraic concepts such as rings, ideals, modules, and quotient structures may be developed as needed to support the theory. Emphasis is placed on rigorous proof, structural analysis, and the use of field-theoretic methods in advanced algebra and related areas. Prerequisite: MATH 5384 with a grade of "B" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MATH 5314. Number Theory.
This course examines selected topics in number theory at the graduate level. Content may include elementary number theory, quadratic forms, and introductory concepts from algebraic or analytic number theory, with emphasis on fundamental structures, methods, and proofs. Topics are chosen to provide flexibility while maintaining mathematical rigor and coherence. The course develops techniques for analyzing integers and related algebraic objects, with attention to problem#solving strategies and theoretical reasoning. Specific topics may vary depending on instructor expertise and student background, but the course is designed to strengthen students' understanding of core ideas in number theory and prepare them for further study or research in mathematics. Prerequisite: MATH 5384 with a grade of "B" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MATH 5317. Problems in Advanced Mathematics.
This course is open to graduate students on an individual basis by arrangement with the mathematics department. Students investigate topics appropriate to their level of mathematical preparation, applying advanced reasoning and analytical skills to selected problem sets or focused areas of study. The specific emphasis varies and may include theoretical exploration, problem solving techniques, or preparatory work for future coursework. The course supports mathematical development while maintaining flexibility in content, method, and depth. A substantial degree of mathematical maturity is expected, and the course may be repeated with different emphases. This course does not apply toward graduate degree credit.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from Graduate GPA|Leveling
Grade Mode: Leveling/Assistantships

MATH 5319. The Theory of Integration.
This course covers the theory of integration with special emphasis on Lebesgue integrals. Topics include the Lebesgue integral for bounded, finitely supported, and measurable functions, convergence theorems, differentiability of monotone functions, absolute continuity, Lp spaces, and Lp completeness. Additional attention may be given to convergence theorems, and the role of integration theory in modern analysis. Emphasis is placed on rigorous proof, abstract reasoning, and the analytical foundations needed for advanced work in real analysis, probability, and related mathematical fields.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MATH 5329. General Topology.
This course studies topological spaces and their properties at the graduate level. Topics include topological spaces and continuous functions, connectedness, compactness, separation axioms, product and quotient constructions, metrization, and CW complexes, together with selected related topics as time permits. Emphasis is placed on rigorous proof, careful use of definitions, construction of examples and counterexamples, and the role of topology in advanced study of analysis, geometry, and algebra.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MATH 5331. Metric Spaces.
This course provides an introduction to point set topology with a central focus on the structure and properties of metric spaces. Students study topics such as open and closed sets, convergence, continuity, compactness, completeness, and connectedness within the context of metric spaces. The course also includes a brief introduction to general topological spaces to illustrate how metric spaces fit into broader topological frameworks. Emphasis is placed on rigorous definitions, logical reasoning, and the development of proof based skills that support advanced mathematical study.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MATH 5336. Studies in Applied Mathematics.
This course examines selected topics in applied mathematics at the graduate level. Possible areas of study include optimization and control theory, numerical analysis, calculus of variations, boundary value problems, special functions, tensor analysis, and other subfields of applied mathematics. Topics are chosen to reflect current mathematical methods and applications, with emphasis on analytical techniques, modeling, and problem#solving. The specific content may vary depending on instructor expertise and student preparation. This course may be repeated for credit when the topic emphasis differs, allowing students to engage with multiple areas of applied mathematics in depth. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Standard Letter

MATH 5338. Advanced Independent Study in Mathematics or Statistics.
This course provides graduate students with an opportunity to pursue advanced independent study in mathematics or statistics under the supervision of a faculty member. Students investigate specialized topics aligned with faculty research interests through theoretical analysis, empirical investigation, or critical review and synthesis of existing scholarly literature. Emphasis is placed on independent inquiry, depth of understanding, and adherence to disciplinary standards of rigor and clarity. The specific subject matter and methods of study are determined collaboratively by the student and supervising faculty member. This course may be repeated once for credit when the topic emphasis differs. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Standard Letter

MATH 5340. Scientific Computation.
This course studies computational methods used in science and mathematics through the analysis and implementation of algorithms in a computer algebra or scientific computing environment. Topics include symbolic, numerical, and graphical techniques for solving mathematical problems, algorithmic approaches to scientific computation, and applications drawn from mathematics, science, and engineering. Emphasis is placed on the mathematical structure of computational methods, the interpretation of computed results, and the effective use of computation as a tool for advanced problem solving.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

MATH 5350. Combinatorics.
This course studies graduate-level combinatorics with emphasis on enumeration, structure, and proof. Topics may include permutations, combinations, Stirling numbers, chromatic numbers, Ramsey numbers, generating functions, Pólya theory, Latin squares, random block design, and related combinatorial structures. Additional topics may include recurrence relations, special sequences, discrete probability, extremal set theory, and graph-theoretic methods as they support the development of combinatorial reasoning. Emphasis is placed on rigorous proof, effective mathematical communication, and the use of combinatorial techniques in discrete mathematics and related areas. Prerequisite: Instructor Approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MATH 5355. Applied and Algorithmic Graph Theory.
This course studies graph theory with emphasis on the close relationship between theoretical and algorithmic aspects of the subject. Topics may include connectivity, trees, planarity, graph coloring, matchings, and network models, together with algorithms such as max-flow min-cut, maximum matching, shortest-path methods, and optimization algorithms for facility location problems in networks. Emphasis is placed on rigorous reasoning, algorithmic analysis, and the application of graph-theoretic methods to discrete structures, optimization, and network-based problems in mathematics and related fields. Prerequisite: MATH 5388 with a grade of 'C' or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MATH 5360. Mathematical Modeling.
This course introduces the principles and techniques of mathematical modeling with applications drawn primarily from the natural sciences. Students examine the process of translating real#world phenomena into mathematical representations and analyzing those models using appropriate analytical and computational tools. Emphasis is placed on deterministic systems, stochastic models, and diffusion processes. The course explores model formulation, assumptions, solution methods, and interpretation of results, with attention to the strengths and limitations of different modeling approaches. Through selected examples, students develop skills in constructing, analyzing, and evaluating mathematical models as tools for understanding complex systems. Prerequisite: MATH 5301 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MATH 5373. Theory of Functions of Real Variables.
This course covers measure theory with special emphasis on the Lebesgue measure. Topics include the outer measure, sigma-algebra of measurable sets, properties of measurable sets, Borell-Canteli lemma, non-measurable sets, Cantor-Lebesgue function, Lebesgue measurable functions, pointwise limits, simple approximations, and Littlewood's three principles. Additional attention may be given to convergence theorems, and the role of approximation theory in modern analysis. Emphasis is placed on rigorous proof, abstract reasoning, and the analytical foundations needed for advanced work in real analysis, probability, and related mathematical fields. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MATH 5374. Numerical Linear Algebra.
This course introduces tools that mathematical scientists use with vectors and matrices. Topics include direct and iterative methods for solving linear systems, least-squares problems, eigenvalue problems, algorithmic stability under perturbations, and numerical methods for large, sparse systems. Additional topics may include Gaussian elimination, Jacobi and Gauss–Seidel methods, conjugate gradient methods, GMRES, Fast Fourier Transform techniques, and multigrid methods, with attention to both theoretical analysis and computational implementation. Emphasis is placed on balancing rigorous mathematical reasoning with practical numerical computation in applications from science, engineering, and applied mathematics.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MATH 5376F. Introduction to Probability Theory and Models.
This course introduces the definitions, constructions, theorems, and techniques used to build and analyze probability models. Students explore both the abstract foundations of probability theory and its application to a wide range of modeling contexts. Topics include conditional expectation, convergence of random variables, the weak and strong laws of large numbers, the central limit theorem, random walks, martingales, and Brownian motion. The course emphasizes the active construction and evaluation of probability models while developing the rigorous theoretical background needed to understand their behavior. Students engage with proofs, examples, and analytical methods that support deeper understanding of stochastic processes and probabilistic structures.
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 5381. Foundations of Set Theory.
This course provides a graduate-level study of set theory as a foundation for modern mathematics. Topics include sets, relations, functions, finite and infinite structures, cardinality, ordinals, transfinite methods, and basic principles of mathematical logic. Emphasis is placed on precise definitions, rigorous proof, and formal reasoning. The course develops the language and techniques used across advanced areas such as analysis, algebra, topology, and logic. It supports further graduate study and research in theoretical mathematics and foundations.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MATH 5382. Foundations of Real Analysis.
This course covers the foundations of mathematical analysis. Topics include the real number system, sequences, series, limits, and continuity of functions, together with methods of proof used in advanced mathematics. Additional attention may be given to completeness, compactness, inequalities, and the logical structure of rigorous analysis as students transition from computational calculus to proof-based reasoning. Emphasis is placed on precise definitions, careful argumentation, and the development of core concepts that support further study in analysis and related areas. Prerequisite: MATH 5381 with a grade of 'C' or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MATH 5384. Geometric Approach to Abstract Algebra.
This course studies the definitions and elementary properties of groups, rings, integral domains, fields, and vector spaces, with particular emphasis on the rings of integers, rational numbers, complex numbers, and polynomials. Attention is given to the structural relationships among these algebraic systems and to the interplay between algebra and geometry. Emphasis is placed on rigorous proof, abstraction, and the use of algebraic structures to analyze mathematical patterns, transformations, and foundational ideas that support advanced study in algebra and related areas. Prerequisite: MATH 5381 with a grade of 'C' or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MATH 5386. Knots and Surfaces, An Introduction to Low-Dimensional Topology.
This course introduces fundamental topics in low#dimensional topology with emphasis on knot theory and the topology of surfaces. Students study knot polynomials and other knot invariants, as well as methods for distinguishing and classifying knots. The course also examines the topological classification of surfaces and associated invariants, including orientability, genus, and Euler characteristic. Emphasis is placed on understanding how invariants are defined and used to distinguish topological spaces. Through selected examples and proofs, students develop familiarity with core concepts, techniques, and reasoning in low#dimensional topology, preparing them for further study in topology or related areas of mathematics.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MATH 5388. Discrete Mathematics.
This course provides a graduate-level study of discrete mathematics, emphasizing counting techniques, recurrence relations, discrete probability, and graph theory. Topics include permutations and combinations, inclusion-exclusion, generating functions, recurrence methods, discrete probabilistic models, and graph-theoretic structures. Emphasis is placed on rigorous reasoning, proof, and discrete modeling. The course highlights connections among combinatorics, probability, and graph theory and supports applications in mathematics, computation, and related quantitative fields. It prepares students for advanced coursework and research involving discrete structures and mathematical modeling.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MATH 5392. Survey of Geometries.
This course examines major geometric systems through an axiomatic and structural perspective. Topics include the axiomatic development of finite geometries, affine and projective geometry, Euclidean geometry, and selected non#Euclidean geometries, with emphasis on their relationships to neutral geometry and Hilbert's axioms. The course also may explore geometric transformations and an introduction to fractal geometry as extensions of classical geometric ideas. Students analyze how different axiom systems give rise to distinct geometric structures and investigate connections among algebraic, transformational, and metric approaches to geometry. Emphasis is placed on logical reasoning, proof techniques, and comparative analysis of geometric frameworks.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MATH 5393. Numerical Optimization.
This course introduces optimization methods used across mathematics, engineering, and applied sciences. Students study foundational concepts in optimization theory and examine numerical algorithms designed to locate points satisfying optimality conditions. Emphasis is placed on convergence analysis, algorithmic behavior, and practical implementation considerations. Topics include gradient based methods, unconstrained and constrained optimization techniques, line search and trust region strategies, and computational approaches for analyzing algorithm performance. Through examples, proofs, and computational exercises, students gain experience interpreting optimality conditions and selecting appropriate numerical techniques for a variety of mathematical problems.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MATH 5399A. Thesis.
This course provides students with the opportunity to conduct an independent, original research project under the supervision of a faculty advisor. Students formulate a research question, engage with relevant scholarly literature, and apply appropriate methods to investigate a focused topic within mathematics, mathematics education, or a closely related field. Emphasis is placed on rigorous reasoning, clear exposition, and adherence to disciplinary standards for scholarship. The course culminates in the completion of a written thesis that demonstrates the student's ability to conduct sustained inquiry and communicate results effectively. This course represents a student's initial thesis enrollment. No thesis credit is awarded until student has completed the thesis in Mathematics 5399B.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

MATH 5399B. Thesis.
This course provides students with the opportunity to conduct an independent, original research project under the supervision of a faculty advisor. Students formulate a research question, engage with relevant scholarly literature, and apply appropriate methods to investigate a focused topic within mathematics, mathematics education, or a closely related field. Emphasis is placed on rigorous reasoning, clear exposition, and adherence to disciplinary standards for scholarship. The course culminates in the completion of a written thesis that demonstrates the student's ability to conduct sustained inquiry and communicate results effectively. This represents a student's continuing thesis enrollment. The student continues to enroll in this course until the thesis is submitted for binding.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

MATH 5492. Experiencing the Hungarian Approach through Observation and Teaching Practicum.
This course provides a first-hand experience in putting the Hungarian style guided discovery into practice. As part of the course, students will spend one week at a mathematics camp for secondary students that is being run using the Hungarian style of teaching. Students will observe mathematics classes, discuss pedagogy with camp instructors, and design and teach their own lesson to camp participants.
4 Credit Hours. 4 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MATH 5599B. Thesis.
This course provides students with the opportunity to conduct an independent, original research project under the supervision of a faculty advisor. Students formulate a research question, engage with relevant scholarly literature, and apply appropriate methods to investigate a focused topic within mathematics, mathematics education, or a closely related field. Emphasis is placed on rigorous reasoning, clear exposition, and adherence to disciplinary standards for scholarship. The course culminates in the completion of a written thesis that demonstrates the student's ability to conduct sustained inquiry and communicate results effectively. This represents a student's continuing thesis enrollment. The student continues to enroll in this course until the thesis is submitted for binding.
5 Credit Hours. 5 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

MATH 5999B. Thesis.
This course provides students with the opportunity to conduct an independent, original research project under the supervision of a faculty advisor. Students formulate a research question, engage with relevant scholarly literature, and apply appropriate methods to investigate a focused topic within mathematics, mathematics education, or a closely related field. Emphasis is placed on rigorous reasoning, clear exposition, and adherence to disciplinary standards for scholarship. The course culminates in the completion of a written thesis that demonstrates the student's ability to conduct sustained inquiry and communicate results effectively. This represents a student's continuing thesis enrollment. The student continues to enroll in this course until the thesis is submitted for binding.
9 Credit Hours. 9 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit