

## Mathematics

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### Master of Science in Mathematics

#### Purpose

The MS in Mathematics is designed to enhance and enrich training in the field of mathematics for persons who teach at the secondary level or in community colleges, and to provide a rigorous depth and breadth of mathematical study for people who plan to work as applied mathematicians in industry or government agencies, as well as those who wish to continue their studies at the doctoral level. The department offers the Master of Science degree with thesis and non-thesis tracks.

#### Admission Requirements

Students should have an undergraduate degree in mathematics or related field. Those lacking the appropriate background will be required to complete leveling work. The departmental graduate advisor in consultation with the mathematics faculty will review the student's transcript and determine if leveling work is needed. Leveling requirements generally include the following courses:

- MATH 2413, 2414, 3306, 3311, 3332, 3433, 4309, 4332

The departmental graduate advisor will assist the student in selecting a graduate committee. The committee should consist of a minimum of three members, at least two of whom are from the graduate faculty of the Department of Mathematics. The third may be chosen from the graduate faculty of a department in which the student takes supportive graduate course work.

### Master of Science in Mathematics

#### Required Courses

MATH 5305	Statistical Models	3
MATH 5308	Abstract Algebra	3
MATH 5320	Real Analysis	3
MATH 5350	Linear Algebra	3
MATH 5198	Research Analysis	1
11 hours from 5000-level MATH courses except MATH 5688 and MATH 5699		11
6 hours from approved 5000-level MATH courses, 5000-level supporting courses, or thesis		6
<b>Total Hours</b>		<b>30</b>

#### Comprehensive Examination

The department requires an oral comprehensive examination for the MS degree. The comprehensive examination will be administered by the student's graduate committee during the last semester of the program. The Dean of the College of Graduate Studies or a representative from the Graduate Office will be invited to participate in the oral examination. If the result of the oral comprehensive examination is less than satisfactory, additional course work in areas of weakness may be recommended before rescheduling the examination.

### Accelerated Master of Science in Mathematics Program (5-year BS to MS)

The Accelerated MS Program allows talented undergraduates at Tarleton State University an opportunity to complete the requirements for the MS degree at an accelerated pace. Selected undergraduate students may begin taking graduate courses during their junior year, earning 6 to 12 graduate mathematics hours (5000-Level) that can be counted toward both the BS in Mathematics and the MS in Mathematics degree (see additional required courses for a BS in Mathematics under the accelerated master's option for more details). Courses may be selected from Math 5301, 5305, 5306, 5308, 5309, 5311, 5312, 5320, 5330, 5340, 5350, 5360, 5370, 5371, 5373, 5375, 5376, 5377, 5378, 5379, 5380, 5386, and 5390.

A minimum GPA of 3.0 is required for all graduate work taken as an undergraduate student.

Thus students will earn a non-thesis MS degree in the same field within 12 months of completing the BS degree or obtain a thesis-based MS degree in the same field within 18 months of completing the BS degree. All requirements for the MS must be satisfied.

#### Accelerated Masters Admission

Students must have a minimum accumulated grade point average of 3.5/4.0 at TSU. Students must have completed between 75 and 108 credit hours, including credits earned from advanced placement. Transfer students must have completed a minimum of two full-time semesters and 24 hours at Tarleton. Contact the Graduate Advisor for further details .

## Mathematics Courses

### **MATH 5086. Advanced Special Problems in Mathematics. 1-3 Credit Hours (Lecture: 0 Hours, Lab: 1-3 Hours).**

Special problems in mathematics. Work may be either theory or laboratory. May be repeated with approval of the department head for additional credit. Prerequisite: Approval of department head.

### **MATH 5088. Thesis. 1-6 Credit Hours (Lecture: 1-6 Hours, Lab: 0 Hours).**

Scheduled when the student's committee chair determines the student is ready to begin the thesis. No credit is earned until the student has enrolled in at least 6 credit hours of thesis and the thesis is certified as completed by the student's committee, at which time the student will be awarded 6 credit hours of thesis. Prerequisite: 18 hours of approved graduate credit toward the degree and consent of the student's committee.

### **MATH 5198. Research Analysis. 1 Credit Hour (Lecture: 1 Hour, Lab: 0 Hours).**

An overview of the components of research in the main areas of mathematics. These areas will include pure mathematics and statistics, applied mathematics and statistics, and mathematics education. The course will culminate with a study of what is a proper literary review and how to submit an article for publication. Prerequisite: Graduate standing in the mathematics department or approval of the department head.

### **MATH 5301. Nonparametric Statistics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Introduction to nonparametric statistics. Topics will include hypothesis testing, contingency tables, rank tests, and goodness-of-fit tests. Prerequisite: Junior or senior level statistics course.

### **MATH 5305. Statistical Models. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

This course covers the basics of experimental design, mathematical theory for linear and logistic regression models in the multivariate case, and diagnostics and remedial measures for these models. Other topics will be selected from time series analysis, principle components, canonical correlations, factor analysis, discriminant analysis, and cluster analysis. Prerequisite: MATH 3311.

### **MATH 5306. Dynamical Systems. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Advanced study of dynamical systems. Topics will be selected from discrete and continuous dynamical systems, sensitivity analysis, models of the physical, life, and social sciences, and bifurcation analysis. Prerequisites: Differential Equations and Linear Algebra.

### **MATH 5308. Abstract Algebra. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Topics will be selected from: groups, homomorphism, isomorphism, direct products and sums, invariant properties, rings, and fields. Prerequisite: MATH 4332.

### **MATH 5309. Complex Variables. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

An introduction to complex analysis. Topics will be selected from elementary operations and analytic functions, curves and integrals, power series, Cauchy's theorem, zeroes and singularities of analytic functions, Laurent series, maximum principle, analytic continuation, harmonic functions, conformal mapping and transformations. Prerequisite: MATH 2414 or approval of department head.

### **MATH 5312. Design of Experiments. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Students will learn about planning and conducting an experiment. Data analysis using appropriate software is covered. Prerequisite: MATH 5305 or approval of department head.

### **MATH 5320. Real Analysis. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Topics will be chosen from: sets and operators; cardinal numbers and ordinal types; metric spaces and Lebesgue measure; metric properties of sets; differentiation and integration. Prerequisite: MATH 4309.

### **MATH 5330. Mathematical Modeling. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

An advanced course in mathematical modeling. Topics will be selected from scaling, dimensional analysis, regular and singular perturbation theory, stability theory, and asymptotic analysis. Prerequisites: Differential Equations and Linear Algebra.

### **MATH 5340. Topology. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

An introduction to point set topology. Topics will include open and closed sets, interior, closure, boundary, neighborhoods, continuous functions, separation and subspaces. Additional topics will be selected from compactness, connectedness and continua. Prerequisite Course(s): MATH 4309.

### **MATH 5350. Linear Algebra. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

An advanced course in linear algebra. Topics to be selected from linear spaces and operators, canonical forms, quadratic forms and optimization, computation and condition, and compatible systems. Prerequisite: Linear Algebra.

### **MATH 5360. Numerical Analysis. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

An advanced study of numerical analysis. Topics will be selected from linear systems, approximation theory, numerical differential and integral equations, integration theory. Prerequisite: MATH 3360.

### **MATH 5362. Data Warehousing. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Use SQL for manipulation and exploration of large data sets by creating tables, transforming data, using joins, and performing simple queries. Prerequisites: COSC 1310 or equivalent.

### **MATH 5364. Data Science I. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

This course centers on the identification, exploration, and description of new patterns contained within data sets using appropriate software. Selected topics will be chosen from data exploration, classification, cluster analysis, and model evaluation and comparison. Prerequisites: Probability and Statistics.

### **MATH 5366. Data Science II. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

This course centers on the identification, exploration, and extraction of new patterns from natural language text documents using appropriate software. Selected topics will be chosen from association analysis, anomaly detection, text mining, dimensionality reduction, and model evaluation and comparison. Prerequisites: MATH 5364.

### **MATH 5370. History of Mathematics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

A historical and philosophical development of mathematics from earliest times down to the present. Mathematical topics are presented in a historical and philosophical setting not only to provide a unifying theme, but also to illustrate how the evolution of mathematical ideas finally led to modern concepts in the field. Students having prior credit for History of Mathematics will not receive credit for MATH 5370. Prerequisite: 6 advanced hours in MATH.

### **MATH 5371. Euclidean and Non-Euclidean Geometries. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

This course focuses on important geometric concepts of Euclidean and non-Euclidean geometries from an axiomatic perspective. Technology will be included where appropriate. Prerequisite: 3 hours of undergraduate geometry.

### **MATH 5373. Theory of Functions. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

This course is designed to emphasize the role of function as the key unifying concept of mathematics and to extend the understanding of the structural foundations of mathematics. The properties of various families of functions will also be studied. Prerequisite: 24 hours of MATH, including MATH 2413. Course fee \$15.

### **MATH 5375. Statistical Reasoning and Probability. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

This course focuses on statistical reasoning and decision making by extending the elements of probability and statistics introduced in an undergraduate course. Topics may include probability theory, distribution functions, statistical inference, sampling methods, regression analysis, and ANOVA. Technology will be incorporated where appropriate. Prerequisite: 3 hours of undergraduate statistics.

**MATH 5376. Algebraic Structures. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

This course examines algebraic structures in secondary and post-secondary mathematics from an advanced perspective. Analysis of algebraic concepts and underlying theory, along with the appropriate integration of manipulatives and technology in accordance with the standards of the National Council of Teachers of Mathematics, will be emphasized. Prerequisite: 24 hours of MATH at the undergraduate level, including Calculus.

**MATH 5377. In-Depth Mathematical Reasoning. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

The study of mathematics from an advanced perspective, taking into account not only the interconnections among topics but their relationship to higher mathematics. Important new mathematical insights and understandings will be revealed in its structure and its applicability. The focus will be on concept analysis, problem analysis, and mathematical connections as well as mathematical habits of mind. Prerequisite: 24 hours from MATH, including MATH 2413.

**MATH 5378. Technology-Aided Mathematics-. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

Students will engage in mathematical problem-solving using technological tools. Technologies may include graphing handhelds, data collection devices, computer software packages, and internet resources. This course may be repeated for credit as the topic changes. Prerequisite: 24 hours of MATH, including MATH 2413.

**MATH 5379. Trends and Issues in Research. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

In this seminar-style course, students have a forum for discussion and presentation of inquiries into the history, current trends, and issues pertaining to analysis of research trends in mathematics education and its effect on policy, curriculum, and the teaching and learning of mathematics. Prerequisite: 24 hours of MATH, including MATH 120.

**MATH 5380. Selected Topics in Mathematical Theory. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

An examination of topics in mathematical theory appropriate for secondary mathematics educators. Topics will be selected from geometry and topology, number theory, modern algebra, and library research in mathematics. This course may be repeated for credit as the topic changes. Prerequisite: Approval of department head.

**MATH 5390. Selected Topics in Mathematics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).**

An examination of topics in applied mathematics. Topics for study will be selected from advanced mathematical modeling, advanced numerical techniques, practical optimizations, calculus of variations, dynamic programming, integral equations, optimal control, perturbation methods, and library research in applied mathematics. This course may be repeated for credit as the topic changes. Prerequisite: Approval of department head.

**MATH 5699. Internship. 1-6 Credit Hours (Lecture: 1-6 Hours, Lab: 0 Hours).**

The student will complete a supervised and comprehensive work experience in a mathematics-related position with a public or private business organization for career preparation in a mathematics-related enterprise. Credit in this course does not count towards the 24 hour requirement for the M.S. in Mathematics. Prerequisite: Mathematics graduate student with department head approval. Field assignment fee \$75.

**Statistics Courses**