

# BACHELOR OF SCIENCE-MATHEMATICS-PURE MATHEMATICS CONCENTRATION

## Degree Requirements

Students should refer to their DegreeWorks degree audit in their Web for Students account for more information regarding their degree requirements.

Code	Title	Hours
<b>Major Requirements</b>		
General Education Requirements ( <a href="http://catalog.tamut.edu/academic-information/university-core-curriculum/#corecurriculumtext">http://catalog.tamut.edu/academic-information/university-core-curriculum/#corecurriculumtext</a> )		42
<b>Mathematics Core Courses:</b>		
MATH 2413	Calculus I <sup>1,2</sup>	4
MATH 2414	Calculus II	4
MATH 2415	Calculus III	4
MATH 2305	Discrete Mathematics	3
MATH 2318	Linear Algebra	3
MATH 2320	Differential Equations	3
MATH 357	Probability and Statistics using R	3
MATH 415	Applied Numerical Analysis	3
MATH 430	Mathematical Modeling	3
MATH 450	Combinatorics and Graph Theory	3
MATH 493	Capstone in Mathematics (EL)	3
<b>Pure Math Concentration:</b>		
MATH 321	College Geometry	3
MATH 330	Math Foundations and Applications	3
MATH 334	Introduction to Abstract Algebra	3
MATH 380	Real Analysis	3
MATH 437	Number Theory	3
<b>Electives (as needed to meet minimum degree requirements including 54 semester credits of upper division)</b>		
Upper Division Electives (300-400 level)		24
<b>Minimum Hours for Degree</b>		<b>120</b>

Note: A minimum of 54 upper division hours (300 and 400 level courses) are required for this degree. Resident credit totaling 25% of the hours is required for the degree. A minimum GPA of 2.0 is required in three areas for graduation: Overall GPA, Institutional GPA, and Major GPA.

## Mathematics -Pure Mathematics Concentration-Four Year Plan

Students should refer to their DegreeWorks degree audit in their Web for Students account for more information regarding their degree requirements.

### First Year

Code	Title	Hours
<b>Fall</b>		
PSCI 2301	American Government I: Federal & Texas Constitutions	3
ENGL 1301	Composition I <sup>minimum grade of 'C' required</sup>	3
MATH 2413	Calculus I	4
Life and Physical Sciences Core Curriculum Requirement ( <a href="http://catalog.tamut.edu/academic-information/university-core-curriculum/#corecurriculumtext">http://catalog.tamut.edu/academic-information/university-core-curriculum/#corecurriculumtext</a> )		3
IS 1100	University Foundations <sup>mandatory for FTIC students</sup>	1
<b>Fall total semester credit hours</b>		<b>14</b>
<b>Spring</b>		
PSCI 2302	American Government II: Federal & Texas Political Behavior	3
ENGL 1302	Composition II	3
MATH 2305	Discrete Mathematics	3

MATH 2414	Calculus II	4
Life and Physical Sciences Core Curriculum Requirement ( <a href="http://catalog.tamut.edu/academic-information/university-core-curriculum/#corecurriculumtext">http://catalog.tamut.edu/academic-information/university-core-curriculum/#corecurriculumtext</a> )		3
<b>Spring total semester credit hours</b>		<b>16</b>
<b>First Year Total Semester Credit Hours</b>		<b>30</b>

## Second Year

Code	Title	Hours
<b>Fall</b>		
MATH 2415	Calculus III	4
MATH 2318	Linear Algebra	3
HIST 1301	United States History I	3
Creative Arts Core Curriculum Requirement ( <a href="http://catalog.tamut.edu/academic-information/university-core-curriculum/#corecurriculumtext">http://catalog.tamut.edu/academic-information/university-core-curriculum/#corecurriculumtext</a> )		3
Language, Philosophy and Culture Core Curriculum Requirement ( <a href="http://catalog.tamut.edu/academic-information/university-core-curriculum/#corecurriculumtext">http://catalog.tamut.edu/academic-information/university-core-curriculum/#corecurriculumtext</a> )		3
<b>Fall total semester credit hours</b>		<b>16</b>
<b>Spring</b>		
MATH 2320	Differential Equations	3
MATH 330	Math Foundations and Applications	3
HIST 1302	United States History II	3
SPCH 1315	Public Speaking	3
or COMM 1307	Introduction to Mass Communication	
or COMM 1311	Introduction to Communication Studies	
Elective - Upper or Lower Division as needed to meet upper division and overall requirement		2-3
<b>Spring total semester credit hours</b>		<b>14-15</b>
<b>Second year Total Semester Credit Hours</b>		<b>30-31</b>

## Third Year

Code	Title	Hours
<b>Fall</b>		
MATH 321	College Geometry	3
MATH 450	Combinatorics and Graph Theory	3
Social and Behavioral Science Core Curriculum Requirement ( <a href="http://catalog.tamut.edu/academic-information/university-core-curriculum/#corecurriculumtext">http://catalog.tamut.edu/academic-information/university-core-curriculum/#corecurriculumtext</a> )		3
Upper Division Elective (300-400 level)		3
Component Area Option B of the Core Curriculum ( <a href="http://catalog.tamut.edu/academic-information/university-core-curriculum/#corecurriculumtext">http://catalog.tamut.edu/academic-information/university-core-curriculum/#corecurriculumtext</a> )		3
<b>Fall total semester credit hours</b>		<b>15</b>
<b>Spring</b>		
MATH 334	Introduction to Abstract Algebra	3
MATH 357	Probability and Statistics using R	3
Upper Division Elective (300-400 level)		3
Upper Division Elective (300-400 level)		3
Upper Division Elective (300-400 level)		3
<b>Spring total semester credit hours</b>		<b>15</b>
<b>Third Year Total Semester Credit Hours</b>		<b>30</b>

## Fourth Year

Code	Title	Hours
<b>Fall</b>		
MATH 380	Real Analysis	3

MATH 430	Mathematical Modeling	3
MATH 437	Number Theory	3
Upper Division Elective (300-400 level)		3
Upper Division Elective (300-400 level)		3
<b>Fall total semester credit hours</b>		<b>15</b>
<b>Spring</b>		
MATH 415	Applied Numerical Analysis	3
MATH 493	Capstone in Mathematics (EL)	3
Upper Division Elective (300-400 level)		3
Upper Division Elective (300-400 level)		3
Elective - Upper or Lower Division as needed to meet upper division and overall requirement		3
<b>Spring total semester credit hours</b>		<b>15</b>
<b>Fourth Year Total Semester Credit Hours</b>		<b>120</b>

Note: A minimum of 54 upper division hours (300 and 400 level courses) are required for this degree. Resident credit totaling 25% of the hours is required for the degree. A minimum GPA of 2.0 is required in three areas for graduation: Overall GPA, Institutional GPA, and Major GPA.

**MATH 0300. Pre-Algebra. 3 Hours.**

This course provides a study of the concepts and applications of arithmetic operations on whole numbers, fractions, and decimals, ratios and proportions, percentages, measurements, interpretation of graphs and statistics, geometry, exponents, algebraic expression, and problem solving. Students must complete the course with a C or better to receive credit. Calculators will not be allowed for use in this course. Placement will be determined by TSI readiness indicators.

**MATH 0301. Elementary Algebra. 3 Hours.**

This course provides a study of the concepts and applications of algebraic expressions, equations, inequalities, problem solving, polynomials and factoring, rational expressions and equations, systems of equations, graphing techniques, radical expressions and equations, and quadratic equations. Students must complete the course with a C or better to receive credit. Appropriate computer software and hand held technologies will be utilized. Placement will be determined by TSI readiness indicators.

**MATH 0302. Intermediate Algebra. 3 Hours.**

This course provides a study of the concepts and applications of rational expressions and equations, linear equations and inequalities, radicals, quadratic equations, and graphs. This course is intended for students who place below the minimum score on an entrance assessment test in mathematics. Appropriate computer software and hand held technologies will be utilized. Students must complete the course with a C or better to receive credit. Placement will be determined by TSI readiness indicators.

**MATH 1314. College Algebra. 3 Hours.**

This course provides a rigorous study of the concepts and applications of linear, quadratic, higher-order polynomial, rational, radical, exponential and logarithmic functions, and solving systems of equations using various methods. Additional topics such as sequences, series, probability, and conics may be included. This course is designed to prepare STEM majors for success in calculus. Appropriate computer software and hand held technologies will be utilized. Prerequisite: Must have satisfied the math portion of TSI. Placement will also be determined by the Math Placement Exam score.

**MATH 1316. Plane Trigonometry. 3 Hours.**

This course provides a rigorous study of the concepts and applications of sets, ordered relations, number intervals, trigonometric functions, radian measure, variations and graphs of functions, solutions of right and general triangles, identities, graphing, inverse functions, circular functions, vectors, complex numbers, polar and parametric equations. This course is designed to further prepare STEM majors for success in calculus. Appropriate computer software and hand held technologies will be utilized. Prerequisite: Must have satisfied the math portion of TSI. Placement will also be determined by the Math Placement Exam score.

**MATH 1324. Mathematics for Business and Social Sciences I. 3 Hours.**

This course provides a rigorous study of the concepts from college algebra (linear equations, quadratic equations, functions and graphs, inequalities), sets, probability, mathematics of finance (simple and compound interest, annuities), linear programming, matrices, and systems of linear equations. This course is designed to prepare students majoring in business or social science. Applications will be taken from management, economics, business, and sociology. Appropriate computer software and hand held technologies will be utilized. Prerequisite: Must have satisfied the math portion of TSI.

**MATH 1325. Business Calculus. 3 Hours.**

This course provides a rigorous study of the concepts of limits and continuity, derivatives, graphing and optimization, exponential and logarithmic functions, antiderivatives, and integration. This course is designed to prepare students majoring in business. Applications will be taken from management, economics, and business. Appropriate computer software and hand held technologies will be utilized. Prerequisite: MATH 1324 or MATH 1314 with a C or better.

**MATH 1332. Contemporary Mathematics I. 3 Hours.**

This course provides a study of the concepts and applications of sets, logic, number systems, number theory, relations, functions, probability and statistics. Applications will be taken from meaningful real-world examples that allow students to see how mathematics can be used by everyone to solve problems, not just by mathematicians and scientists. This course is designed for non-STEM, non-business majors. Appropriate computer software and hand held technologies will be utilized. Prerequisite: Must have satisfied the math portion of TSI.

**MATH 1342. Elementary Statistical Methods. 3 Hours.**

This course provides a rigorous study of the concepts and applications of the collection, analysis, presentation, and interpretation of data and probability. Analysis includes descriptive statistics, correlation and regression, confidence intervals and hypothesis testing. Appropriate computer software and hand held technologies will be utilized. Prerequisite: Must have satisfied the math portion of the TSI.

**MATH 1350. Fundamentals of Mathematics I. 3 Hours.**

This course provides a rigorous study of the concepts and applications of sets, functions, numeration systems, number theory, and properties of the natural numbers, integers, rational, and real number systems with an emphasis on problem solving and critical thinking. This course is designed for students seeking EC-6 teacher certification. Appropriate computer software and hand held technologies will be utilized. Prerequisite: MATH 1314 with a C or better.

**MATH 1351. Fundamentals of Math II. 3 Hours.**

This course provides a rigorous study of the concepts and applications of geometry, probability, statistics, and measurement with an emphasis on problem solving and critical thinking. This course is designed for students seeking EC-6 teacher certification. Appropriate computer software and hand held technologies will be utilized. Prerequisite: MATH 1350 and MATH 1314 with a C or better.

**MATH 2305. Discrete Mathematics. 3 Hours.**

This course provides a rigorous study of the concepts and applications of topics designed to prepare math, computer science, and engineering majors for a background in abstraction, notation, and critical thinking for the mathematics most directly related to computer science. Topics include: logic, relations, functions, basic set theory, countability and counting arguments, proof techniques, mathematical induction, combinatorics, discrete probability, recursion, sequence and recurrence, elementary number theory, graph theory, and mathematical proof techniques. Appropriate computer software and hand held technologies will be utilized. Prerequisite: MATH 2413 with a C or better or instructor permission.

**MATH 2318. Linear Algebra. 3 Hours.**

This course provides a rigorous study of the concepts and applications of systems of linear equations, matrices, vector spaces, determinants, eigenvectors, eigenvalues, and linear transformations. Appropriate computer software and hand held technologies will be utilized. Prerequisite: MATH 2414 with a C or better.

**MATH 2320. Differential Equations. 3 Hours.**

This course provides a rigorous study of the concepts and applications of first- and second-order ordinary differential equations and systems of ODEs, existence and uniqueness of solutions, initial value problems, the Laplace Transform, compartment models, first- and second-order rate laws, eigenvalues, eigenvectors, and eigenspaces of matrices. This course is taught with a modeling perspective and will utilize applications from areas such as physics, biology, pharmacology, chemistry, ecology, sociology, and electric engineering. Numerical, symbolic and graphing techniques will be used to obtain solutions. Appropriate computer software and hand held technologies will be utilized. Prerequisite: MATH 2414 with a C or better.

**MATH 2412. Pre-Calculus. 4 Hours.**

This course provides a rigorous study of the concepts and applications of the fundamental topics of calculus including algebraic functions and their graphs, trigonometric functions and identities, polynomial, rational, exponential, and logarithmic functions, solutions to equations and inequalities, analytic geometry, and polar coordinates. This course is designed to prepare STEM majors for success in calculus. Appropriate computer software and hand held technologies will be utilized. Prerequisite: MATH 1314 with a C or better or the equivalent preparation by STEM department chair permission. Placement will also be determined by the Math Placement Exam score.

**MATH 2413. Calculus I. 4 Hours.**

This course provides a rigorous study of the concepts and applications of limits and continuity; the Fundamental Theorem of Calculus; definition of the derivative of a function and techniques of differentiation; applications of the derivative to maximizing or minimizing a function; the chain rule, mean value theorem, and rate of change problems; curve sketching; definite and indefinite integration of algebraic, trigonometric, and transcendental function, with an application to calculation of areas. Appropriate computer software and hand held technologies will be utilized. Prerequisite: MATH 1314 and MATH 1316 with a C or better, or MATH 2412 with a C or better. Placement will also be determined by the Math Placement Exam score.

**MATH 2414. Calculus II. 4 Hours.**

This course provides a rigorous study of the concepts and applications of integration, trigonometric functions, sequences and series, indeterminate forms, improper integrals, and elementary differential equations. Appropriate computer software and hand held technologies will be utilized. Prerequisite: MATH 2413 with a C or better.

**MATH 2415. Calculus III. 4 Hours.**

This course provides a rigorous study of the concepts and applications of three dimensional analytic geometry and vectors, differentiation and integration of vector-valued functions and motion in space, arc length and curvature, functions of several variables, partial derivatives, multiple integrals, and integration in vector fields. Appropriate computer software and hand held technologies will be utilized. Prerequisite: MATH 2414 with a C or better.

**MATH 289. Independent Study in Mathematics. 1-4 Hours.**

This course provides an option for individualized instruction and research. It may be repeated when topics vary. Prerequisite: Instructor approval.

**MATH 321. College Geometry. 3 Hours.**

This course provides a rigorous study of the concepts and applications of the properties of finite geometrics and of points, lines, triangles, and circles in Euclidean geometry. Non-Euclidean geometries will also be studied and contrasted. This course will be taught with a discovery approach in which students scaffold their comprehension through careful axiomatic study. Appropriate computer software and hand held technologies will be utilized. Prerequisite: MATH 2413 with a C or better.

**MATH 326. Problem Solving for Elementary Teachers. 3 Hours.**

This course provides a study of the concepts taken from algebra, number theory, geometry, probability, statistics, measurement, and logic as they relate to the elementary school math curriculum. Prerequisite: MATH 1314 and MATH 1350 and MATH 1351 with grades of C or better.

**MATH 330. Math Foundations and Applications. 3 Hours.**

This course provides a rigorous study of the foundational concepts that are inherent in upper division mathematics. It is intended to provide a transition from the mechanical understanding of lower-level concepts to the abstract nature of upper-level ideas. Students are exposed to a wide range of introductory topics such as set theory, functions/relations, logic, groups, proof-writing, combinatorics, countable/uncountable sets, and elements of advanced calculus. Prerequisite: MATH 2414.

**MATH 334. Introduction to Abstract Algebra. 3 Hours.**

This course provides a rigorous study of the concepts and applications of the properties of the integers, permutations, groups, rings, integral domains, and fields. Appropriate computer software and hand held technologies will be utilized. Prerequisite: MATH 330 or MATH 2305 with a C or better.

**MATH 357. Probability and Statistics using R. 3 Hours.**

This course provides a rigorous study of the concepts and applications of probability, discrete and continuous distribution, estimation, and hypothesis testing using concepts from calculus. Appropriate computer software and hand held technologies will be utilized. Course is cross-listed with EE 307. Credit cannot be granted for both MATH 357 and EE 307. Prerequisite: MATH 2414 with a C or better.

**MATH 358. Regression Analysis. 3 Hours.**

This course provides a rigorous study of the concepts and applications of regression analysis. It introduces techniques of building models and fitting data, simple linear and multiple regression models, nonlinear regression models, and residual analysis. Appropriate computer simulation methods, software, and handheld technologies will be utilized. Prerequisite: MATH 357.

**MATH 372. Cryptology I. 3 Hours.**

This course provides a rigorous study of the introductory concepts and applications of cryptography and various cryptosystems. A familiarity with concepts from discrete mathematics and linear algebra is assumed in the student. Topics include character ciphers, block and stream ciphers, exponentiation ciphers, public key cryptography, knapsack ciphers, and cryptographic protocols/applications. Computer software will be utilized where appropriate. Prerequisite: MATH 2305 or COSC 1321.

**MATH 380. Real Analysis. 3 Hours.**

Sets, relations and functions, sequences of real numbers and sequences in  $\mathbb{R}^n$ , continuous and differentiable functions on  $\mathbb{R}^n$ , Riemann Integral. Prerequisites: MATH 2415 or MATH 2305 with grades of C or better.

**MATH 415. Applied Numerical Analysis. 3 Hours.**

This course provides a rigorous study of the concepts and applications of numerical approximation methods for the solution of problems such as systems of linear equations, curve fitting, root finding, differentiation, and integration. This course will have a strong emphasis in the applications of these numerical methods and how to implement them in computer programs using algorithms. Prior experience in a programming language will be useful but not essential and as such appropriate computer software and hand-held technologies will be utilized. Prerequisite: MATH 2414 with a C or better.

**MATH 430. Mathematical Modeling. 3 Hours.**

This course provides a rigorous study of the concepts and applications of techniques used to model data related to real-world systems and scenarios from areas such as physics, biology, pharmacology, chemistry, ecology, sociology, astronomy, and archeology. Discrete and continuous models, theoretical and empirical models, deterministic and probability models and analytic and simulation models will be considered. Appropriate computer software and hand held technologies will be utilized. Prerequisite: MATH 2414 with a C or better.

**MATH 431. Internship in Mathematics. 3 Hours.**

The internship is a work experience that will allow the student to develop skills, gain hands-on business experience, and test career choices and options. The internship will complement and validate the student's academic training.

**MATH 432. Discrete and Continuous Modeling. 3 Hours.**

This course concentrates on the simulation of systems covering the basics in detail and exploring the diverse aspects, including continuous event simulation and optimization with simulation. It explores the connections between discrete and continuous modeling and applies a specific focus to fields including engineering, manufacturing, social science, environmental, transport and logistics, and healthcare. Prerequisite: MATH 430.

**MATH 437. Number Theory. 3 Hours.**

This course provides a rigorous study of the concepts and applications of the properties of integer representations and operations, analysis and complexity of algorithms, mathematical induction, divisibility, primes and composites, congruences and systems, the Fundamental Theorem of Arithmetic, Pythagorean triples, multiplicative functions, and cryptology. Appropriate computer software and hand held technologies will be utilized. Prerequisite: MATH 330 or MATH 2305 with a C or better.

**MATH 445. Title Fourier Transform. 3 Hours.**

This course provides a rigorous study of the concepts and applications of the Fourier Transform. The topics include: The Fourier transform as a tool for solving physical problems. Fourier series, the Fourier transform of continuous and discrete signals and its properties. The Dirac delta, distributions, and generalized transforms. Convolutions and correlations and applications; probability distributions, sampling theory, filters, and analysis of linear systems. The discrete Fourier transform and the Fast Fourier Transform (FFT) algorithm. Multidimensional Fourier transform and use in imaging. Further applications to optics, crystallography. Emphasis is on relating the theoretical principles to solving practical engineering and science problems. Prerequisites: MATH 2318 Linear Algebra and MATH 2320 Differential Equation.

**MATH 450. Combinatorics and Graph Theory. 3 Hours.**

This course provides a rigorous study in the topics of combinatorics and graph theory. Topics include principles of counting, graphs, digraphs, Eulerian and Hamiltonian graphs, connectivity, path algorithms, trees, planarity, coloring of graphs, tree searches and sortings, binomial coefficients, generating functions, recurrence relations, and networks flows, and associated algorithms. Appropriate computer software and hand-held technologies will be utilized. Prerequisite: MATH 330 or MATH 2305 with grade of C or better.

**MATH 489. Individual Study. 1-3 Hours.**

This course provides an option for individualized instruction and research. It may be repeated when topics vary. Prerequisite: Instructor approval.

**MATH 493. Capstone in Mathematics (EL). 3 Hours.**

This is the conclusion of preparation of a portfolio of mathematical experiences composed of artifacts from throughout a student's time in upper-level mathematics classes. Presentation of a selected portfolio artifact will be required. Students will be graded on Satisfactory (S) or Unsatisfactory (U) basis. Prerequisite: Senior standing and instructor permission.

**MATH 497. Special Topics. 3 Hours.**

Instructors will provide an organized class designed to cover areas of specific interest. Students may repeat the course when topics vary.

**MATH 499. Independent Research. 1-6 Hours.**

This is an independent research in Math conducted by a student under the guidance of a faculty member of his or her choice. The student is required to maintain a research journal and submit a project report by the end of the semester and potentially make an oral presentation on the project. SCH and hours are by arrangement and, with a change in content, this course may be repeated for credit. Prerequisite: Consent of instructor.

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