DEPARTMENT OF MATHEMATICS AND STATISTICS

Ekaterina Shemyakova, Chair
Hiba Fayoumi, Undergraduate Advisor – Pure Mathematics, Applied Mathematics, Mathematics with Computer Science, and Math Minor
Zhiwei Chen, Undergraduate Advisor - Actuarial Science
Qin Shao, Undergraduate Advisor - Data Science

Mission

The mission of the undergraduate programs in the mathematical science offer by the Department of Mathematics and Statistics is to provide our majors with the skills and conceptual understanding required to succeed as professionals in occupations requiring training in the mathematical sciences or to succeed in further study at the graduate level.

Degrees Offered

The Department of Mathematics and Statistics offers degree programs for a Bachelor of Science in Mathematics.

Advanced Placement

- Students with a score of 3 or better on AB calculus will receive credit for MATH 1850.
- Students with a score of 3, 4 or 5 on the BC calculus test will receive credit for both MATH 1850 and MATH 1860.
- Students with a score below 3 may be able to obtain credit by taking a departmental test.
- Students with a score of 3 or better on the Statistics Test will receive credit for MATH 2600.

Degrees and Programs Offered

- BS in Mathematics (https://catalog.utoledo.edu/undergraduate/natural-sciences-mathematics/mathematics-statistics/bs-mathematics/)
- Minor in Mathematics (https://catalog.utoledo.edu/undergraduate/natural-sciences-mathematics/mathematics-statistics/minor-mathematics/)

MATH 1180 Reasoning With Mathematics
[3 credit hours]
Reasoning with Mathematics will prepare students for an increasingly information-based society. Students will acquire the skills necessary to make rational decisions based on real data and evaluate numerical information. They will be exposed to general methods of inquiry that apply in a wide variety of settings. They will be able to critically assess arguments and make rational decisions. Finally, students will develop the ability to judge the strengths and limitations of quantitative approaches.
Term Offered: Spring, Summer, Fall
Core Mathematics, OT36 Mathematics

MATH 1200 Mathematical Modeling and Problem Solving
[4 credit hours]
Mathematical modeling of data using linear, quadratic, rational, and radical functions in their numerical, symbolic, graphic, and verbal forms. Problem solving methods and strategies will be emphasized. Course is not applicable toward the undergraduate Mathematics major requirements. Math core course.
Term Offered: Spring, Summer, Fall
Core Mathematics

MATH 1210 Mathematics For Education Majors I
[3 credit hours]
Principles of elementary number theory, base systems, foundations of arithmetic operations, fractions, decimals and problem solving techniques. Course is not applicable toward the undergraduate Mathematics major requirements.
Prerequisites: MATH 1180 with a minimum grade of C- or MATH 1200 with a minimum grade of C- or Aleks Math Placement Test with a score of 46 or Aleks Math Placement Retest with a score of 46 or ACT Math with a score of 20 or Math - Coll Algebra Placement with a score of 10 or Math - Elem Algebra Placement with a score of 12 or SAT Mathematics with a score of 480 or MATH SECTION SCORE with a score of 510
Term Offered: Spring, Fall
Core Mathematics

MATH 1220 Mathematics For Education Majors II
[3 credit hours]
Development of integers, rational numbers and real numbers; probability, statistics, informal geometry, geometric figures and measurements. Course is not applicable toward the undergraduate Mathematics major requirements.
Prerequisites: MATH 1210 with a minimum grade of C-
Term Offered: Spring, Summer, Fall
Core Mathematics, OT36 Mathematics

MATH 1310 College Algebra Corequisite Lab
[0 credit hours]
Corequisite course associated with MATH 1320. Learning experiences to develop skills and to enhance the material presented in MATH 1320. Placement based on departmental guidelines.
Corequisites: MATH 1320
Term Offered: Spring, Fall

MATH 1320 College Algebra
[3 credit hours]
Number system; elementary theory of equations and inequalities; functions and relations; exponentials and logarithms; systems of equations and topics in analytic geometry. Course is not applicable toward the undergraduate Mathematics major requirements. No credit given for students who have credit for MATH 1340.
Prerequisites: ((High School GPA with a score of 3.0 and (ACT Math with a score of 18 or Aleks Math Placement Test with a score of 44 or Aleks Math Placement Retest with a score of 44 or SAT Mathematics with a score of 500 or MATH SECTION SCORE with a score of 460 or MATH 1200 with a minimum grade of C+ or MATH 1180 with a minimum grade of B+) or (MATH 1310 (may be taken concurrently) with a minimum grade of C and (ACT Math with a score of 16 or Aleks Math Placement Test with a score of 36 or Aleks Math Placement Retest with a score of 36 or SAT Mathematics with a score of 430 or MATH SECTION SCORE with a score of 390 or MATH 1200 with a minimum grade of C- or MATH 1180 with a minimum grade of C-))) or (ACT Math with a score of 24 or Aleks Math Placement Test with a score of 56 or Aleks Math Placement Retest with a score of 56 or SAT Mathematics with a score of 580 or MATH SECTION SCORE with a score of 560 or MATH 1200 with a minimum grade of C+ or MATH 1180 with a minimum grade of B+) or (MATH 1310 (may be taken concurrently) with a minimum grade of C and (ACT Math with a score of 20 or Aleks Math Placement Test with a score of 48 or Aleks Math Placement Retest with a score of 48 or SAT Mathematics with a score of 520 or MATH SECTION SCORE with a score of 490 or MATH 1200 with a minimum grade of C- or MATH 1180 with a minimum grade of C-))) or Math - Coll Algebra Placement with a score of 10
Term Offered: Spring, Summer, Fall
Core Mathematics, OT36 Mathematics

MATH 1330 Trigonometry
[3 credit hours]
Definitions and graphs of trigonometric functions and their inverses, solving trigonometric equations, applications and topics in analytic geometry. Course is not applicable toward the undergraduate Mathematics major requirements. No credit given for students who have credit for MATH 1340.
Prerequisites: (High School GPA with a score of 3.25 and (ACT Math with a score of 20 or Aleks Math Placement Test with a score of 48 or Aleks Math Placement Retest with a score of 48 or SAT Mathematics with a score of 520 or MATH SECTION SCORE with a score of 490)) or (ACT Math with a score of 24 or Aleks Math Placement Test with a score of 66 or Aleks Math Placement Retest with a score of 66 or SAT Mathematics with a score of 580 or MATH SECTION SCORE with a score of 560) or MATH 1320 with a minimum grade of C- or Math - Coll Algebra Placement with a score of 15
Term Offered: Spring, Summer, Fall
Core Mathematics, OT36 Mathematics

MATH 1340 College Algebra And Trigonometry
[0-5 credit hours]
Functions and graphs, exponential and logarithmic functions, trigonometric functions and applications, systems of equations and topics in analytic geometry. No credit for students who have credit for MATH 1320 or 1330.
Prerequisites: (High School GPA with a score of 3.25 and (ACT Math with a score of 20 or Aleks Math Placement Test with a score of 48 or Aleks Math Placement Retest with a score of 48 or SAT Mathematics with a score of 520 or MATH SECTION SCORE with a score of 490)) or (ACT Math with a score of 24 or Aleks Math Placement Test with a score of 66 or Aleks Math Placement Retest with a score of 66 or SAT Mathematics with a score of 580 or MATH SECTION SCORE with a score of 560) or MATH 1320 with a minimum grade of C- or (Math - Coll Algebra Placement with a score of 15 and Math - Trigonometry Placement with a score of 9)
Term Offered: Spring, Fall
Core Mathematics, OT36 Mathematics

MATH 1730 Calculus with Applications to Business and Finance
[0-5 credit hours]
An introduction to differential and integral calculus. Topics include limits, derivatives, maxima/minima, indefinite and definite integrals with an emphasis on business applications and technology use.
Prerequisites: High School GPA with a score of 3.5 and (ACT Math with a score of 20 or Aleks Math Placement Test with a score of 48 or Aleks Math Placement Retest with a score of 48 or SAT Mathematics with a score of 520 or MATH SECTION SCORE with a score of 490) or (ACT Math with a score of 24 or Aleks Math Placement Test with a score of 68 or Aleks Math Placement Retest with a score of 68 or SAT Mathematics with a score of 580 or MATH SECTION SCORE with a score of 560) or MATH 1320 with a minimum grade of C- or MATH 1330 with a minimum grade of C- or MATH 1340 with a minimum grade of C- or Math - Coll Algebra Placement with a score of 15
Term Offered: Spring, Summer, Fall
Core Mathematics, OT36 Mathematics

MATH 1750 Calculus For The Life Sciences With Applications I
[0-4 credit hours]
Definitions of trigonometric functions, solving trigonometric equations, functions, limits and derivatives, exponential and logarithmic functions, and applications. Course is not applicable toward the undergraduate Mathematics major requirements.
Prerequisites: High School GPA with a score of 3.5 and (ACT Math with a score of 20 or Aleks Math Placement Test with a score of 48 or Aleks Math Placement Retest with a score of 48 or SAT Mathematics with a score of 520 or MATH SECTION SCORE with a score of 490) or (ACT Math with a score of 24 or Aleks Math Placement Test with a score of 68 or Aleks Math Placement Retest with a score of 68 or SAT Mathematics with a score of 580 or MATH SECTION SCORE with a score of 560) or MATH 1320 with a minimum grade of C- or MATH 1330 with a minimum grade of C- or MATH 1340 with a minimum grade of C- or Math - Coll Algebra Placement with a score of 15
Term Offered: Spring, Summer, Fall
Core Mathematics, OT36 Mathematics

MATH 1760 Calculus For The Life Sciences With Applications II
[0-3 credit hours]
Indefinite and definite integrals, probability, vectors, least squares, differential equations. Course is not applicable toward the undergraduate Mathematics major requirements.
Prerequisites: MATH 1750 with a minimum grade of C- or MATH 1850 with a minimum grade of C- or MATH 1830 with a minimum grade of C-
Term Offered: Spring, Summer, Fall
Core Mathematics, OT36 Mathematics

MATH 1850 Single Variable Calculus I
[0-4 credit hours]
Limits, differentiation, Fundamental Theorem of Calculus, curve sketching, maxima/minima, definite and indefinite integrals, applications. Course is not applicable toward the undergraduate Mathematics major requirements.
Prerequisites: High School GPA with a score of 3.5 and (Aleks Math Placement Test with a score of 68 or Aleks Math Placement Retest with a score of 68 or Math - Trigonometry Placement with a score of 12) and (ACT Math with a score of 24 or SAT Mathematics with a score of 580 or MATH SECTION SCORE with a score of 560 or Aleks Math Placement Test with a score of 76 or Aleks Math Placement Retest with a score of 76 or Math - Trigonometry Placement with a score of 12) and (ACT Math with a score of 27 or SAT Mathematics with a score of 640 or MATH SECTION SCORE with a score of 620) or (Math - Coll Algebra Placement with a score of 15 and Math - Trigonometry Placement with a score of 12) or MATH 1340 with a minimum grade of C- or MATH 1330 with a minimum grade of C-
Term Offered: Spring, Summer, Fall
Core Mathematics, OT36 Mathematics

MATH 1860 Single Variable Calculus II
[0-4 credit hours]
Applications and techniques of integration, polar coordinates and calculus of plane curves, infinite series and Taylor series, vectors and geometry of space.
Prerequisites: MATH 1830 with a minimum grade of C- or MATH 1850 with a minimum grade of C-
Term Offered: Spring, Summer, Fall
Core Mathematics, OT36 Mathematics

MATH 1890 Elementary Linear Algebra
[3 credit hours]
Matrix algebra, systems of linear equations, determinants, vector spaces, linear transformations, eigenvalues and eigenvectors, applications, additional topics chosen from Google's page rank algorithm, Digital Image Compression, and others.
Prerequisites: MATH 1840 with a minimum grade of C- or MATH 1860 with a minimum grade of C-
Term Offered: Spring, Summer, Fall
Core Mathematics, OT36 Mathematics

MATH 1980 Topics In Mathematics
[1-4 credit hours]
Selected topics in mathematics.
Term Offered: Spring, Summer, Fall

MATH 2190 Foundations of Mathematics
[3 credit hours]
This course lays the logical and set-theoretic foundations for upper level mathematics courses. Topics include: logical connectives, quantifiers; techniques of proof; set operations; functions; equivalence classes; partitions, cardinality, natural numbers, rationals, real numbers.
Prerequisites: MATH 1830 with a minimum grade of C- or MATH 1850 with a minimum grade of C-
Term Offered: Spring

MATH 2450 Calculus For Engineering Technology I
[0-8 credit hours]
Differential calculus of algebraic and trigonometric functions, including limits, curve sketching, motion, maxima/minima, related rates, integral calculus of algebraic functions.
Prerequisites: High School GPA with a score of 3.5 and (Aleks Math Placement Test with a score of 68 or Aleks Math Placement Retest with a score of 68 or Math - Trigonometry Placement with a score of 12) and (ACT Math with a score of 24 or SAT Mathematics with a score of 580 or MATH SECTION SCORE with a score of 560) or (Aleks Math Placement Test with a score of 76 or Aleks Math Placement Retest with a score of 76 or Math - Trigonometry Placement with a score of 12) and (ACT Math with a score of 27 or SAT Mathematics with a score of 640 or MATH SECTION SCORE with a score of 620) or (Math - Coll Algebra Placement with a score of 15 and Math - Trigonometry Placement with a score of 12) or MATH 1340 with a minimum grade of C- or MATH 1330 with a minimum grade of C-
Term Offered: Spring, Summer, Fall
Core Mathematics, OT36 Mathematics

MATH 2460 Calculus For Engineering Technology II
[0-4 credit hours]
Transcendental functions, methods of integration, applications of the integral, polar coordinates, vectors and vector operation, lines and planes, parametric equations.
Prerequisites: MATH 2450 with a minimum grade of C- or MATH 1850 with a minimum grade of C-
Term Offered: Spring, Summer, Fall
Core Mathematics, OT36 Mathematics

MATH 2600 Introduction To Statistics
[3 credit hours]
An introduction to descriptive and inferential statistical methods including point and interval estimation, hypothesis testing and regression. No credit allowed if taken after MATH 3610 or 4680; credit not allowed for both MATH 2600 and 2630. Course is not applicable toward the undergraduate Mathematics major requirements.
Prerequisites: High School GPA with a score of 3.0 and (ACT Math with a score of 18 or Aleks Math Placement Test with a score of 44 or Aleks Math Placement Retest with a score of 44 or SAT Mathematics with a score of 500 or MATH SECTION SCORE with a score of 460) or (ACT Math with a score of 24 or Aleks Math Placement Test with a score of 56 or Aleks Math Placement Retest with a score of 56 or SAT Mathematics with a score of 580 or MATH SECTION SCORE with a score of 560) or MATH 1200 with a minimum grade of C+ or MATH 1180 with a minimum grade of B+ or Math - Coll Algebra Placement with a score of 10
Term Offered: Spring, Summer, Fall
Core Mathematics, OT36 Mathematics

MATH 2620 Discrete Probability
[3 credit hours]
Sample spaces, events, counting techniques, probability distributions and their applications. No credit if taken after 4680. Course is not applicable toward the undergraduate Mathematics major requirements.
Prerequisites: (High School GPA with a score of 3 and ACT Math with a score of 18 or Aleks Math Placement Test with a score of 44 or Aleks Math Placement Retest with a score of 44 or SAT Mathematics with a score of 500 or MATH SECTION SCORE with a score of 460) or (ACT Math with a score of 24 or Aleks Math Placement Test with a score of 56 or Aleks Math Placement Retest with a score of 56 or SAT Mathematics with a score of 580 or MATH SECTION SCORE with a score of 560) or MATH 1200 with a minimum grade of C+ or MATH 1180 with a minimum grade of B+ or Math - Coll Algebra Placement with a score of 10
Term Offered: Spring

MATH 2640 Statistics for Applied Science
[3 credit hours]
Introduction to statistical methods. Modeling relationships between variables. Basic concepts in probability. Introduction to design of experiments, surveys and observational studies. Overview of statistical procedures used in applied science literature.
Prerequisites: High School GPA with a score of 3.0 and (ACT Math with a score of 18 or Aleks Math Placement Test with a score of 44 or Aleks Math Placement Retest with a score of 44 or SAT Mathematics with a score of 500 or MATH SECTION SCORE with a score of 460) or (ACT Math with a score of 24 or Aleks Math Placement Test with a score of 56 or Aleks Math Placement Retest with a score of 56 or SAT Mathematics with a score of 580 or MATH SECTION SCORE with a score of 560) or MATH 1200 with a minimum grade of C+ or MATH 1180 with a minimum grade of B+ or Math - Coll Algebra Placement with a score of 10
Term Offered: Spring, Fall
Core Mathematics

MATH 2850 Elementary Multivariable Calculus
[4 credit hours]
Geometry of functions of several variables, partial differentiation, multiple integrals, vector algebra and calculus (including Theorems of Green, Gauss and Stokes), and applications.
Prerequisites: MATH 1840 with a minimum grade of C- or MATH 1860 with a minimum grade of C-
Term Offered: Spring, Summer, Fall

MATH 2860 Elementary Differential Equations
[3 credit hours]
An introduction to the analysis and solution of ordinary differential equations with emphasis on the fundamental techniques for solving linear differential equations.
Prerequisites: MATH 2850 with a minimum grade of C-
Term Offered: Spring, Summer, Fall

MATH 2870 Introduction to Differential Equations and Linear Algebra for Engineers
[4 credit hours]
An introduction to principles of matrix algebra and the analysis and solution of ordinary differential equations with an emphasis on engineering applications
Prerequisites: MATH 1860 with a minimum grade of C-
Term Offered: Spring, Summer, Fall

MATH 2890 Numerical Methods And Linear Algebra
[3 credit hours]
Topics include: matrices, characteristic roots, solution of linear and nonlinear equations, curve fitting, integration, differentiation and numerical solution of ordinary differential equations. MATLAB is introduced and used to analyze problems. Additional topics are chosen from Google's page rank algorithm, Digital Image Compression, and others.
Prerequisites: MATH 1830 with a minimum grade of C- or MATH 1850 with a minimum grade of C- or MATH 1920 with a minimum grade of C-
Term Offered: Spring, Summer, Fall

MATH 3000 Symbolic Logic
[3 credit hours]
A study of propositional and predicate logic, the symbolic techniques used to evaluate deductive arguments. Topics may include computability, set theory, Bayesianism and other formal systems with mathematical or philosophical relevance.
Prerequisites: MATH 1180 with a minimum grade of C-
Term Offered: Spring, Fall

MATH 3190 Introduction To Mathematical Analysis
[3 credit hours]
This course is intended to introduce students to mathematical analysis. The focus will be on learning to write clear, rigorous proofs. Topics include set theory and logic, the real number system and its topology, sequences, limits and continuity.
Prerequisites: MATH 1840 with a minimum grade of C- or MATH 1860 with a minimum grade of C-
Term Offered: Fall

MATH 3200 Number Theory
[3 credit hours]
Divisibility, congruences, diophantine equations, numerical functions, quadratic reciprocity.
Prerequisites: MATH 2190 with a minimum grade of C- or MATH 3190 with a minimum grade of C-
Term Offered: Spring, Fall

MATH 3320 Introduction To Abstract Algebra
[3 credit hours]
Sets and mappings, integers, groups, rings and applications.
Prerequisites: MATH 2190 with a minimum grade of C- or MATH 3190 with a minimum grade of C-
Term Offered: Spring

MATH 3440 Fundamentals Of Modern Geometry I
[3 credit hours]
Euclidean geometry from a modern viewpoint, constructions and transformations. Primarily for students in secondary education.
Prerequisites: MATH 1840 with a minimum grade of C- or MATH 1860 with a minimum grade of C-
Term Offered: Fall

MATH 3450 Fundamentals Of Modern Geometry II
[3 credit hours]
Euclidean geometry from a modern viewpoint, constructions and transformations. Primarily for students in secondary education.
Prerequisites: MATH 3440 with a minimum grade of C-
Term Offered: Spring

MATH 3510 History Of Mathematics
[3 credit hours]
Contributions to the development of mathematics by various groups and individuals from the earliest history to the present, with special emphasis on the elementary branches: arithmetic, algebra, geometry and calculus.
Prerequisites: MATH 1840 with a minimum grade of C- or MATH 1860 with a minimum grade of C-
Term Offered: Fall

MATH 3610 Statistical Methods I
[3 credit hours]
Basic probability, sampling, descriptive statistics, statistical inference, regression, correlation, analysis of variance, goodness of fit, model formulation and testing.
Prerequisites: MATH 1840 with a minimum grade of C- or MATH 1860 with a minimum grade of C- or MATH 3190 with a minimum grade of C-
Term Offered: Summer, Fall

MATH 3620 Statistical Methods II
[3 credit hours]
Multiple regression, analysis of covariance, standard experimental designs, contingency tables, nonparametric methods and methods for sample surveys.
Prerequisites: MATH 3610 with a minimum grade of C-
Term Offered: Spring

MATH 3920 Junior Readings
[1-3 credit hours]
Selected subjects in mathematics of special interest to students and the professor.
Term Offered: Spring, Summer, Fall

MATH 4300 Linear Algebra I
[3 credit hours]
Theory of vector spaces and linear transformations, including such topics as matrices, determinants, inner products, eigenvalues and eigenvectors, and rational and Jordan canonical forms.
Prerequisites: MATH 2190 with a minimum grade of C- or MATH 3190 with a minimum grade of C-
Term Offered: Fall

MATH 4330 Abstract Algebra I
[3 credit hours]
Arithmetic of the integers, unique factorization and modular arithmetic; group theory including normal subgroups, factor groups, cyclic groups, permutations, homomorphisms, the isomorphism theorems, abelian groups and p-groups.
Prerequisites: MATH 2190 with a minimum grade of C- or MATH 3190 with a minimum grade of C-
Term Offered: Fall

MATH 4340 Abstract Algebra II
[3 credit hours]
Ring theory including integral domains, field of quotients, homomorphisms, ideals, Euclidean domains, polynomial rings, vector spaces, roots of polynomials and field extensions.
Prerequisites: MATH 4330 with a minimum grade of C-
Term Offered: Spring

MATH 4350 Applied Linear Algebra
[3 credit hours]
Matrices, systems of equations, vector spaces, linear transformations, determinants, eigenvalues and eigenvectors, singular value decomposition, pseudoinverses, rank, numerical methods and applications to various areas, e.g., the Google Matrix or Digital Image Compression or others.
Prerequisites: MATH 1890 with a minimum grade of C- or MATH 2890 with a minimum grade of C-
Term Offered: Spring, Summer

MATH 4380 Discrete Structures And Analysis Of Algorithms
[3 credit hours]
Discrete mathematical structures for applications in computer science such as graph theory, combinatorics, and groups theory, asymptotics, recurrence relations and analysis of algorithms.
Prerequisites: MATH 3320 with a minimum grade of C- or MATH 4330 with a minimum grade of C-
Term Offered: Fall

MATH 4450 Introduction To Topology I
[3 credit hours]
Metric spaces, topological spaces, continuous maps, bases and subbases, closure and interior operators, products, subspaces, sums, quotients, separation axioms, compactness and local compactness.
Prerequisites: MATH 2190 with a minimum grade of C- or MATH 3190 with a minimum grade of C-
Term Offered: Fall

MATH 4460 Introduction To Topology II
[3 credit hours]
Connectedness and local connectedness, convergence, metrization, function spaces. The fundamental groups and its properties, covering spaces, classical applications, e.g. Jordan Curve Theorem, Fundamental Theorem of Algebra, Brouwer's Fixed Point Theorem.
Prerequisites: (MATH 4450 with a minimum grade of C- and MATH 3320 with a minimum grade of C-) or (MATH 4450 with a minimum grade of C- and MATH 4330 with a minimum grade of C-)
Term Offered: Spring

MATH 4540 Classical Differential Geometry I
[3 credit hours]
Smooth curves in Euclidean space including the Frenet formulae. Immersed surfaces with the Gauss map, principal curvatures and the fundamental forms. Special surfaces including ruled surfaces and minimal surfaces. Intrinsic Geometry including the Gauss Theorem Egregium.
Prerequisites: MATH 2860 with a minimum grade of C-

MATH 4550 Classical Differential Geometry II
[3 credit hours]
Tensors, vector fields, and the Cartan approach to surface theory, Bonnet's Theorem and the construction of surfaces via solutions of the Gauss Equation. Geodesics parallel transport, and Jacobi Fields. Theorems of a global nature such as Hilbert's Theorem or the Theorem of Hopf-Rinow.
Prerequisites: MATH 4540 with a minimum grade of C-

MATH 4600 Advanced Statistical Methods I
[3 credit hours]
Basics of descriptive statistics, study designs and statistical inference. Properties of, and assumptions required for, inference for means, variances, and proportions from one and two-sample paired and unpaired studies. Introduction to ANOVA with multiple comparisons. Model assessment and diagnostics. Statistical software will be employed. Opportunities to apply procedures to real data. Emphasis placed on the foundations to approaches in introductory statistics.
Prerequisites: MATH 2600 with a minimum grade of D- or MATH 2640 with a minimum grade of D- or MATH 3610 with a minimum grade of D- or MATH 4690 with a minimum grade of D-
Term Offered: Fall

MATH 4610 Applications Of Statistics II
[3 credit hours]
Continuation of Applications of Statistics I.
Prerequisites: MATH 4600 with a minimum grade of C-
Term Offered: Spring

MATH 4620 Theory Of Interest
[3 credit hours]
This course covers the measurement of interest, certain annuities, yield rates, amortization and sinking funds, bonds and other securities and application of interest theory.
Prerequisites: MATH 1840 with a minimum grade of C- or MATH 1860 with a minimum grade of C-
Term Offered: Spring, Fall

MATH 4640 Statistical Computing
[3 credit hours]
Modern statistical computing, including programming tools, modern programming methodologies, design of data structures and algorithms, numerical computing and graphics. Additional topics selected from simulation studies, rejection sampling, importance sampling, Monte Carlo integration, and bootstrapping.
Prerequisites: MATH 3610 with a minimum grade of C- or MATH 4600 with a minimum grade of C- or MATH 4690 with a minimum grade of C-
Term Offered: Fall

MATH 4680 Introduction To Theory Of Probability
[3 credit hours]
Probability spaces, random variables, probability distributions, moments and moment generating functions, limit theorems, transformations and sampling distributions.
Prerequisites: MATH 2850 with a minimum grade of C-
Term Offered: Summer, Fall

MATH 4690 Introduction To Mathematical Statistics
[3 credit hours]
Sampling distributions, point and interval estimation, hypothesis testing, regression and analysis of variance.
Prerequisites: MATH 4680 with a minimum grade of C-
Term Offered: Spring

MATH 4710 Methods Of Numerical Analysis I
[3 credit hours]
Floating point arithmetic; polynomial interpolation; numerical solution of nonlinear equations; Newton's method. Likely topics include: numerical differentiation and integration; solving systems of linear equations; Gaussian elimination; LU decomposition; Gauss-Seidel method.
Prerequisites: MATH 2860 with a minimum grade of C-
Term Offered: Spring, Fall

MATH 4720 Methods Of Numerical Analysis II
[3 credit hours]
Likely topics include: Computation of eigenvalues and eigenvectors; solving systems of nonlinear equations; least squares approximations; rational approximations; cubic splines; fast Fourier transforms; numerical solutions to initial value problems; ordinary and partial differential equations.
Prerequisites: MATH 4710 with a minimum grade of C-
Term Offered: Spring

MATH 4760 Actuarial Mathematics I
[3 credit hours]
Short-term insurance and reinsurance coverages; severity, frequency and aggregate models; parametric estimation; introduction to credibility; pricing and reserving for short-term insurance coverages; option pricing fundamentals.
Prerequisites: MATH 4680 (may be taken concurrently) with a minimum grade of C-
Term Offered: Fall

MATH 4770 Actuarial Mathematics II
[3 credit hours]
Long-term insurance coverages and retirement financial security programs, mortality models, present value random variables for long-term insurance coverages, premium and policy value calculation for long-term insurance coverages.
Prerequisites: MATH 4760 (may be taken concurrently) with a minimum grade of C-
Term Offered: Spring

MATH 4780 Advanced Calculus
[3 credit hours]
Extrema for functions of one or more variables, Lagrange multipliers, indeterminate forms, inverse and implicit function theorems, uniform convergences, power series, transformations, Jacobians, multiple integrals.
Prerequisites: MATH 2850 with a minimum grade of C-

MATH 4800 Ordinary Differential Equations
[3 credit hours]
Modern theory of differential equations; transforms and matrix methods; existence theorems and series solutions; and other selected topics.
Prerequisites: MATH 2860 with a minimum grade of C-
Term Offered: Spring, Fall

MATH 4810 Partial Differential Equations
[3 credit hours]
First and second order equations; numerical methods; separation of variables; solutions of heat and wave equations using eigenfunction techniques; and other selected topics.
Prerequisites: MATH 2860 with a minimum grade of C-
Term Offered: Spring

MATH 4820 Introduction To Real Analysis I
[3 credit hours]
The real number system; continuity and differentiability of functions; convergence of sequences and series; applications.
Prerequisites: MATH 2190 with a minimum grade of C- or MATH 3190 with a minimum grade of C-
Term Offered: Fall

MATH 4830 Introduction To Real Analysis II
[3 credit hours]
Riemann Integral; limits of functions; elementary metric space theory including compactness, connectedness and completeness. Optional topics include differentiable functions on Rn; the Implicit and Inverse Function Theorems.
Prerequisites: MATH 4820 with a minimum grade of C-
Term Offered: Spring

MATH 4880 Complex Variables
[3 credit hours]
Analytic functions; Cauchy's theorem; Taylor and Laurent series; residues; contour integrals; conformal mappings, analytic continuation and applications.
Prerequisites: MATH 2860 with a minimum grade of C-
Term Offered: Spring

MATH 4900 Senior Seminar
[1-3 credit hours]
Seminar on a topic not usually covered in a course. Library research and paper to be expected.
Term Offered: Spring, Summer, Fall

MATH 4920 Senior Readings
[1-3 credit hours]
Selected subjects in mathematics of special interest to students and the professor. (By arrangement with professor and student.)
Term Offered: Spring, Summer, Fall

MATH 4940 Internship in the Mathematical Sciences
[3 credit hours]
MATH 4940 Co-Op Experience [3 credit hours] Approved internship experience. Course may be repeated for credit with departmental permission. Terms Offered: Spring, Summer, Fall
Term Offered: Spring, Summer, Fall

MATH 4960 Actuarial Science Problem Seminar
[1-3 credit hours]
The primary activity will be student solution and presentation of problems of a type given on actuarial exams.
Term Offered: Spring, Fall

Honors in Mathematics

1. **Admission:** Students are normally admitted to departmental honors after completing honors sections of:

Code	Title	Hours
MATH 1850	Single Variable Calculus I	4
MATH 1860	Single Variable Calculus II	4
In addition Departmental Honors requires students to enroll in 3 additional honors sections of courses in the major numbered 2190 or higher.		9
Total Hours		**17**

Students may also be admitted to the program at the discretion of the Math Majors Committee and should consult the departmental undergraduate advisor.

2. **Requirements:** Graduation with honors in mathematics depends upon doing a substantial amount of work in mathematics beyond the requirements of the bachelor's degree. To graduate with departmental honors in mathematics a student must ordinarily maintain a GPA in mathematics greater than 3.5 and write an expository paper on a topic in mathematics that demonstrates knowledge of the subject matter significantly beyond the expectations of the student's course work. The research and writing of the paper is conducted under the supervision of a faculty member with an interest in the subject, and as a part of fulfilling this requirement the student must enroll in either the junior or senior reading class, MATH 3920 or MATH 4920, that counts as an elective in the major. The actual details of the student's program are determined by consulting with the Department's honors advisor and the student's topic supervisor.