MATHEMATICS AND STATISTICS

Department Information

Department of Mathematics and Statistics website
https://www.southalabama.edu/colleges/artsandsci/mathstat/

Developmental Studies

The courses and academic support through an on-demand tutoring center offered by the developmental studies in mathematics provide students with the opportunity to strengthen the basic mathematical skills necessary to progress to college-level mathematics courses.

Credits earned in courses with a DS prefix do not meet degree requirements within the University. The credits earned do carry institutional, non-degree credit and allow students to qualify for financial aid. Grades earned are computed into the overall GPA in most colleges and hours are counted toward classification (sophomore, etc.). Credits earned in courses with a MTH prefix count as free electives.

Math Lab Information
Location
The Math Technology Lab is located in ASC 1301.

Resources:

- 210 computer workstations with Internet access
- Separate testing area and private tutoring rooms
- Study room for one-on-one or group tutoring
- Tutors and instructors available during all operating hours to assist students

Undergraduate Studies

The purpose of the Department of Mathematics and Statistics is to provide a well-rounded program for students majoring in the mathematical sciences and to fulfill the mathematical science needs of students in other fields of study. To this end, the department emphasizes excellence in teaching, and encourages the professional growth of its faculty through study, research, and consulting.

The Department offers a major leading to the Bachelor of Science Degree in Mathematics and Statistics. We also offer a minor in mathematics and a minor in applied statistics. Students pursuing a degree in Mathematics and Statistics also must have a minor in another discipline.

All first-time freshmen must successfully complete CAS 100 as a degree requirement. Students must enroll during their first term at USA, except for summer-entry students who must enroll in the fall semester following entry.

Where to Begin in the Mathematics Courses?
Students must begin at the proper level and in the proper track in mathematics. Students who lack college level credit in mathematics should take the placement exam at least 48 hours prior to registering for a mathematics course. Students must register online to take the test. Times and days of the test as well as registration information are available at the department website.

Graduate Studies

A Master of Science degree in Mathematics is offered by the Department of Mathematics and Statistics. The program has been designed to meet the varied needs and goals of most students seeking advanced degrees in mathematics. The course of study accommodates students interested in traditional and modern mathematics, applied mathematics, statistics, and computer science.

Requirements for Admission

Students are admitted each semester. The following criteria supplement the Graduate School requirements.

Regular Admission

1. A bachelor's degree in mathematics or in a mathematics-related field from an accredited institution of higher education with a concentration of upper-level mathematics courses including a sequence in advanced calculus, or real analysis, or coursework which clearly demonstrates readiness for a graduate program in mathematics.
2. A minimum GPA of at least a 3.0 on all undergraduate work. In exceptional cases, applicants may be considered with at least a 2.5 GPA on all undergraduate work, or at least a 2.75 GPA on the last 60 hours of undergraduate work.
3. Submission of scores on the General Test of the Graduate Record Examination. A minimum combined score of 297 on the verbal and quantitative sections or a minimum score of 148 on the quantitative section (without regard to the score on the verbal section). An advanced degree or other standardized test score may be considered in lieu of a GRE score.
4. English proficiency requirement for international applicants:
   - Minimum Duolingo Score of 100 **or**
   - Minimum TOEFL score of 71 **or**
   - Minimum IELTS score of 6 **or**
   - Minimum iTEP score 3.7 **or**
   - Minimum Pearsons (PTE Academic) score 48

   Applicants who hold a bachelor's degree from an accredited U.S. institution are not required to submit test scores.
5. Three original letters of recommendation written by persons familiar with the applicant's qualifications and ability to undertake the proposed course of study are required.

Non-Degree Admission

Applicants who do not meet all the conditions for admission or who are not interested in earning a graduate degree may apply for non-degree admission. Adequate undergraduate preparation in mathematics which indicates a reasonable chance of success in graduate mathematics courses is required for non-degree admission. After admission, permission of the department graduate coordinator is required for each course taken. In cases where undergraduate preparation is inadequate for a particular graduate course, a plan of study including additional undergraduate courses can be worked out in consultation with the graduate coordinator.

Graduate Assistantships

Graduate students holding assistantships are usually assigned duties such as tutoring or supervising recitation sections in the Department of Mathematics and Statistics. Awards are normally made for the academic year, but one semester awards are occasionally possible. An assistantship application can be obtained from the Graduate Coordinator in the department and on- line. Three letters of recommendation sent

directly to the Graduate Coordinator are required. Graduate Assistants are required to enroll in MA 592 (Seminar) each semester.

Policies and Procedures

The document "Department Policies and Procedures for the MS Degree Program in Mathematics" is posted on the departmental website. It contains details concerning advising, the comprehensive examination, graduate assistant duties, student meetings and colloquia.

Degrees, Programs, or Concentrations

- Applied Statistics Graduate Certificate (http://bulletin.southalabama.edu/programs-az/arts-sciences/mathematics-statistics/applied-statistics-graduate-certificate/)
- Applied Statistics Minor (http://bulletin.southalabama.edu/programs-az/arts-sciences/mathematics-statistics/applied-statistics-minor/)
- Mathematics (MS) - Non-Thesis Option (http://bulletin.southalabama.edu/programs-az/arts-sciences/mathematics-statistics/mathematics-ms-non-thesis-option/)
- Mathematics (MS) - Non-Thesis Option with Computer Science Emphasis (http://bulletin.southalabama.edu/programs-az/arts-sciences/mathematics-statistics/mathematics-ms-non-thesis-option-computer-science-emphasis/)
- Mathematics (MS) - Thesis Option (http://bulletin.southalabama.edu/programs-az/arts-sciences/mathematics-statistics/mathematics-ms-thesis-option/)
- Mathematics and Statistics Major (BS) (http://bulletin.southalabama.edu/programs-az/arts-sciences/mathematics-statistics/mathematics-statistics-major-bs/)
- Mathematics Minor (http://bulletin.southalabama.edu/programs-az/arts-sciences/mathematics-statistics/mathematics-minor/)

Courses

Mathematics (MA)

MA 100 Mathematics in Society 3 cr
An introduction and real life applications to the mathematics of finance, probability, and descriptive statistics with particular emphasis on mathematics of finance. Specific topics include geometric progressions, compound interest, annuities, perpetuities, permutations, combinations, probability measure, and statistical measures of central location and dispersion. This course does not satisfy the mathematics requirement for General Studies.

MA 101 Intro to Mathematical Thought 3 cr
A course designed to give the nonscience major-especially humanities and fine arts majors-an appreciation of the method, content, and scope of mathematics. This course does not satisfy the mathematics requirement for General Studies.

MA 105 Algebra for Math Placement 4 cr
Introduction to equations of straight lines in various forms and transition between these forms; Manipulation and solution of linear equations and linear inequalities; graphing solution sets on the number line and expression of solution sets in both set and interval notation. Simplification, multiplication, and division of polynomials; Factoring quadratic expressions and the solution of quadratic equations by factoring; Solution of basic rational equations; Addition, subtraction, multiplication and division of rational expressions; simplification of complicated ratios of rational expressions. Working with set operations: Absolute value inequalities and equations and compound inequalities; Addition, subtraction, multiplication, division, and simplification of expressions with radicals and/or rational exponents and rationalization of numerator or denominator. Credit for both MTH 100, MTH 101 and MA 105 is not allowed.

MA 110 Finite Mathematics 3 cr
This course is intended to give an overview of topics in finite mathematics together with their applications. The course includes logic, sets, counting, permutations, combinations, basic probability, descriptive statistics and their applications, and financial mathematics. Students are required to have a scientific calculator. Core Course. Note: May be offered for Honors credit. NOTE: MA 110 is not a Pre-requisite for nor is it intended to be preparatory for any course except MA 201 and MA 202.

MA 111 Math in Society 3 cr
This course focuses on developing mathematical concepts and interpreting data used in society. Topics may include percentage, creating and analyzing different types of graphs, estimation, apportionment, linear and exponential growth, simple and compound interest, and descriptive statistics. An emphasis on technology such as Excel will be prevalent.

MA 112 Precalculus Algebra 3 cr
The course covers algebraic, graphical and numerical properties of functions, focusing on linear, quadratic, general polynomial, absolute value, rational, exponential, and logarithmic functions. Topics also include equations, inequalities, and complex numbers. Applications of mathematics to modeling real world situations are emphasized. Credit for both MA 112 and MA 115 not allowed. Core Course.
Prerequisite: A02 22 or MTH 100 (may be taken concurrently) Minimum Grade of C or MMT 070 or MTH 101 Minimum Grade of C or MA 105 Minimum Grade of C or S02 510 or S12 540

MA 113 Precalculus Trigonometry 3 cr
Continuation of MA 112. Topics include numerical, graphical and algebraic properties of trigonometric functions, inverse trigonometric functions, right angle trigonometry, parametric equations, polar coordinates, and conic sections. Development and application of mathematical models to real-world situations is emphasized. Credit for both MA 113 and MA 115 not allowed. Core Course.
Prerequisite: A02 24 or MMT 080 or MA 112 Minimum Grade of C or S02 560 or S12 580 or SS2 24

MA 115 Precal Algebra-Trigonometry 4 cr
This fast-paced course is designed as a review of the algebra and trigonometry needed in calculus. It covers the material of MA 112 and MA 113 in one semester. Topics include numerical, graphical and algebraic properties of polynomial, rational, exponential, logarithmic, and trigonometric functions; inverse trigonometric functions; right angle trigonometry; parametric equations; polar coordinates and conic sections. Applications of mathematics to modeling real world situations are emphasized. Credit for both MA 112 and MA 115 not allowed; credit for both MA 113 and MA 115 not allowed. Core Course.
Prerequisite: A02 25 or MMT 080 or S02 570 or S12 590 or SS2 25

MA 120 Calculus and Its Applications 3 cr
Introduction to calculus with an emphasis on problem solving and applications. Key concepts are presented graphically, numerically and algebraically, although the stress is on a clear understanding of graphs and tabular data. The course covers: algebraic, exponential and logarithmic functions, their properties and their use in modeling; the concepts of derivative and definite integral and applications. Credit for both MA 120 and MA 125 not allowed. MA 120 is not a prerequisite for subsequent calculus courses. Core Course.
Prerequisite: A02 24 or MMT 080 or MA 112 Minimum Grade of C or MA 113 Minimum Grade of C or MA 115 Minimum Grade of C or S02 560 or S12 580 or SS2 24

MA 125 Calculus I 4 cr
The course provides an introduction to calculus with emphasis on differential calculus. Topics include limits of functions, derivatives of algebraic and transcendental functions, application of the derivative to curve sketching, optimization problems, and examples in the natural sciences, engineering, and economics. The course concludes with an introduction to anti-derivatives, definite integrals, and the fundamental theorem of calculus. Credit for both MA 120 and MA 125 is not allowed. Prerequisite: Sufficient Mathematics Placement Exam score. Core Course. NOTE: MA 110, MA 112, MA 113, MA 115, MA 120, and MA 125 have strict Pre-requisites. To be able to enroll in these courses a student needs either to pass the Pre-requisite course with C or better or to have a sufficient Mathematics Placement Exam score.
Prerequisite: A02 27 or MMT 090 or MA 113 Minimum Grade of C or MA 115 Minimum Grade of C or S02 620 or S12 640 or SS2 27

MA 126 Calculus II 4 cr
This course is a continuation of MA 125 with emphasis on integral calculus. Topics include techniques of integration; applications of the definite integral to geometry, natural sciences, engineering, and economics; improper integrals; infinite sequences and series; Taylor polynomials and Taylor series; parametric equations and polar coordinates. Core Course.
Prerequisite: MA 125 Minimum Grade of C

MA 150 Contemporary Math-Stat Seminar 1 cr
This course gives an overview of modern mathematics and statistics from the point of view of the practitioners. The course is designed for majors in mathematics and statistics at all levels as well as those student who are considering mathematics or statistics as a major or minor area of study. Topics usually included are elements of geometry, algebra, analysis, methods of statistical inference, the role of the computer in the analytical sciences; these topics vary from semester to semester. This course cannot be taken for credit simultaneously with ST 150. NOTE: May be offered for Honors Credit.

MA 201 Math for Elem Teachers I 3 cr
An examination of some of the major ideas encountered in K-6 mathematics. Topics include introduction to problem solving, numeration systems, modeling arithmetic operations of whole numbers, elementary number theory, properties and operations for whole numbers, integers, rational numbers and real numbers. An emphasis on problem solving is prevalent in this course. NOTE: MA 201 does not fulfill graduation requirements for any curriculum other than College of Education and Professional Studies.
Prerequisite: MA 110 Minimum Grade of C or MA 112 Minimum Grade of C or MA 113 Minimum Grade of C or MA 115 Minimum Grade of C or MA 120 Minimum Grade of C or MA 125 Minimum Grade of C or MA 150 Minimum Grade of C

MA 202 Math for Elem Teachers II 3 cr
An examination of some of the major topics encountered in teaching geometry in K-6 mathematics. Topics include geometric shapes in the plane and in space, U.S. and metric systems of measurement, perimeter and area of shapes in the plane, the Pythagorean Theorem, surface area and volume of figures in space, and coordinate geometry. An emphasis on problem solving is prevalent in this course. NOTE: MA 202 does not fulfill graduation requirements for any curriculum other than College of Education and Professional Studies.
Prerequisite: MA 110 Minimum Grade of C or MA 112 Minimum Grade of C or MA 113 Minimum Grade of C or MA 115 Minimum Grade of C or MA 120 Minimum Grade of C or MA 125 Minimum Grade of C or MA 150 Minimum Grade of C

MA 227 Calculus III 4 cr
Vectors; functions of several variables; partial derivatives; local linearity; directional derivatives; the gradient; differential of a function; the chain rule; higher order partial derivatives; optimization of functions of several variables; multiple integrals and their applications; parametric curves and surfaces; vector fields; line and surface integrals; vector calculus. Core Course.
Prerequisite: MA 126 Minimum Grade of C

MA 237 Linear Algebra I 3 cr
This course provides an introduction to linear algebra. Topics include systems of linear equations, matrices, Gaussian elimination, rank, linear independence, subspaces, basis, dimension, linear transformations, determinants, eigenvalues and eigenvectors, change of basis, diagonalization, the abstract concept of a vector space, and applications. Core Course.
Prerequisite: MA 126 Minimum Grade of C

MA 238 Differential Equations I 3 cr
This course provides an introduction to ordinary differential equations. Topics include first order differential equations, higher order linear differential equations, systems of first order linear differential equations, Laplace transforms, methods for approximating solutions to first order differential equations, applications. Students should have taken or be taking MA 227. Core Course.
Prerequisite: MA 126 (may be taken concurrently) Minimum Grade of C

MA 267 Discrete Math Structures 3 cr
This course is an introduction to discrete mathematics for students majoring in computer-related areas. Students will be introduced to concepts and methods that are essential to theoretical computer science. A strong emphasis is placed on mathematical reasoning and proofs. Topics include sets, functions, induction, recursion, combinatorics and graphs. Students must have sufficient mathematics placement exam score.
Prerequisite: A02 24 or MMT 080 or MA 113 Minimum Grade of C or MA 115 Minimum Grade of C or SS2 24

MA 290 Special Topics - 1-3 cr
Selected topics in elementary undergraduate mathematics. This course may be repeated for a maximum of six credits.

MA 303 Math for Elem Teachers III 3 cr
An exploration of problem solving strategies. Problems exemplifying the various problem solving strategies studied. Emphasis on the development of problem solving skills by exploring interesting problems which demand for their solution that the student select from a wide variety of possible strategies and use a wide variety of conceptual tools. NOTE: MA 303 does not fulfill graduation requirements for any curriculum other than elementary education.
Prerequisite: MA 202 Minimum Grade of C and MA 201 Minimum Grade of C

MA 311 Intro to Number Theory 3 cr
An introduction to classical number theory with a balance between theory and computation. Topics include mathematical induction, divisibility properties, properties of prime numbers, the theory of congruences, number theoretic functions, continued fractions.
Prerequisite: MA 126 Minimum Grade of C

MA 316 Linear Algebra II 3 cr
A continuation of MA 237. Topics include inner product spaces, spectral theorem for symmetric operators, complex vector spaces, Jordan canonical form. Additional topics such as duality and Tensor products among others to be included at the discretion of the instructor.
Prerequisite: MA 237 Minimum Grade of C

MA 318 Matrix Theory 3 cr
A theoretical as well as computational treatment of the notions of determinant, inverse, rank and diagonalization of a matrix with real and complex entries. Eigenvalues and eigenvectors, similarity, solutions of linear systems of algebraic equations, Jordan canonical forms. Students are required to have a graphing calculator.
Prerequisite: (MA 126 Minimum Grade of C or MA 233 Minimum Grade of C)

MA 320 Foundations of Math - W 3 cr
A transition to higher mathematics with an emphasis on proof techniques. Topics include symbolic logic, elementary set theory, induction, relations, functions, and the structure of the number system. Mathematics and Statistics majors are encouraged to take MA 320 as soon as possible after completing MA 125.
Prerequisite: MA 125 Minimum Grade of C and (EH 102 Minimum Grade of C or EH 105 Minimum Grade of C)

MA 321 Elementary Geometry 3 cr
This course covers the major topics from the secondary school curriculum of plane and solid geometry from a modern viewpoint. Emphasis will be placed on axioms, undefined terms, definitions, theorems, and proofs. Topics include straightedge and compass constructions, Euclidean geometry, Euclidean space, congruence, isometry, reflection, rotation, translation, vectors, parallel postulate, similarity, Pythagorean theorem, coordinate geometry, non-Euclidean geometry, projective geometry, projective space, perspective, homogenous coordinates.
Prerequisite: MA 320 Minimum Grade of C

MA 332 Differential Equations II 3 cr
Series solutions of second order linear equations. Numerical methods. Nonlinear differential equations and stability. Partial differential equations and Fourier series. Sturm-Liouville problems.
Prerequisite: MA 227 Minimum Grade of C and MA 238 Minimum Grade of C

MA 334 Advanced Calculus I 3 cr
This is the first of a two course sequence designed to provide students with the theoretical context of concepts encountered in MA 125 through MA 227. Topics covered include Completeness Axiom, sequences of real numbers, suprema and infima, Cauchy sequences, open sets and accumulation points in Euclidean space, completeness of Euclidean space, series of real numbers and vectors, compactness, Heine- Borel Theorem, connectedness, continuity, Extremum Theorem, Intermediate Value Theorem, differentiation of functions of one variable.
Prerequisite: MA 227 Minimum Grade of C and MA 237 Minimum Grade of C and MA 320 Minimum Grade of C
Cross-Listed: MA 486

MA 335 Advanced Calculus II 3 cr
This is the second of a two course sequence designed to provide students with the theoretical context of concepts encountered in MA 125 through MA 227. Topics covered include integration of functions of one variable, pointwise and uniform convergence, integration and differentiation of series, differentiable mappings of several variables, chain rule, product rule and gradients, Mean Value Theorem, Taylor's Theorem, Inverse Function Theorem, Implicit Function Theorem.
Prerequisite: MA 334 Minimum Grade of C
Cross-Listed: MA 487

MA 354 Comp Assist Math Modeling - W 3 cr
This course is intended to provide the basic ideas regarding formulation, development, testing and reporting of mathematical models of various real world problems. Deterministic and stochastic models, optimization and simulations will be covered. Emphasis will be on careful mathematical formulations and the use of computer software, such as Microsoft Excel, Mathematica and Matlab. A term project will be an important component of this course. The course is taught in a laboratory setting with computers as lab equipment.
Prerequisite: (EH 102 Minimum Grade of C or EH 105 Minimum Grade of C) and MA 227 Minimum Grade of C and MA 238 Minimum Grade of C

MA 367 Combinatorial Enumeration 3 cr
An introduction to the mathematical theory of counting. Topics covered are: basic counting principles, permutations, combinations, pigeonhole principle, inclusion-exclusion principle, partitions, recurrence relations, generating functions, and enumeration under group action.
Prerequisite: (MA 126 Minimum Grade of C and MA 267 Minimum Grade of C) or (MA 320 Minimum Grade of C)

MA 390 Special Topics 1-3 cr
Selected topics in advanced undergraduate mathematics. This course may be repeated for a maximum of six credits.

MA 410 History of Mathematics - W 3 cr
Historical survey of the general development of mathematics with a balance of historical perspective and mathematical structure. CLEP College Composition score of 50 OR EH 102 OR EH 105 is required for W component.
Prerequisite: ((EH 102 Minimum Grade of C or MA 320 Minimum Grade of C) and EDM 310 (may be taken concurrently) Minimum Grade of C)

MA 413 Abstract Algebra I - W 3 cr
An introduction to group theory and ring theory. Topics include permutations and symmetries, subgroups, quotient groups, homomorphisms, as well as examples of rings, integral domains, and fields. CLEP College Composition score of 50 OR EH 102 OR EH 105 is required for W component.
Prerequisite: MA 237 Minimum Grade of C and (MA 311 Minimum Grade of C or MA 320 Minimum Grade of C) and (EH 102 Minimum Grade of C or EH 105 Minimum Grade of C)

MA 414 Abstract Algebra II - W 3 cr
A continuation of MA 413 focusing on rings and fields. Topics include rings, ideals, integral domains, fields and extension fields. Geometric constructions and Galois theory are introduced.
Prerequisite: MA 413 Minimum Grade of C and (EH 102 Minimum Grade of C or EH 105 Minimum Grade of C)

MA 425 Graph Theory 3 cr
The purpose of this course is to give a first introduction to classical and modern methods in graph theory for majors in mathematics, computer science, and engineering. The goal is to enable the students to apply the basic concepts and methods in graph theory to the design and analysis of computer algorithms, to solving problems in graph theory, and to model applications in science and engineering.
Prerequisite: (MA 237 Minimum Grade of C or MA 320 Minimum Grade of C or MA 367 Minimum Grade of C)

MA 434 Topology 3 cr
An introduction to topology with emphasis on the geometric aspects of the subject. Topics covered include surfaces, topological spaces, open and closed sets, continuity, compactness, connectedness, product spaces, and identification and quotient spaces. Credit for both MA 434 and MA 542 is not allowed.
Prerequisite: MA 227 Minimum Grade of C and MA 237 Minimum Grade of C and MA 320 Minimum Grade of C

MA 436 Numerical Analysis 3 cr
This course provides an introduction to numerical analysis. Topics include numerical solutions of nonlinear equations, numerical differentiation and integration, interpolation and splines, as well as numerical methods for differential equations. An essential part of the course is the implementation and error analysis of discussed numerical methods in Python. No prior programming skills are required. Credit for both MA 436 & MA 565 is not allowed.
Prerequisite: MA 227 Minimum Grade of C and MA 238 (may be taken concurrently) Minimum Grade of C

MA 437 Complex Variables 3 cr
Arithmetic of complex numbers; regions in the complex plane, limits, continuity and derivatives of complex functions; elementary complex functions; mapping by elementary functions; contour integration, power series, Taylor series, Laurent series, calculus or residues; conformal representation; applications. Credit for both MA 437 and MA 537 not allowed.
Prerequisite: MA 238 Minimum Grade of C

MA 451 Probability 3 cr
A comprehensive introduction to probability, the mathematical theory used to model uncertainty, covering the axioms of probability, random variables, expectation, classical discrete and continuous families of probability models, the law of large numbers and the central limit theorem. Credit for both MA 451 and MA 550 is not allowed.
Prerequisite: MA 227 Minimum Grade of C and MA 237 Minimum Grade of C

MA 452 Financial Mathematics 3 cr
Introduction to financial mathematics and a brief introduction to financial economics. Students will learn about the time value of money, annuities, loans, bonds, general cash flows and portfolios, immunization, general derivatives, options, forwards and futures, swaps and hedging from the point of view of an actuarial scientist.
Prerequisite: MA 126 Minimum Grade of C

MA 458 Operations Research - W 3 cr
An introduction to linear programming. The course will include a study of the simplex method as well as using computers to solve linear systems of equations. As time permits, topics covered will include sensitivity analysis, duality, integer programming, transportation, assignment, transshipment, and networks. Credit for both MA 458 and MA 567 is not allowed.
Prerequisite: MA 237 Minimum Grade of C and (EH 102 Minimum Grade of C or EH 105 Minimum Grade of C)

MA 467 Mathematical Logic 3 cr
An introduction to formal first-order logic, first-order metatheory, and its extensions. Topics include axiom systems and their models, completeness, compactness, and recursive sets and functions. Identical with PHL 467. Credit cannot be received for both PHL 467 and MA 467.
Prerequisite: (PHL 321 Minimum Grade of C or MA 320 Minimum Grade of C)
Cross-Listed: PHL 467

MA 481 Cryptography 3 cr
This course provides an introduction to classical and modern methods of message encryption and decryption (cryptography) as well as possible attacks to cryptosystems (cryptanalysis). Topics include classical (symmetric) cryptosystems (DES, AES), public-key (asymmetric) cryptosystems (Diffie-Hellman, RSA, ElGamal), modes of operation, one-way and trapdoor functions, Hash functions, cryptographic protocols. Credit for both MA 481 and MA 581 is not allowed.
Prerequisite: MA 311 Minimum Grade of C or (MA 126 Minimum Grade of C and MA 267 Minimum Grade of C)
Cross-Listed: MA 581

MA 486 Advanced Calculus I 3 cr
This is the first of a two-course sequence designed to provide students with the theoretical context of concepts encountered in MA 125 through MA 227. Topics covered include Completeness Axiom, sequences of real numbers, suprema and infima, Cauchy sequences, open sets and accumulation points in Euclidean space, completeness of Euclidean space, series of real numbers and vectors, compactness, Heine-Borel Theorem, connectedness, continuity, Extremum Theorem, Intermediate Value Theorem, differentiation of functions of one variable.
Prerequisite: (MA 227 Minimum Grade of C and MA 237 Minimum Grade of C and MA 320 Minimum Grade of C)
Cross-Listed: MA 334

MA 487 Advanced Calculus II 3 cr
This is the second of a two course sequence designed to provide students with the theoretical context of concepts encountered in MA 125 through MA 227. Topics covered include integration of functions of one variable, pointwise and uniform convergence, integration and differentiation of series, differentiable mappings of several variables, chain rule, product rule and gradients, Mean Value Theorem, Taylor's Theorem, Inverse Function Theorem, Implicit Function Theorem.
Prerequisite: (MA 486 Minimum Grade of C)
Cross-Listed: MA 335

MA 490 Special Topics 1-3 cr
Selected topics in advanced undergraduate mathematics. This course may be repeated for a maximum of six credits.

MA 494 Directed Studies 1-3 cr
Directed individual study. Requires permission of department chair.

MA 499 Honors Senior Project - H 3-6 cr
With the guidance and advice of a faculty mentor, honors students will identify, and carry out a research project in Mathematics. The outcome of the research project will include a formal presentation at the annual Honors Student Colloquium. The senior project will be judged and graded by three members of the faculty, chaired by the faculty mentor.

MA 501 Functions and Modeling 3 cr
This course is designed for secondary mathematics education majors. The emphasis of this course is to engage in activities that will strengthen students? knowledge of common topics covered in secondary mathematics, and how these topics correlate to college mathematics. An emphasis on using multiple representations, data analysis, technology, and problem-solving is prevalent in this course. Students will also be asked to explain their reasoning through writing assignments and provide mathematical proofs to problems.
Prerequisite: MA 126 Minimum Grade of C

MA 502 Intro to Abstract Algebra 3 cr
An introduction to the fundamental concepts of modern algebra such as groups, rings, and fields through concrete examples. This course is designed for graduate students in the College of Education and Professional Studies.
Prerequisite: MA 126 Minimum Grade of C

MA 503 Introduction to Analysis 3 cr
A careful look at the elements, procedures, and applications of differential and integral calculus. This course is designed for graduate students in the College of Education and Professional Studies.
Prerequisite: MA 126 Minimum Grade of C

MA 504 Introduction to Geometry 3 cr
An introduction to the foundations of geometry using both synthetic and metric approaches. Euclidean, finite, projective, and hyperbolic geometrics are discussed. The axioms for various geometries are discussed. The course is designed for graduate students in the College of Education and Professional Studies.
Prerequisite: MA 126 Minimum Grade of C

MA 505 Mathematical Problem Solving 3 cr
An in-depth activity-based approach to the methods and strategies for mathematical problem solving for students in Mathematical Education. Problems selected from logic, algebra, analysis, geometry, combinatorics, number theory and probability. This course is designed for graduate students in the College of Education and Professional Studies.
Prerequisite: MA 126 Minimum Grade of C

MA 506 Statistics for Teachers 3 cr
Prepares in-service and pre-service teachers to teach statistics in high schools using data-based approach. Uses hands-on-activities approach and simulation of situations to teach concepts and technology to teach data analysis. This course is designed for graduate students in the College of Education and Professional Studies.
Prerequisite: MA 126 Minimum Grade of C

MA 507 Adv Ordinary Differential Eqns 3 cr
A graduate-level introduction to topics of ordinary differential equations and their applications in physics and engineering.
Prerequisite: MA 227 Minimum Grade of C

MA 508 Adv Partial Differential Eqns 3 cr
A continuation of MA 507 with more emphasis on theory of partial differential equations, as well as their applications in physics and engineering problems.
Prerequisite: MA 227 Minimum Grade of C

MA 511 Algebra I 3 cr
A graduate level introduction to group theory. Topics include quotient groups, homomorphisms, group actions, Sylow theorems, composition series, simple groups, free groups, fundamental theorem of abelian groups.
Prerequisite: (MA 311 Minimum Grade of C) or (MA 320 Minimum Grade of C)

MA 512 Algebra II 3 cr
A graduate level introduction to ring theory and fields. Topics include ring homomorphisms, quotient rings, ideals, rings of fractions, Euclidean domains, principal ideal domains, unique factorization domains, modules, finite fields, field extensions.
Prerequisite: MA 511 Minimum Grade of C

MA 515 Number Theory 3 cr
Modular arithmetic, arithmetic functions; prime numbers; algebraic number theory.

MA 516 Topics in Number Theory 3 cr
A second course in number theory, covering topics of interest to the students and instructor.
Prerequisite: MA 515 Minimum Grade of C

MA 518 Linear Algebra I 3 cr
Fields, vector spaces, dual spaces, quotient spaces, multilinear forms, linear transformations, algebras, adjoints, eigenvalues.
Prerequisite: (MA 237 Minimum Grade of C)

MA 519 Linear Algebra II 3 cr
Triangular form, nilpotence, Jordan form, inner products, self-adjoint transformations, positive transformations, isometries, Spectral Theorem, polar decomposition, applications to analysis.
Prerequisite: MA 518 Minimum Grade of C

MA 521 Enumerative Combinatorics 3 cr
Pigeonhole principle, basic counting techniques, binomial coefficients, inclusion-exclusion principle, recurrence relations, generating functions, systems of distinct representatives, finite fields.
Prerequisite: (MA 320 Minimum Grade of C) or (MA 367 Minimum Grade of C)

MA 525 Graph Theory 3 cr
Fundamental concepts, connectedness, graph coloring, planarity and Kuratowski's theorem, four-color theorem, chromatic polynomial, Eulerian and Hamiltonian graphs, matching theory, network flows, NP-complete graph problems, Markov chains, matroids.
Prerequisite: (MA 320 Minimum Grade of C) or (MA 367 Minimum Grade of C) or (MA 521 Minimum Grade of C)

MA 535 Real Analysis I 3 cr
An introduction to real analysis. Topics include: the metric topology of the reals, limits and continuity, differentiation, Riemann-Stieltjes integral.
Prerequisite: Undergraduate course in advanced calculus.

MA 536 Real Analysis II 3 cr
A continuation of MA 535. Topics covered include sequences and series of functions, differentiation and integration in several variables, an introduction to to the Lebesgue integral and differential forms as time allows.
Prerequisite: MA 535 Minimum Grade of C

MA 537 Complex Analysis 3 cr
Arithmetic of complex numbers; regions in the complex plane; limits, continuity and derivatives of complex functions; elementary complex functions; mappings by elementary functions; contour integration; power series; Taylor series; Laurent series; calculus of residues; conformal representation; applications. Credit for both MA 537 and MA 437 is not allowed.
Prerequisite: MA 238 Minimum Grade of C

MA 538 Topics in Complex Analysis 3 cr
A second course in complex analysis, covering topics of interest to the students and instructor.
Prerequisite: MA 537 Minimum Grade of C

MA 539 Measure Theory 3 cr
Foundations of the general theory of measure and integration with particular attention to the Lebesgue integral. Function spaces, product measure and Fubini's theorem, the Radon-Nikodym theorem and applications to probability theory are discussed, and possibly additional topics such as Haar measure or the Ergodic Theorem.
Prerequisite: MA 536 Minimum Grade of C

MA 540 Differential Geometry 3 cr
Local and global theory of curves and surfaces in three-dimensional space.
Prerequisite: (MA 227 Minimum Grade of C) or (MA 237 Minimum Grade of C) or (MA 238 Minimum Grade of C)

MA 542 Topology I 3 cr
An introduction to topology with emphasis on the geometric aspects of the subject. Topics covered include surfaces, topological spaces, open and closed sets, continuity, compactness, connectedness, product spaces, and identification and quotient spaces. Credit for both MA 542 and MA 434 is not allowed.
Prerequisite: (MA 227 Minimum Grade of C) or (MA 237 Minimum Grade of C) or (MA 320 Minimum Grade of C)

MA 543 Topology II 3 cr
A continuation of MA 542. Topics covered include the fundamental group, triangulations, classification of surfaces, homology, the Euler-Poincare formula, the Borsuk-Ulam theorem, the Lefschetz fixed-point theorem, knot theory, covering spaces, and applications.
Prerequisite: MA 542 Minimum Grade of C or MA 434 Minimum Grade of C

MA 550 Probability 3 cr
A comprehensive introduction to probability, the mathematical theory used to model uncertainty, covering the axioms of probability, random variables, expectation, classical discrete and continuous families of probability models, the law of large numbers and the central limit theorem. Credit for both MA 550 and MA 451 is not allowed.
Prerequisite: (MA 227 Minimum Grade of C or MA 237 Minimum Grade of C)

MA 551 Theory of Statistics 3 cr
A comprehensive introduction to the mathematical foundations of statistics. Sufficient statistics and information, parameter estimation, maximum likelihood and moment estimation, optimality properties of estimators and confidence intervals. Hypothesis testing, likelihood ratio tests and power functions. Credit for both MA 551 and ST 470 is not allowed.
Prerequisite: MA 451 Minimum Grade of C or MA 550 Minimum Grade of C

MA 555 Statistical Analysis I 3 cr
A first course in an integrated two course sequence in applied statistical theory and methods for research workers in technical fields. Coverage includes probability and basic probability models, mathematical expectations, random sampling processes and central limit theorem, estimation, hypothesis testing and power analysis, some applications of the theory of least squares. Computer assisted data analysis is used.

MA 560 Statistical Analysis II 3 cr
A second course (continuation of MA 555) in an integrated two-course sequence in applied statistical theory and methods for research workers in technical fields. Coverage includes regression analysis, design and analysis of experiments, factorial experiments, analysis of covariance, nonparametric analytical techniques, analysis of count data. Computer assisted data analysis is used.
Prerequisite: MA 555 Minimum Grade of C

MA 565 Numerical Analysis 3 cr
This course provides an introduction to numerical analysis. Topics include numerical solutions of nonlinear equations, numerical differentiation and integration, interpolation and splines, as well as numerical methods for differential equations. An essential part of the course is the implementation and error analysis of discussed numerical methods in Python. No prior programming skills are required. Credit for both MA 436 & MA 565 is not allowed.
Prerequisite: MA 238 Minimum Grade of C

MA 567 Operations Research 3 cr
An introduction to linear programming. The course will include a study of the simplex method as well as using computers to solve linear systems of equations. As time permits, topics covered will include sensitivity analysis, duality, integer programming, transportation, assignment, transshipment, and networks. Credit for both MA 567 and MA 458 is not allowed.
Prerequisite: MA 237 Minimum Grade of C

MA 568 Topics in Operations Research 3 cr
A second course in operations research, covering topics of interest to the students and instructor.
Prerequisite: MA 567 Minimum Grade of C

MA 571 Ordinary Diff Equations 3 cr
An introduction to ordinary differential equations from a dynamical systems perspective. Topics include existence and uniqueness theorems, dependence on initial data, linear systems and exponential of operators, stability of equilibria, Poincare-Bendixson theorem. Additional topics such as applications to population dynamics, classical mechanics, periodic attractors among others will be included at the discretion of the instructor.
Prerequisite: MA 518 Minimum Grade of C

MA 572 Partial Differential Equations 3 cr
An introduction to partial differential equations emphasizing spectral methods. Topics include elementary Hilbert spaces, Fourier series and integrals and their applications to the study of the basic partial differential equations of mathematical physics. More advanced topics such as asymptotic properties and regularity of solutions and nonlinear equations among others will be included at the discretion of the instructor.
Prerequisite: MA 536 Minimum Grade of C

MA 581 Cryptography 3 cr
This course provides an introduction to classical and modern methods of message encryption and decryption (cryptography) as well as possible attacks to cryptosystems (cryptanalysis). Topics include classical (symmetric) cryptosystems (DES, AES), public-key (asymmetric) cryptosystems (Diffie-Hellman, RSA, ElGamal), modes of operation, one-way and trapdoor functions, Hash functions, cryptographic protocols. Credit for both MA 481 and MA 581 is not allowed.
Prerequisite: MA 311 Minimum Grade of C or (MA 126 Minimum Grade of C and MA 267 Minimum Grade of C)
Cross-Listed: MA 481

MA 590 Special Topics - 1-3 cr
Selected topics in elementary graduate mathematics. This course may be repeated for a maximum of six credits.

MA 592 Seminar 1 cr
Student Seminar. Topics covered vary. This course may be repeated indefinitely, but only two credits count towards the degree. Grading system: satisfactory/unsatisfactory.

MA 594 Directed Study 1-3 cr
Directed individual study. Prerequisites: Approval of the department chair.

MA 599 Thesis 1-6 cr
Thesis. Requires approval of research prospectus by Department Graduate Committee.

Mathematics for College (MTH)

MTH 100 Intermediate Algebra 3 cr
This course covers the foundations required for success in Precalculus Algebra. This course will provide an introduction to manipulating and solving algebraic expression, linear and quadratic equations and inequalities. Graphing functions, lines, piecewise functions, and quadratics will be explored. The algebraic manipulation of exponents, logarithms, rational and radical expressions, and polynomials will be discussed. Practical applications and problem solving are also included. This course is a prerequisite for MA 112. Credit for both MTH 100, MTH 101 and MTH 105 is not allowed.

MTH 101 Essentials for Precalculus 3 cr
This course covers the foundations required for success in Precalculus Algebra. This course will provide an introduction to manipulating and solving algebraic expression, linear and quadratic equations and inequalities. Graphing functions, lines, piecewise functions, and quadratics will be explored. The algebraic manipulation of exponents, logarithms, rational and radical expressions, and polynomials will be discussed. Practical applications and problem solving are also included. This course is a corequisite support course that must be taken with MA 112. Credit for both MTH 100, MTH 101 and MTH 105 is not allowed.
Prerequisite: (MMT 60) or (A02 18) or (SS2 18) or (S02 460) or (S12 500)
Corequisite: MA 112

Statistics (ST)

ST 150 Contemporary Math-Stat Seminar 1 cr
This course gives an overview of modern mathematics and statistics from the point of view of the practitioners. The course is designed for majors in mathematics and statistics at all levels as well as those students who are considering mathematics and statistics as a major or minor area of study. Topics usually included are elements of geometry , algebra, analysis, methods of statistical inference, the role of the computer in the analytical sciences; these topics vary from semester to semester. This course cannot be taken for credit simultaneously with MA 150, but may be repeated in different semesters. NOTE: May be offered for Honors Credit.
Cross-Listed: MA 150

ST 210 Stat Reason and Application 3 cr
An introduction to modern statistics designed to provide the student with a solid foundation in statistical concepts, reasoning and applications. Emphasis given to problem identification, methodology selection and interpretation of results. Analysis of data accomplished by extensive use of statistical computer software, thereby minimizing manual computation. Coverage includes descriptive statistics, probability models, estimation, and hypothesis testing. High School level algebra is recommended. Computer Lab fee. NOTE: ST 210 is intended for students in all disciplines except Engineering and Computer Science. Credit for both ST 210 and ST 315 not allowed. May be offered for Honors Credit.

ST 305 Applied Stat Health Sciences 3 cr
An introduction to statistical reasoning and data analysis for the health sciences. Coverage includes descriptive statistics, methods of data collection, estimation, hypothesis testing, non-parametric statistics, ANOVA, repeated measures, correlation and other measures of association, modeling data with linear and logistic regression. Critique of selected research articles and case studies incorporating research and evidence-based practice will be adopted to connect statistics to daily work in healthcare field. Statistical computer software (e.g. Minitab) will be extensively used for data analysis. Computer Lab fee. Note: This course is offered only as a fully online course and only for health sciences students.
Prerequisite: MA 110 Minimum Grade of C or MA 112 Minimum Grade of C

ST 310 Stat Research Techniques 3 cr
This course is a continuation of ST 210. Coverage includes analysis of experimental designs such as completely randomized design, randomized block design, and factorial design using analysis of variance (ANOVA), correlation, simple and multiple regression analysis, model building, nonparametric techniques, contingency table analysis, sampling and survey methods. Time permitting topics such as time series analysis and statistical simulations will be covered. Statistical computer software will be extensively used for data analysis. Computer Lab fee. NOTE: Credit for only ONE course from ST 310, ST 315 and ST 320 is allowed.
Prerequisite: ST 210 Minimum Grade of C

ST 315 Applied Probability-Statistics 3 cr
Concepts of probability theory, discrete and continuous probability distributions including gamma, beta, exponential and Weibull, descriptive statistics, sampling, estimation, confidence intervals, testing of hypothesis, ANOVA and multiple comparisons, linear and multiple regression, correlation, nonparametric analysis, contingency table analysis, computer-assisted data analysis using appropriate statistical software. Computer Lab fee.
Prerequisite: MA 125 Minimum Grade of C

ST 320 Applied Stat Analysis 3 cr
Descriptive statistics, probability distributions, sampling, estimation, confidence intervals and hypothesis testing, experimental designs, ANOVA and multiple comparisons, linear and multiple regression, correlation, nonparametric analysis, goodness of fit, contingency table analysis, quality control, acceptance sampling, computer-assisted data analysis using appropriate statistical software. Computer Lab fee. NOTE: ST 315 and ST 320 are intended for students in Engineering, Computer Science, and Mathematics. ST 315 covers additional probability distributions while ST 320 additionally covers concepts of quality control and acceptance sampling. Students in these disciplines should consult with their academic advisor for appropriate choice between ST 315 and ST 320. Computer Lab fee. NOTE: Credit for only ONE course from ST 310, ST 315, and ST 320 is allowed.
Prerequisite: MA 125 Minimum Grade of C

ST 335 Applied Regression Analysis 3 cr
Simple, polynomial and multiple linear regression; residual and lack-of-fit analysis; simple, multiple, partial and multiple-partial correlation analysis; model building algorithms; dummy variables; analysis of covariance; model comparisons; analysis of experimental designs including messy data; nonlinear regression models; computer-assisted data analysis using appropriate statistical software. Computer Lab fee. NOTE: Satisfies the Technology Proficiency Requirement for Math/Stat majors.
Prerequisite: ST 210 Minimum Grade of C or ST 315 Minimum Grade of C or ST 320 Minimum Grade of C

ST 340 Design-Analysis of Experiments 3 cr
Principles, constructions, and analysis of experimental designs to include completely randomized, randomized complete block, Latin square and split plot designs, factorial experiments, designs with nested and/or crossed factors, multifactor experiments with randomization restrictions, transformations, incomplete block designs, multiple comparisons including contrasts, confounding, fractional replication, computer-assisted data analysis. Computer Lab fee.
Prerequisite: ST 210 Minimum Grade of C or ST 310 Minimum Grade of C or ST 315 Minimum Grade of C or ST 320 Minimum Grade of C

ST 345 Sampling-Survey Techniques 3 cr
Sampling concepts and designs for survey investigations; sampling methodologies including applications of simple random, stratified, one-and-two stage cluster, and systematic sampling; sample size determination; ratio and regression estimation; population size estimation; random response modeling; acceptance sampling including applications of single and multiple 2-class attribute sampling plans; computer-assisted data analysis using appropriate statistical software. Computer Lab fee.
Prerequisite: ST 210 Minimum Grade of C or ST 310 Minimum Grade of C or ST 315 Minimum Grade of C or ST 320 Minimum Grade of C

ST 350 Applied Time Series Analysis 3 cr
Fundamental concepts; classical regression models as forecasting models, exponential smoothings, stationary and nonstationary models, additive and multiplicative decompositions, moving average, autoregressive, ARMA and ARIMA processes, estimation in MA, AR ARMA, and ARIMA processes. Box-Jenkins methodology, computer aided modeling, applications. Computer Lab fee.
Prerequisite: ST 210 Minimum Grade of C or ST 315 Minimum Grade of C or ST 320 Minimum Grade of C

ST 355 Nonparametric Stat Methods 3 cr
Distribution-free analysis of location and scale measures, nonparametric treatment of fundamental statistical designs, nonparametric comparison procedures, association and contingency table analysis, nonparametric goodness-of fit procedures, and tests for randomness, nonparametric regression and other measures of association, computer intensive statistical methods. Computer Lab fee.
Prerequisite: ST 210 Minimum Grade of C or ST 315 Minimum Grade of C or ST 320 Minimum Grade of C

ST 415 Stat Qual Control Reliability 3 cr
Probability distributions in quality control, inferences about process quality, control charts for attributes and variables, process capability analysis, economic design of control charts, custom charts, acceptance sampling by attributes and variables, six sigma concepts, reliability concepts, censoring, definitions and properties of survival distributions, methods of estimating and comparing reliability distributions, Kaplan-Meier estimation, burn-in models with a major emphasis on computer-assisted data analysis. Computer Lab fee.

ST 425 Applied Linear Models 3 cr
Some results of matrix algebra, multivariate normal distributions, distributions of quadratic forms, general linear models, design models with one factor and two factors including interaction, component-of-variance models, and computing techniques. Computer Lab fee.
Prerequisite: MA 237 Minimum Grade of C and ST 335 Minimum Grade of C or ST 340 Minimum Grade of C

ST 450 Categorical Data Analysis 3 cr
Analysis of two-way, three-way and higher dimension contingency tables using log-linear models, measures of association for nominal and ordinal tables, multiple-factor models, multiple response models, logistic regression, and weighted least squares. Computer Lab fee.

ST 460 Multivariate Stat Analysis 3 cr
Multivariate normal distribution, sampling distribution, hypothesis testing, principal components and introduction to factor analysis, canonical correlation analysis, discriminant and classification analysis, and MANOVA. Computer Lab fee.

ST 470 Theory of Statistics 3 cr
A comprehensive introduction to the mathematical foundations of statistics. Sufficient statistics and information. Parameter estimation, maximum likelihood and moment estimation, optimality properties of estimators and confidence intervals. Hypothesis testing, likelihood ratio tests and power functions. Credit for both ST 470 and MA 551 is not allowed.
Prerequisite: MA 451 Minimum Grade of C

ST 475 Stat Computing and Graphics 3 cr
Introduction to computer-assisted data analysis with statistical computer software, including SAS, R/S-Plus. Coverage includes basics of SAS, common SAS statistical procedures, high-dimensional data visualization, some elements of statistical computing such as numerical computation, semi-numerical computation, symbolic and graphical computation, and special topics selected by instructor. (Credit for ST 475 and ST 575 is not allowed. Computer Lab fee.
Prerequisite: ST 210 Minimum Grade of C or ST 315 Minimum Grade of C
Cross-Listed: ST 575

ST 478 Stat Learning Tech in Data Sci 3 cr
Statistical learning refers to a set of tools for modeling and understanding complex datasets. It is a recently developed area in statistics and blends with parallel developments in computer science and, in particular, machine learning. The purpose of this course is to provide the student with a foundation in modern (non-traditional) statistical learning techniques to deal with small to large complex datasets. Analysis of data is accomplished by extensive use of statistical software thereby minimizing manual computation. Coverage includes introduction to statistical learning, classification or supervised learning methods, resampling methods, linear and non-linear model selection techniques, support vector machines and tree-based methods. Credit for both ST 478 and ST 580 not allowed.
Prerequisite: ST 335 (may be taken concurrently) Minimum Grade of C and CSC 121 (may be taken concurrently) Minimum Grade of C

ST 480 Statistical Practicum - W 1 cr
Relates to the student's classroom studies with actual statistical problems encountered in practice. Working with the departmental statistical consultant, the student will participate in providing statistical assistance to research faculty in applied fields. Computer Lab fee.
Prerequisite: ST 335 Minimum Grade of C and ST 340 Minimum Grade of C)

ST 490 Special Topics 1-3 cr
Selected topics in advanced undergraduate applied statistics This course may be repeated for a maximum of six credits.

ST 494 Directed Studies 1-3 cr
Directed Study. May be repeated for a maximum of six credits.
Prerequisite: Permission of Department Chair.

ST 499 Honor Senior Project - H 3-6 cr
With the guidance and advice of a faculty mentor, Honors Students will identify, and carry out a research project in Statistics. The outcome of the research project will include a formal presentation at the annual Honors Student Colloquium. The senior project will be judged and graded by three members of the faculty, chaired by the faculty mentor.

ST 525 Appl Stat for Clinical Trials 3 cr
This course introduces the fundamental concepts of clinical trials and statistical methods in clinical trials with examples. Topics include clinical trial design and development, randomization, blindness, sample size and power calculation, data collection and management, missing data, survival analysis, association and reproducibility, crossover trials, Bayesian adaptive methods, and others. Most of the statistical methods will be implemented using R. Procedures or subroutines from other statistical software packages, such as SAS and SPSS, will also be introduced as needed.
Prerequisite: ST 210 Minimum Grade of C or ST 305 Minimum Grade of C or ST 315 Minimum Grade of C or ST 540 Minimum Grade of C

ST 540 Stat in Research I 3 cr
A service course for graduate students in disciplines other than mathematics and statistics. A non-calculus exposition in support of application. Coverage includes descriptive statistics, probability and probability distributions, sampling, estimation, tests of significance, analysis of variance, correlation, linear, polynomial, and multiple linear regression including residual and lack of fit analysis, nonparametric procedures, contingency table analysis, and computer-assisted data analysis using appropriate computer software. Computer Lab fee.

ST 545 Stat in Research II 3 cr
Continuation of ST 540. Coverage includes regression analysis through matrices, multiple, partial and multiple-partial correlation analysis, model building algorithms, non-linear regression, analysis of covariance, completely randomized, randomized complete block, and factorial experimentation for equal and unequal cell replication, logistic regression, resampling, basic multivariate techniques, and computer-assisted data analysis. Computer Lab fee.
Prerequisite: ST 540 Minimum Grade of C

ST 550 Environmental Statistics 3 cr
Sampling environmental populations; parametric and nonparametric and estimation; applications of lognormal, Weibull, gamma and beta distributions; locating hot spots; censored data; outlier detection; trend analysis, seasonality; estimation of animal abundance. Computer Lab fee.
Prerequisite: ST 210 Minimum Grade of C or ST 315 Minimum Grade of C or ST 540 Minimum Grade of C

ST 555 Categorical Data 3 cr
Introduction to categorical response data, probability distributions for categorical data, statistical inference for proportions, contingency tables and measures of association, logistic regression, log-linear models for contingency tables, multi-category response models, models for matched pairs categorical response variables. Credit for both ST 450 and ST 555 is not allowed.
Prerequisite: ST 540 Minimum Grade of C or ST 315 Minimum Grade of C or ST 335 Minimum Grade of C
Cross-Listed: ST 450

ST 560 Appl Desgn & Analysis of Exper 3 cr
A software aided introduction to the design and analysis of experiments for univariate and multivariate data. The coverage includes designs such as block designs, factorial designs, repeated measurement designs, hierarchical designs, response surface methods, and Taguchi methods along with various ANOVA techniques for univariate data, ANCOVA for the correlated data, and MANOVA for multivariate data. Analysis of data will be accomplished by extensive use of statistical software. Computer lab fee.
Prerequisite: ST 540 Minimum Grade of C

ST 570 Applied Multivariate Stat 3 cr
This course is designed to broaden and enrich students' knowledge and understanding of statistical methodology related to multivariate techniques. It includes applications of multivariate normal distribution, sampling distribution, hypothesis testing, principal components, MANOVA, and introduction to factor analysis, canonical correlation analysis, discriminant, and classification analysis.
Prerequisite: (ST 540 Minimum Grade of C)

ST 575 Stat Computing and Graphics 3 cr
Introduction to computer-assisted data analysis with statistical computer software, including SAS, R/S-Plus. Coverage includes basics of SAS, common SAS statistical procedures, high-dimensional data visualization, some elements of statistical computing such as numerical computation, semi-numerical computation, symbolic and graphical computation, and special topics selected by instructor. (Credit for ST 475 and ST 575 is not allowed. Computer Lab fee.
Prerequisite: ST 210 Minimum Grade of C or ST 315 Minimum Grade of C
Cross-Listed: ST 475

ST 580 Stat Learning Tech in Data Sc 3 cr
Statistical learning refers to a set of tools for modeling and understanding complex datasets. It is a recently developed area in statistics and blends with parallel developments in computer science and, in particular, machine learning. The purpose of this course is to provide the student with a foundation in modern (non-traditional) statistical learning techniques to deal with small to large complex datasets. Analysis of data is accomplished by extensive use of statistical software thereby minimizing manual computation. Coverage includes introduction to statistical learning, classification or supervised learning methods, resampling methods, linear and non-linear model selection techniques, support vector machines and tree-based methods.
Prerequisite: ST 540 Minimum Grade of C

ST 585 Nonparametric Modeling 3 cr
This course is designed to introduce an alternative set of methodologies to existing and non-existing statistical methods with emphasis on distribution-free and robust procedures. The coverage includes distribution-free analysis of location and scale measures. Nonparametric treatment of fundamental statistical designs, nonparametric multiple comparison procedures, association and contingency table analysis, goodness-of-fit procedures. Nonparametric regression and other measures of association and computer intensive methods. Statistical computer software is intended to enhance the facility with applications of various techniques covered in this course.
Prerequisite: ST 335 Minimum Grade of C and ST 540 Minimum Grade of C

ST 590 Sp Topic: 1-3 cr
Selected topics in advanced applied statistics. This course may be repeated for a maximum of six credits.

Faculty

Faculty Name	Faculty Department	Faculty Position	Degrees Held
ABEYNANDA, GAYAN SHANAKA (gsabeynanda@southalabama.edu)	Mathematics and Statistics	Assistant Professor	BS, Univ of Colombo MS, Louisiana State University PHD, Louisiana State University
ADAMS, JAMES RANDOM (adams@southalabama.edu)	Mathematics and Statistics	Instructor	BS, Spring Hill College MS, University of South Alabama
ALLRED, SARAH ELIZABETH (sarahallred@southalabama.edu)	Mathematics and Statistics	Assistant Professor	BS, Auburn University MS, Louisiana State University PHD, Louisiana State University
ATUTEY, OLIVIA A. (oatutey@southalabama.edu)	Mathematics and Statistics	Assistant Professor	BS, University of Ghana MS, Youngstown State University PHD, Bowling Green St U-Main Campus
BINDELE, HUYBRECHTS FRAZI (hbindele@southalabama.edu)	Mathematics and Statistics	Associate Professor	BS, Marien Ngouabi University MS, Marien Ngouabi University MS, Internatl Centre for Theo Phys PHD, Auburn University
BYRNE, MARIA A (abyrne@southalabama.edu)	Mathematics and Statistics	Associate Professor	BS, University of Notre Dame MS, University of Notre Dame PHD, University of Notre Dame
CHILUKURI, SRIDEVI (schilukuri@southalabama.edu)	Mathematics and Statistics	Instructor	BS, Kakatiya University MS, Osmania University
CLONTZ, STEVEN CRAIG (sclontz@southalabama.edu)	Mathematics and Statistics	Associate Professor	BS, Auburn University MS, Auburn University PHD, Auburn University
COLARUSSO, MARK A (mcolarusso@southalabama.edu)	Mathematics and Statistics	Associate Professor	BS, Queens University MA, University of California-San D PHD, University of California-San D
DASINGER, JACOB ARTHUR (jdasinger@southalabama.edu)	Mathematics and Statistics	Senior Instructor	BS, University of South Alabama MS, University of South Alabama PHD, University of Southern Miss
FARMER, SONNA LEIGH (sfarmer@southalabama.edu)	Mathematics and Statistics	Senior Instructor	BS, Mississippi State University MS, Mississippi State University
FURNO, JOANNA M. (jfurno@southalabama.edu)	Mathematics and Statistics	Assistant Professor	BS, Wisconsin Lutheran College PHD, University of NC- Chapel Hill
GRACE, KEVIN MANUEL (kevingrace@southalabama.edu)	Mathematics and Statistics	Assistant Professor	BS, Pensacola Christian College MS, University of South Alabama PHD, Louisiana State University

KHAIR, HUMAIRA (humairakhair@southalabama.edu)	Mathematics and Statistics	Instructor	BS, Jahangirnagar University MS, Jahangirnagar University MS, Univ of Manitoba
LIOI, JOSHUA D (jlioi@southalabama.edu)	Mathematics and Statistics	Assistant Professor	BS, Clemson University MS, University of Notre Dame PHD, University of Notre Dame
MCDONALD, TERRI LYNN (tlmcdonald@southalabama.edu)	Mathematics and Statistics	Part-Time Instructor	BS, University of South Alabama MS, University of South Alabama
MUDROCK, JEFFREY ALLEN (mudrock@southalabama.edu)	Mathematics and Statistics	Assistant Professor	BS, University of Illinois-Urbana MS, University of Illinois-Urbana PHD, Illinois Inst of Technology
MULEKAR, MADHURI S (mmulekar@southalabama.edu)	Mathematics and Statistics	Professor	BS, University of Mumbai MS, University of Mumbai PHD, Oklahoma State University
PAVELESCU, ANDREI BOGDAN (andreipavelescu@southalabama.edu)	Mathematics and Statistics	Associate Professor	BA, University of Bucharest MA, Johns Hopkins University MPHIL, University of Pennsylvania PHD, University of Southern CA
PAVELESCU, ELENA (elenapavelescu@southalabama.edu)	Mathematics and Statistics	Associate Professor	BA, University of Bucharest PHD, University of Pennsylvania
PEREIRA DE ANDRADE, NELITA CLARA (ncpereiradeandrade@southalabama.edu)	Mathematics and Statistics	Instructor	BS, University of South Alabama MS, University of South Alabama
PERERA, JAYASINGHAGE RUCHIRA NIRMALI (ruchiraperera@southalabama.edu)	Mathematics and Statistics	Assistant Professor	BS, Univ of Colombo MS, New Mexico State U-Main Campus PHD, Louisiana State University
PILLEN, CORNELIUS (pillen@southalabama.edu)	Mathematics and Statistics	Professor	MS, University of Mass-Amherst PHD, University of Mass-Amherst
PRAMANIK, PARAMAHANSA (ppramanik@southalabama.edu)	Mathematics and Statistics	Assistant Professor	BS, University of Calcutta MA, Northern Illinois University MS, Northern Illinois University PHD, Northern Illinois University
PROKHOROV, VASILIY ALEKSEYEVICH (prokhoro@southalabama.edu)	Mathematics and Statistics	Professor	MS, Moscow State University PHD, Steklov Mathematical Institute DSC, Steklov Mathematical Institute
STRAUB, ARMIN (straub@southalabama.edu)	Mathematics and Statistics	Associate Professor	MS, Tulane University PHD, Tulane University
SWANEPOEL, HELENE (heleneswanepoel@southalabama.edu)	Mathematics and Statistics	Part-Time Instructor	BS, North-West University MS, University of South Alabama
WAITES, LAURELIN OLSEN (laurelinwaites@southalabama.edu)	Mathematics and Statistics	Instructor	BS, University of South Alabama MS, University of South Alabama
WATTIER, SHEILA RENEE (srwattier@southalabama.edu)	Mathematics and Statistics	Instructor	BS, University of South Alabama MED, University of South Alabama
WILBERT, ARIK (wilbert@southalabama.edu)	Mathematics and Statistics	Assistant Professor	BS, University of Bonn MS, University of Bonn PHD, University of Bonn