MATHEMATICS (MATH-UH)

MATH-UH 1000AQ Mathematics for Statistics and Calculus Part I (2 Credits)

Typically offered Fall and Spring

This course will provide the basic mathematical toolkit needed for students who do not wish to pursue calculus but still need to be exposed to the mathematical concepts and techniques that are required to study elementary statistics and mathematical models in the social sciences. Emphasis will be placed on the understanding of important concepts and on developing analytical skills rather than just on computational skills, the use of algorithms, and the manipulation of formulae.

Grading: Ugrd Abu Dhabi Graded

Repeatable for additional credit: No

- Bulletin Categories: Mathematics: Courses for Non-Majors
- Bulletin Categories: Quantitative Reasoning

MATH-UH 1000BQ Mathematics for Statistics and Calculus Part II (2 Credits)

Typically offered Fall and Spring

A fundamental understanding of mathematical functions is critical before engaging in the rigors of calculus. This course examines single variable functions, including their algebraic and geometric properties. By necessity, the course begins with an exploration of the following question: What is a function, and how can it be represented geometrically as a graph? The course delves into standard function manipulations and examines a range of mathematical functions, including polynomial, trigonometric, and exponential functions. The course further provides an in-depth study of trigonometric functions, trigonometric equations and trigonometric identities, including double angle and half angle formulae and their application. In addition, there is an introduction to the polar coordinates system and vectors in two and three dimensions. Basic sequences are also studied. By the end of the course, students will have a solid preparation for calculus, from the algebraic, geometric and analytic point of view.

Grading: Ugrd Abu Dhabi Graded

Repeatable for additional credit: No

Prerequisites: MATH-UH 1000A(Q) and for First-Year and Second Year Students.

- Bulletin Categories: Mathematics: Courses for Non-Majors
- Bulletin Categories: Quantitative Reasoning

MATH-UH 1010Q Foundations of Mathematics (4 Credits)

Typically offered Spring

Mathematics is a convenient and powerful language, providing a deep, unified framework for all scientific developments. All existing results from the three fundamental categories of mathematics - geometry, algebra, and analysis - can be formally expressed in terms of set theory, predicates, quantifiers, and logical connectives. This course explores the axiomatic method, some elements of logic and formal languages, and set theory. In addition, the system of real numbers and all other fundamental number systems can be firmly established on the ground of natural numbers; therefore, the course introduces elementary arithmetic and the universal method of constructing new objects from already known sets by means of equivalence relations. Abstract concepts are introduced through basic but fundamental and universal examples or problems, carefully chosen as illuminants of broader ideas and sources of new theoretical and practical applications.

Grading: Ugrd Abu Dhabi Graded

Repeatable for additional credit: No

Prerequisites: MATH-UH 1000B or equivalent.

- Bulletin Categories: Mathematics Major: Required
- Bulletin Categories: Mathematics
- Bulletin Categories: Quantitative Reasoning
- Crosslisted with: Mathematics Major: Required
- Crosslisted with: Mathematics

MATH-UH 1012Q Calculus with Applications to Science and Engineering (4 Credits)
Typically offered Fall and Spring
This course presents the basic principles of calculus by examining functions and their derivatives and integrals with a special emphasis placed on the utilitarian nature of the subject material. Since the derivative measures the instantaneous rate of change of a function and the definite integral measures the total accumulation of a function over an interval, these two ideas form the basis for nearly all mathematical formulas in science, engineering, economics, and other fields. This course also provides instruction in how to model situations in order to solve problems. Applications include graphing, and maximizing and minimizing functions. In addition to two weekly lectures, students attend a weekly recitation focused on applications. Placement into Calculus with Applications is decided by discussion with mentors and the results of a mathematics placement examination. This course focuses on the needs of students in science and engineering.
Grading: Ugrd Abu Dhabi Graded
Repeatable for additional credit: No
Prerequisites: MATH-UH 1000B or MATH-UH 1002, MATH-UH 1005 or Math Proficiency Assessment.

- Bulletin Categories: Applied Math Minor: Required
- Bulletin Categories: Biology Major: Required
- Bulletin Categories: Biology
- Bulletin Categories: Chemistry: Common Required
- Bulletin Categories: Chemistry
- Bulletin Categories: Computer Science Major: Required
- Bulletin Categories: Computer Science
- Bulletin Categories: Mathematics Major: Required
- Bulletin Categories: Mathematics
- Bulletin Categories: Physics Major: Required
- Bulletin Categories: Physics
- Bulletin Categories: Quantitative Reasoning
- Bulletin Categories: Required Mathematics Courses
- Crosslisted with: Biology Major: Required
- Crosslisted with: Biology
- Crosslisted with: Chemistry: Common Required
- Crosslisted with: Chemistry
- Crosslisted with: Computer Science Major: Required
- Crosslisted with: Computer Science
- Crosslisted with: Engineering Common Courses (ECC)
- Crosslisted with: Engineering
- Crosslisted with: Mathematics Major: Required
- Crosslisted with: Mathematics
- Crosslisted with: Physics Major: Required
- Crosslisted with: Physics

MATH-UH 1013Q Calculus with Applications to Economics (4 Credits)
Typically offered Fall and Spring
This course presents the foundations of calculus by examining functions and their derivatives and integrals with a special emphasis placed on the utilitarian nature of the subject material. Since the derivative measures the instantaneous rate of change of a function and the definite integral measures the total accumulation of a function over an interval, these two ideas form the basis for nearly all mathematical formulas in science, engineering, economics, and other fields. This course also provides instruction in how to model situations in order to solve problems. Applications include graphing, and maximizing and minimizing functions. In addition to two weekly lectures, students attend a weekly recitations focused on applications. Placement into Calculus with Applications is decided by discussion with mentors and the results of a mathematics placement examination. This course focuses on the needs of students in economics.
Grading: Ugrd Abu Dhabi Graded
Repeatable for additional credit: No
Prerequisites: MATH-UH 1000B or MATH-UH 1002 or Math Proficiency Assessment.

- Bulletin Categories: BOS Major: Econ-Math Required
- Bulletin Categories: Economics Major: Required Mathematics
- Bulletin Categories: Mathematics: Courses for Non-Majors
- Bulletin Categories: Quantitative Reasoning
- Crosslisted with: Business, Organizations, and Society
- Crosslisted with: Economics Major: Required
- Crosslisted with: Economics

MATH-UH 1020Q Multivariable Calculus with Applications to Science and Engineering (4 Credits)

Typically offered Fall and Spring

This course explores functions of several variables and has applications to science and engineering. Specific topics include: vectors in the plane and space; partial derivatives with applications; double and triple integrals; spherical and cylindrical coordinates; surface and line integrals; and divergence, gradient, and curl. In addition, the theorems of Gauss and Stokes are rigorously introduced.

Grading: Ugrd Abu Dhabi Graded

Repeatable for additional credit: No

Prerequisites: MATH-UH 1012 or equivalent.

- Bulletin Categories: Applied Math Minor: Required
- Bulletin Categories: Biology Major: Required
- Bulletin Categories: Biology
- Bulletin Categories: Chemistry: Common Required
- Bulletin Categories: Chemistry
- Bulletin Categories: Mathematics Major: Required
- Bulletin Categories: Mathematics
- Bulletin Categories: Physics Major: Required
- Bulletin Categories: Physics
- Bulletin Categories: Quantitative Reasoning
- Bulletin Categories: Required Mathematics Courses
- Crosslisted with: Biology Major: Required
- Crosslisted with: Biology
- Crosslisted with: Chemistry: Common Required
- Crosslisted with: Chemistry
- Crosslisted with: Engineering Common Courses (ECC)
- Crosslisted with: Engineering
- Crosslisted with: Mathematics Major: Required
- Crosslisted with: Mathematics
- Crosslisted with: Physics Major: Required
- Crosslisted with: Physics

MATH-UH 1021Q Multivariable Calculus with Applications to Economics (4 Credits)

Typically offered Fall and Spring

This course explores functions of several variables and has applications to science and engineering as well as economics. This special course for those majoring in economics includes: vectors in the plane and space; partial derivatives with applications; Lagrange multipliers; constrained and unconstrained optimization; double and triple integrals; spherical and cylindrical coordinates; surface and line integrals.

Grading: Ugrd Abu Dhabi Graded

Repeatable for additional credit: No

Prerequisites: MATH-UH 1013 or equivalent.

- Bulletin Categories: Economics Major: Required Mathematics
- Bulletin Categories: Mathematics: Courses for Non-Majors
- Bulletin Categories: Quantitative Reasoning
- Crosslisted with: Economics Major: Required
- Crosslisted with: Economics
- Crosslisted with: Mathematics Major: Required
- Crosslisted with: Mathematics

MATH-UH 1022Q Linear Algebra (4 Credits)

Typically offered Fall and Spring

In many applications of mathematics, a response of some systems is nearly a linear function of the input. These linear systems, which arise in elasticity, in electrical engineering, and in economics for example, involve linear equations in many unknowns. The associated matrix algebra is a rich and beautiful field of mathematics. It is also central to the analysis of linear ordinary and partial differential equations. The material in this course places emphasis on theorems and proofs, and includes systems of linear equations, Gaussian elimination, matrices, determinants, Cramer's rule, vectors, vector spaces, basis and dimension, linear transformations, eigenvalues, eigenvectors, and quadratic forms.

Grading: Ugrd Abu Dhabi Graded

Repeatable for additional credit: No

Prerequisites: MATH-UH 1012 or relevant result in Math Proficiency Assessment.

- Bulletin Categories: Applied Math Minor: Electives
- Bulletin Categories: Engineering: Civil Engineering Required
- Bulletin Categories: Engineering: Computer Engineering Required
- Bulletin Categories: Engineering: Electrical Engineering Required
- Bulletin Categories: Engineering: General Engineering Required
- Bulletin Categories: Engineering: Mechanical Engineering Required
- Bulletin Categories: Mathematics Major: Required
- Bulletin Categories: Mathematics
- Bulletin Categories: Physics Major: Required
- Bulletin Categories: Physics
- Bulletin Categories: Quantitative Reasoning
- Bulletin Categories: Required Mathematics Courses
- Crosslisted with: Engineering Common Courses (ECC)
- Crosslisted with: Engineering
- Crosslisted with: Mathematics Major: Required
- Crosslisted with: Mathematics
- Crosslisted with: Physics Major: Required
- Crosslisted with: Physics

MATH-UH 1023Q Fundamentals of Linear Algebra (2 Credits)
Typically offered Fall
In many applications of engineering and mathematics, a response of systems is a linear function of the input. These linear systems, which arise in elasticity, in circuits, and in numerical simulations, for example, involve linear equations in many unknowns. The associated matrix algebra is a rich field of mathematics. It is also central to the analysis and numerical solutions of linear ordinary and partial differential equations used in engineering and other fields. The topics include practical approaches to systems of linear equations, matrices, determinants, Gaussian elimination, basis and dimension, linear transformations, eigenvalues and eigenvectors.
Grading: Ugrd Abu Dhabi Graded
Repeatable for additional credit: No
Prerequisites: MATH-UH 1012 or equivalent.

- Bulletin Categories: Engineering: Bioengineering Required
- Bulletin Categories: Mathematics: Courses for Non-Majors
- Bulletin Categories: Quantitative Reasoning
- Bulletin Categories: Required Mathematics Courses
- Crosslisted with: Engineering Common Courses (ECC)
- Crosslisted with: Engineering
- Crosslisted with: Mathematics Major: Required
- Crosslisted with: Mathematics

MATH-UH 1024Q Fundamentals of Ordinary Differential Equations (2 Credits)
Typically offered Fall
Ordinary differential equations arise in virtually all fields of engineering. Newton's equations of motion, the rate equations of chemical reactions, the currents flowing in electric circuits, all can be expressed as ordinary differential equations. The course studies first- and second- order equations.
Grading: Ugrd Abu Dhabi Graded
Repeatable for additional credit: No
Prerequisites: MATH-UH 1023 or equivalent.

- Bulletin Categories: Engineering: Computer Engineering Required
- Bulletin Categories: Mathematics: Courses for Non-Majors
- Bulletin Categories: Quantitative Reasoning
- Crosslisted with: Engineering Common Courses (ECC)
- Crosslisted with: Engineering
- Crosslisted with: Mathematics Major: Required
- Crosslisted with: Mathematics

MATH-UH 2010Q Ordinary Differential Equations (4 Credits)
Typically offered Fall and Spring
Ordinary differential equations arise in virtually all fields of applied mathematics. Newton's equations of motion, the rate equations of chemical reactions, the currents flowing in electric circuits, all can be expressed as ordinary differential equations. The solutions of these equations usually evolve a combination of analytic and numerical methods. The course studies first- and second-order equations, solutions using infinite series, Laplace transforms, linear systems, numerical methods.
Grading: Ugrd Abu Dhabi Graded
Repeatable for additional credit: No
Prerequisites: (MATH-UH 1020 or MATH-UH 1021) and Pre or Corequisite: MATH-UH 1022.

- Bulletin Categories: Applied Math Minor: Electives
- Bulletin Categories: Engineering: Civil Engineering Required
- Bulletin Categories: Engineering: Electrical Engineering Required
- Bulletin Categories: Engineering: General Engineering Required
- Bulletin Categories: Engineering: Mechanical Engineering Required
- Bulletin Categories: Mathematics Major: Required
- Bulletin Categories: Mathematics
- Bulletin Categories: Physics Major: Required
- Bulletin Categories: Physics
- Bulletin Categories: Quantitative Reasoning
- Crosslisted with: Engineering Common Courses (ECC)
- Crosslisted with: Engineering
- Crosslisted with: Mathematics Major: Required
- Crosslisted with: Mathematics
- Crosslisted with: Physics Major: Required
- Crosslisted with: Physics

MATH-UH 2011Q Probability and Statistics (4 Credits)
Typically offered Fall and Spring
Most real world phenomena include non-deterministic or non-deterministically predictable features. The course is designed to provide an introduction to the mathematical treatment of such aspects, acquainting the students with both probability and statistics. The course includes: mathematical definition of probability; combinatorics; finite, discrete and continuous probabilities of single and joint random variables; law of large numbers and normal approximation; sampling; estimation; testing of hypotheses; correlation and regression.
Grading: Ugrd Abu Dhabi Graded
Repeatable for additional credit: No
Prerequisites: MATH-UH 1020 or MATH-UH 1021.

- Bulletin Categories: Applied Math Minor: Electives
- Bulletin Categories: Chemistry: Medical Sciences Optional Electives
- Bulletin Categories: Mathematics Major: Required
- Bulletin Categories: Mathematics
- Bulletin Categories: Physics: Electives
- Bulletin Categories: Quantitative Reasoning

MATH-UH 2012Q Abstract Algebra 1 (4 Credits)
Typically offered Fall
Algebra is a part of every field of mathematics, and has applications in the discrete systems of computer science. Fractions, together with their familiar laws of addition, multiplication, and division, provide an example of algebra. The complex numbers form another. This course introduces more general algebras and their properties and applications. Topics considered in this course include groups, homomorphisms, automorphisms and permutation groups. Rings, ideals and quotient rings, Euclidean rings, and polynomial rings are also considered.
Grading: Ugrd Abu Dhabi Graded
Repeatable for additional credit: No
Prerequisites: MATH-UH 1010 and MATH-UH 1022.
- Bulletin Categories: Mathematics Major: Required
- Bulletin Categories: Mathematics
- Bulletin Categories: Quantitative Reasoning
- Crosslisted with: Mathematics Major: Required
- Crosslisted with: Mathematics

MATH-UH 2013Q Analysis 1 (4 Credits)
Typically offered Fall and Spring
Real Analysis builds a more rigorous foundation for calculus and prepares the way for more advanced courses. The emphasis is on the careful formulation of the concepts of calculus, and the formulation and proof of key theorems. The goal is to understand the need for and the nature of a mathematical proof. The course studies the real number system, the convergence of sequences and series, functions of one real variable, continuity, connectedness, compactness, and metric spaces.
Grading: Ugrd Abu Dhabi Graded
Repeatable for additional credit: No
Prerequisites: MATH-UH 1012 and Pre- or Corequisite: MATH-UH 1010.
- Bulletin Categories: Mathematics Major: Required
- Bulletin Categories: Mathematics
- Bulletin Categories: Quantitative Reasoning
- Crosslisted with: Mathematics Major: Required
- Crosslisted with: Mathematics

MATH-UH 2410Q Mathematical Modeling (4 Credits)
Typically offered Fall of even numbered years
Often, the most difficult task of the applied mathematician is the formulation of an analyzable model in the face of a perplexing phenomenon or data set. This course gives students an introduction to all aspects of this process. The basic tools of modeling, including dimensional analysis, asymptotic approximations, qualitative analysis of differential equations, elementary probability, are presented. They are then used, sometimes in combination with very simple numerical simulations, to give a mathematical formulation of and to analyze several self-contained examples, taken mostly from the natural sciences. Students will also be asked to develop or analyze a model of their own choice, in a field of their interest.
Grading: Ugrd Abu Dhabi Graded
Repeatable for additional credit: No
- Bulletin Categories: Category A (Applied Mathematics)
- Bulletin Categories: Quantitative Reasoning

MATH-UH 3090 Research Seminar in Mathematics (2 Credits)
Typically offered Spring
The research seminar provides students with an overview of the diverse multidisciplinary research areas that have captured the interest and fascination of NYUAD mathematicians. Through exposure to NYUAD faculty research, students identify areas of interest for their own capstone research and develop and write an in-depth research proposal over the course of the semester. The final capstone proposal is due at the end of the seminar so that students can begin the Capstone Project in Mathematics 1. Students who have chosen Mathematics as their secondary major do not need to complete the research seminar course; students must instead take two courses in their chosen elective which are not research courses.
Grading: Ugrd Abu Dhabi Graded
Repeatable for additional credit: No
Prerequisites: MATH-UH 2010, MATH-UH 2011Q, and MATH-UH 2013; Mathematics must be declared as primary major.
- Bulletin Categories: Mathematics Major: Required
- Bulletin Categories: Mathematics

MATH-UH 3210 Abstract Algebra 2 (4 Credits)
Typically offered Spring
This course is a continuation of the study of algebraic structures started in Abstract Algebra 1. The notion of rings and fields are thoroughly studied, as well as polynomials over rings such as the ring of integers. This course develops ideas to prepare the students to study Galois theory, one of the most important theories in algebra. The topics include Euclidean domains, principal ideal domains, unique factorization domains, imaginary and real quadratic number fields, extension fields and roots of polynomials, constructions with straight edge and compass, and elements of Galois theory.
Grading: Ugrd Abu Dhabi Graded
Repeatable for additional credit: No
Prerequisites: MATH-UH 2012 or MATH-UA 122 or MATH-UA 132 or MA-UY 1424 or MATH-SHU 131, or MATH-SHU 201.
- Bulletin Categories: Mathematics: Category P (Pure Math)
- Crosslisted with: Mathematics Major: Required
- Crosslisted with: Mathematics

MATH-UH 3212 Analysis 2 (4 Credits)
Typically offered Spring
The second part of the analysis series is devoted to the calculus of functions of several variables. The transition from a single variable to many variables involves important new concepts, which are essential to understanding applications to the natural world. The course entails a rigorous study of functions of several variables, limits and continuity, differentiable functions, the implicit function theorem, Riemann integral, Stokes formula and an introduction to Lebesgue integration.
Grading: Ugrd Abu Dhabi Graded
Repeatable for additional credit: No
Prerequisites: MATH-UH 2013.
- Bulletin Categories: Mathematics: Category P (Pure Math)
- Crosslisted with: Mathematics Major: Required
- Crosslisted with: Mathematics

MATH-UH 3213 Advanced Probability (4 Credits)
Typically offered Spring
The course provides an introduction to rigorous probability theory using measure theory. The necessary notions of measure theory are introduced as needed, and the proofs of essential introductory results of measure theory and probability theory are presented in detail. The main topics of the course include the definition and construction of probability spaces and random variables, limit theorems, conditional expectations, martingales, Markov chains and stochastic processes.
Grading: Ugrd Abu Dhabi Graded
Repeatable for additional credit: No
Prerequisites: MATH-UH 2011Q and MATH-UH 2013.

- Bulletin Categories: Mathematics: Category P (Pure Math)
- Crosslisted with: Mathematics Major: Required
- Crosslisted with: Mathematics

MATH-UH 3410 Number Theory and Cryptography (4 Credits)
Typically offered occasionally
Cryptology existed since the ancient times with the art of ciphers and codes and has now evolved to become a branch of mathematics and computer science that develops the tools and the algorithms underpinning its two divisions: cryptography (development of protocols for the security, authentication and safety of communication) and cryptanalysis (the science of breaking cryptosystems). Before the modern era, cryptography was concerned solely with data confidentiality. For that purpose, classical cryptosystems involving symmetric-key algorithms have been developed. In recent decades, the field has been revolutionized with the invention of asymmetric-key encryption algorithms such as public-key ciphers and later expanded beyond confidentiality concerns to include techniques for user authentication, data integrity checking, data origin authentication, digital signatures, interactive proofs, and secure computation, amongst others. Modern cryptography hence relied on a great deal of fascinating mathematics arising from elementary number theory and the more recent advances expanded to include arithmetic algebraic geometry and algebraic number theory.
Grading: Ugrd Abu Dhabi Graded
Repeatable for additional credit: No
Prerequisites: MATH-UH 1010, CS-UH 1002, or ENGR-UH 2025.

- Bulletin Categories: Category A (Applied Mathematics)
- Bulletin Categories: Computer Science Major: Electives
- Bulletin Categories: Mathematics: Category P (Pure Math)
- Crosslisted with: Computer Science Major: Required
- Crosslisted with: Computer Science
- Crosslisted with: Mathematics Major: Required
- Crosslisted with: Mathematics

MATH-UH 3411 Dynamical Systems (4 Credits)
Typically offered every other year
Many laws of physics are formulated as differential equations or partial differential equations, e.g. the propagation of sound waves, the diffusion of a gas, and the flow of a fluid. These equations are usually nonlinear and the study of their dynamical properties (long time behavior, changes of properties of solutions, …) turns out to be very difficult. The goal of this course is to study some simple aspects of dynamical systems and chaos. Applications to physics, chemistry, biology, and population dynamics are given. In particular, the course will involve the study of many examples coming from physics, biology and engineering. The examples studied will depend on the interests of the students and their majors.
Grading: Ugrd Abu Dhabi Graded
Repeatable for additional credit: No
Prerequisites: MATH-UH 1022 and MATH-UH 2010.

- Bulletin Categories: Category A (Applied Mathematics)
- Bulletin Categories: Mathematics: Category P (Pure Math)
- Bulletin Categories: Physics: Electives
- Crosslisted with: Mathematics Major: Required
- Crosslisted with: Mathematics
- Crosslisted with: Physics Major: Required
- Crosslisted with: Physics

MATH-UH 3413 Numerical Methods (4 Credits)
Typically offered every other year
The course explores how mathematical problems can be analyzed and solved using numerical methods. As such, the subject has very broad applications in applied mathematics, physics, engineering, finance, and life sciences. Topics covered in this course include numerical algorithms for solving linear equations and nonlinear systems of equations, least squares problems, eigenvalue problems, interpolation, numerical quadrature, optimization, and differential equations. Theory and practical examples are combined to study these topics.
Grading: Ugrd Abu Dhabi Graded
Repeatable for additional credit: No
Prerequisites: MATH-UH 1020 or equivalent, and MATH-UH 1022.

- Bulletin Categories: Category A (Applied Mathematics)
- Bulletin Categories: Physics: Electives
- Crosslisted with: Mathematics Major: Required
- Crosslisted with: Mathematics
- Crosslisted with: Physics Major: Required
- Crosslisted with: Physics

MATH-UH 3414 Partial Differential Equations (4 Credits)
Typically offered every other year
Many laws of physics are formulated as partial differential equations, including the propagation of sound waves, the diffusion of a gas, and the flow of a fluid. This course discusses the simplest examples of such laws as embodied in the wave equation, the diffusion equation, and Laplace's equation. The course also discusses nonlinear conservation laws and the theory of shock waves. Applications to physics, chemistry, biology, and population dynamics are discussed.
Grading: Ugrd Abu Dhabi Graded
Repeatable for additional credit: No
Prerequisites: MATH-UH 2010.

- Bulletin Categories: Category A (Applied Mathematics)
- Bulletin Categories: Mathematics: Category P (Pure Math)
- Bulletin Categories: Physics: Electives
- Crosslisted with: Mathematics Major: Required
- Crosslisted with: Mathematics
- Crosslisted with: Physics Major: Required
- Crosslisted with: Physics

MATH-UH 3415Q Stochastic Processes (4 Credits)
Typically offered Spring
Countless real-world phenomena, ranging from biological population sizes and queuing times to weather parameters and stock prices, exhibit stochastic behavior. They can be effectively modeled as stochastic processes, which represent random quantities evolving over time. This course serves as an essential introduction to the theory and practical applications of stochastic processes. By emphasizing pivotal concepts, including random walks, branching processes, Markov chains, the Poisson process, and Brownian motion, it equips students with the analytical tools to comprehend and analyze diverse stochastic phenomena across engineering, economics, biology, physics and computer science.
Grading: Ugrd Abu Dhabi Graded
Repeatable for additional credit: No
Prerequisites: MATH-UH 2011Q or ENGR-AD 2010Q.

- Bulletin Categories: Category A (Applied Mathematics)
- Bulletin Categories: Mathematics: Category P (Pure Math)
- Crosslisted with: Mathematics Major: Required
- Crosslisted with: Mathematics

MATH-UH 3610 Complex Analysis (4 Credits)
Typically offered Spring
Complex analysis, also known as the theory of functions of a complex variable, is the branch of mathematical analysis devoted to complex valued functions of complex variable. It is further used in other branches of mathematics, including algebraic geometry and number theory, and also has diverse applications in science and engineering: fluid dynamics, elasticity, nuclear and electrical engineering, to name just a few examples. The geometrical content of analysis in the complex plane is especially appealing. Topics covered include: complex numbers and complex functions; differentiation and the Cauchy-Riemann equations, Cauchy's theorem, and the Cauchy integral formula; singularities, residues, Taylor and Laurent series; fractional linear transformations and conformal mappings.
Grading: Ugrd Abu Dhabi Graded
Repeatable for additional credit: No
Prerequisites: MATH-UH 1020 or equivalent, and MATH-UH 1022.

- Bulletin Categories: Engineering: Electrical Engineering Required Opt
- Bulletin Categories: Mathematics: Category P (Pure Math)
- Bulletin Categories: Physics: Electives

MATH-UH 3612 Differential Geometry (4 Credits)
Typically offered every other year
This course is a transition from vector calculus to differential geometry, the study of curved spaces. The course plan is to move from a study of extrinsic geometry of curves and surfaces in space, familiar from multivariable calculus, to the intrinsic geometry of manifolds. This includes the study of tangent spaces and vector fields and the concept of Riemannian manifolds and leading to explicit characterizations of metrics, connections, and curvatures. Computational tools will include tensor algebra and differential forms. Using these, derivatives on manifolds and integration on manifolds will generalize the corresponding notions from multivariable calculus. Further topics also include the Euler characteristic, The Gauss-Bonnet theorem, symmetry, homogeneous spaces, and applications such as Electromagnetism and General Relativity.
Grading: Ugrd Abu Dhabi Graded
Repeatable for additional credit: No
Prerequisites: MATH-UH 1020 or MATH-UH 1021 and MATH-UH 1022.

- Bulletin Categories: Category A (Applied Mathematics)
- Bulletin Categories: Mathematics: Category P (Pure Math)
- Crosslisted with: Mathematics Major: Required
- Crosslisted with: Mathematics

MATH-UH 4001 Capstone Project in Mathematics 1 (4 Credits)
Typically offered Fall
The senior Capstone Experience in Mathematics requires students to engage in a long-term, mentored learning experience that culminates in a piece of research. The specific project is developed during the Research Seminar in Mathematics. During the Capstone Project, the proposed work comes to fruition in the form of a research paper along the lines of those found in leading journals in mathematics.
Grading: Ugrd Abu Dhabi Graded
Repeatable for additional credit: No
Prerequisites: MATH-UH 3090.

- Bulletin Categories: Mathematics: Capstone

MATH-UH 4002 Capstone Project in Mathematics 2 (4 Credits)
Typically offered Spring
Continuation of Capstone Project in Mathematics 1 (MATH-UH 4000) culminating with students presenting their work.
Grading: Ugrd Abu Dhabi Graded
Repeatable for additional credit: No
Prerequisites: MATH-UH 4001.

- Bulletin Categories: Mathematics: Capstone

MATH-UH 4610 Topology (4 Credits)
Typically offered every other year
This course is a basic introduction to topology, with a balance between point-set topology, geometric topology, and algebraic topology. The concept of a topological space is introduced and some of its more important properties, like connectedness and compactness, are studied. Then the main focus is on topological surfaces with the aim of establishing the fundamental classification theorem for compact surfaces, connecting to the Euler characteristic. After developing the foundations and the geometric intuition, computational algebraic aspects such as homology are introduced. Further classification uses homotopy, the fundamental group, and covering spaces. The concepts are illustrated in various applications, including the Brouwer Fixed Point Theorem.
Grading: Ugrd Abu Dhabi Graded
Repeatable for additional credit: No
Prerequisites: MATH-UH 2013 and (MATH-UH 1020 or MATH-UH 1021); Corequisite: MATH-UH 2012.

- Bulletin Categories: Mathematics: Category P (Pure Math)
- Crosslisted with: Mathematics Major: Required
- Crosslisted with: Mathematics