MATHEMATICS (MATH-SHU)

MATH-SHU 5 Chance (4 Credits)
Chance is a common word whose meaning can vary, but which generally applies to situations involving a certain amount of unpredictability. How does it differ from fortune – or luck? Is it synonymous with randomness? We all try to increase our chances of success; how do such efforts involve taking or minimizing certain risks? If philosophical discussions about chance can be traced back to antiquity, probabilistic and statistical concepts appeared more recently in mathematics. Starting with gambling strategies, the theory now applies to the core of almost all scientific and technical fields, including statistical and quantum mechanics, chaotic dynamics, phylogenetics, sociology, economics, risk management, and quality control. Bringing together materials and questions from philosophy, mathematics, and other disciplines, this course provides a journey in the history of ideas. Students will investigate key concepts (including independence, expectation, confidence intervals, or tests), consider their applications to specific fields of science, and illustrate them by computer experiments. Readings include excerpts from Lucretius, Pascal, Hume, Laplace, Peirce, and Hacking. Prerequisite: None. Fulfillment: CORE STS.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Science, Technology and Society

MATH-SHU 9 Precalculus (4 Credits)
Typically offered Fall
This course is designed as a preparation for calculus, including study of basic properties of polynomials, rational functions, exponential and logarithmic functions, and trigonometric functions. Systems of linear equations and matrix operations are also covered. Prerequisite: None. Fulfillment: Core Curriculum Math requirement.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Math

MATH-SHU 10 Quantitative Reasoning: Great Ideas in Mathematics (4 Credits)
Typically offered Fall and Spring
Great Ideas in Mathematics. This one-semester course serves as an introduction to great ideas in mathematics. During the course we will examine a variety of topics chosen from the following broad categories. 1) A survey of pure mathematics: What do mathematicians do and what questions inspire them? 2) Great works: What are some of the historically big ideas in the field? Who were the mathematicians that came up with them? 3) Mathematics as a reflection of the world we live in: How does our understanding of the natural world affect mathematics (and vice versa). 4) Computations, proof, and mathematical reasoning: Quantitative skills are crucial for dealing with the sheer amount of information available in modern society. 5) Mathematics as a liberal art: Historically, some of the greatest mathematicians have also been poets, artists, and philosophers. How is mathematics a natural result of humanity's interest in the nature of truth, beauty, and understanding? Why is math a liberal art? Prerequisite: None. Fulfillment: Core Mathematics requirement.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Math

MATH-SHU 121 Calculus I (4 Credits)
This course presents the foundations of calculus for functions of a single variable. Topics addressed include limits, continuity, rules of differentiation, antiderivatives, definite integrals and the fundamental theorem of calculus. Prerequisite: Placement examination or a grade of C or above in MATH–SHU 009 Precalculus. Please note that this course is not equivalent to MATH-SHU 131 Calculus (formerly MATH-SHU 121) and will not be recognized as fulfilling the Calculus prerequisites of higher-level MATH-SHU courses. Students pursuing the following majors will therefore not be able to use MATH-SHU 131 to fulfill major requirements: Economics, Natural Sciences, Mathematics, Data Science, Computer Science, Engineering.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No

MATH-SHU 131 Calculus (4 Credits)
Typically offered Fall and Spring
This course presents the foundations of calculus for functions of a single variable. Topics addressed include limits, continuity, rules of differentiation, approximation,antiderivatives, indefinite and definite integrals, the fundamental theorem of calculus, integration techniques, and improper integrals. Prerequisite: Pre-placement by Faculty based on high-school grades, OR NYU SH “Calculus and Linear Algebra” placement exam, OR grade C or better in MATH-SHU 9 (Precalculus) Antirequisite: MATH-SHU 201 (Honors Calculus) Fulfillment: Economics Core Math requirement; Math Core Math requirement.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Economics Core Math Requirement
- SB Crse Attr: NYU Shanghai: Mathematics Math and Science Requirements

MATH-SHU 140 Linear Algebra (4 Credits)
Typically offered Fall and Spring
This first course in linear algebra covers systems of linear equations, vectors, linear transformations, matrices and their determinants, vector spaces, basis and dimension, eigevectors and eigenvalues, quadratic forms, and matrix decompositions. In addition to its role as an essential topic within mathematics, linear algebra is also critically useful throughout the sciences: for example, in estimation theory, chemical equations, electrical networks, and heat distributions. Prerequisite: Sufficient high school grades, or NYU SH “Calculus and Linear Algebra” placement exam, or a grade of C or better in MATH-SHU 9 (Precalculus). Equivalency: This course counts for MATH-UA 140. Fulfillment: Math required, Honors Math required (with MATH-SHU 143); Engineering required, DS required Math course.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Computer Systems Engineering Required
- SB Crse Attr: NYU Shanghai: Data Science Required Mathematics
- SB Crse Attr: NYU Shanghai: Electrical and Systems Engineering Required
- SB Crse Attr: NYU Shanghai: Honors Mathematics Required Mathematics Course
- SB Crse Attr: NYU Shanghai: Mathematics Required Mathematics Course

MATH-SHU 141 Honors Linear Algebra I (4 Credits)
Typically offered Fall
This is the first semester of a 2-semester sequence in linear algebra for advanced mathematics majors. Topics covered include fields, vector spaces, linear independence, dimension, linear transformations, rank, matrices, eigenvalues, eigenvectors, determinants, characteristic polynomials, and the Cayley-Hamilton theorem. Examples from applications are also covered, including interpolation problems, traffic flows, genetics, the fundamental theorem of algebra, electric circuits, static mechanics, and consumption matrices in economics. Prerequisite: Pre-placement by Faculty based on high-school grades, or MATH-SH "Honors Calculus and Honors Linear Algebra" placement exam, or authorization of the instructor. Fulfillment: Math Constrained Math Elective; Honors Math required, DS Math required course.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No

MATH-SHU 142 Honors Linear Algebra II (4 Credits)
Typically offered occasionally
This course is a continuation of Honors Linear Algebra I. Topics covered include eigenspaces, multiplicities of eigenvalues, diagonalization, the Schur decomposition theorem, inner product spaces, the Gram-Schmidt process, orthogonality, adjoint maps, spectral theory, self-adjoint, normal, and unitary maps, bilinear forms, the Cholesky theorem, singular value decomposition, psuedoinverses, least-squares solutions via normal equations, ideals of polynomials, reducibility of maps, nilpotence, the Jordan decomposition theorem, minimal polynomials, the Penrose-Frobenius theorem, and stochastic matrices. Example covered from applications include data compression, optimization, QR factorization of least squares approximation, solutions of simultaneously coupled polynomial equations, determination of the critical temperature of a superconductor, and image compression via singular value decomposition. Prerequisite: Grade C or better in MATH-SHU 141 (Honors Linear Algebra I), or grade C or better in MATH-SHU 140 (Linear Algebra) and grade C or better in MATH-SHU 143 (Foundations of Mathematical Methods) Fulfillment: Math Constrained Math Elective; Honors Math required; DS concentration in Math.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Honors Mathematics Required Mathematics Course
- SB Crse Attr: NYU Shanghai: Mathematics Constrained Math Elective

MATH-SHU 143 Foundations of Mathematical Methods (4 Credits)
This course is an introduction to the tools of mathematical reasoning, which serves as a solid basis for advanced courses emphasizing proofs and abstraction. Topics include formal logic, sets, relations, and functions, proof techniques, cardinality, complex numbers, combinatorics, discrete probability. Prerequisite: Pre-placement by faculty based on high-school grades, or NYUSH "Calculus and Linear Algebra" placement exam or grade C or better in MATH-SHU 131 Calculus. Antirequisite: MATH-SHU 201 (Honors Calculus). Fulfillment: Honors Math required (with MATH-SHU 140).
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Honors Mathematics Required Mathematics Course

MATH-SHU 151 Multivariable Calculus (4 Credits)
Typically offered Fall and Spring
This course explores calculus of functions of several variables. Topics covered include power series, differentiation and integration of functions of several variables, including directional derivatives, the gradient, line and multiple integrals, and the theorems of Green, divergence, and Stokes. Prerequisite: Grade C or better in either MATH-SHU 131 (Calculus) or MATH-SHU 201 (Honors Calculus) Antirequisite: MATH-SHU 329 (Honors Analysis II) Equivalent to MATH-UA 123, MATH-AD 112. Fulfillment: CHEM required; PHYS required; Engineering required; MATH required; DS required Math course.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Chemistry Required
- SB Crse Attr: NYU Shanghai: Computer Systems Engineering Required
- SB Crse Attr: NYU Shanghai: Data Science Required Mathematics
- SB Crse Attr: NYU Shanghai: Electrical and Systems Engineering Required
- SB Crse Attr: NYU Shanghai: Mathematics Required Mathematics Course
- SB Crse Attr: NYU Shanghai: Physics Required

MATH-SHU 160 Networks and Dynamics (4 Credits)
Typically offered Spring
Today, networks and dynamics play fundamental roles throughout science, engineering and the social sciences. This is a post-calculus mathematics course that is designed to prepare students to understand the mathematical behavior of networks and dynamics as the students enter a broad set of majors -- from mathematics, the natural sciences and engineering through the social sciences such as economics and finance. The preliminary goal is to address the following challenge: today's science and society at large requires us to understand complex networks (be it genetic network that makes us who we are, neural network underlying our brain functions, social network of friends through Facebook or WeChat) and how the behavior of such a complex network evolves in time. The language for providing a scientific understanding of such systems is the mathematics of network theory and dynamical systems theory. This course will introduce analytical methods and mathematical models from network and dynamical systems theory toward understanding dynamical network behavior. Prerequisite: Grade C or better in either MATH-SHU 131 (Calculus) or MATH-SHU 201 (Honors Calculus), and grade C or better in either MATH-SHU 140 (Linear Algebra) or MATH-SHU 141 (Honors Linear Algebra I) . Fulfillment: Biology elective; Economics elective; Math additional Math elective; Honors Math elective; NS elective; Engineering required.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Biology Elective
- SB Crse Attr: NYU Shanghai: Computer Systems Engineering Required
- SB Crse Attr: NYU Shanghai: Economics Elective
- SB Crse Attr: NYU Shanghai: Electrical and Systems Engineering Required
- SB Crse Attr: NYU Shanghai: Honors Mathematics Math Elective
- SB Crse Attr: NYU Shanghai: Mathematics Additional Mathematics Elective
- SB Crse Attr: NYU Shanghai: Neural Science Elective

MATH-SHU 200 Topics in Mathematics: (4 Credits)
Fulfillment: Honors Math elective. Prerequisite: None.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: Yes
- SB Crse Attr: NYU Shanghai: Honors Mathematics Math Elective

MATH-SHU 201 Honors Calculus (4 Credits)
Typically offered Fall
This is a rigorous course in single-variable calculus for mathematics majors, providing preparation for advanced courses in analysis. Topics covered include number systems, functions, graphs, vectors, conic sections, polar coordinates, limits, continuity, least upper bounds, the derivative, convexity and concavity, inverse functions, parametric curves, Riemann sums, integrals, and the fundamental theorem of calculus. Prerequisite: Pre-placement by Faculty based on high-school grades, or NYU SH "Honors Calculus and Honors Linear Algebra" placement exam, or grade A- or better in MATH-SHU 131 (Calculus). Antirequisite: MATH-SHU 143 (Foundations of Mathematical Methods) Fulfillment: Math required; Honors Core Math required; ECON Core Math required.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Economics Core Math Requirement
- SB Crse Attr: NYU Shanghai: Honors Mathematics Math and Science Requirements
- SB Crse Attr: NYU Shanghai: Mathematics Math and Science Requirements
- SB Crse Attr: NYU Shanghai: Mathematics Required Mathematics Course

MATH-SHU 208 Advanced Linear Algebra (4 Credits)
Typically offered Fall
This is an honors course in linear algebra for mathematics majors. Topics covered include systems of linear equations, matrices, LU decomposition, determinants, vector spaces, linear independence, basis and dimension, subspaces and quotient spaces, linear transformations, eigenvalues and eigenvectors, Jordan canonical forms, inner products, orthogonality, quadratic forms, extrema of functions, and symmetric and positive matrices. Prerequisite: Placement on NYU SH mathematics placement exam. Co-requisite: MATH-SHU 201
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No

MATH-SHU 212 Multivariable Calculus and Differential Equations (4 Credits)
Typically offered Spring
This course explores advanced topics in calculus. Topics covered include sequences and series, power series, matrix algebra in dimensions two and three, first and second-order differential equations, series solutions of differential equations, and differentiation and integration of functions of several variables, including directional derivatives, the gradient, and double, triple, and line integrals. Prerequisite: Grade of C or better in MATH-SHU 131.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No

MATH-SHU 226 Functional Analysis (4 Credits)
Typically offered occasionally
This course on applications of concepts in functional analysis gives special emphasis to function spaces used in practice, including Hilbert, Hardy, and Sobolev spaces. Other topics covered include the spectral theorem and its application to differential equations, Fourier series, compact operators, Fredholm determinants, measure, volume, and nonlinear analysis for infinite-dimensional spaces, and Brownian motion. Prerequisite: Grade C or better in MATH-SHU 339 (Real variables). Fulfillment: Math Constrained Math elective; Honors Math elective.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Honors Mathematics Math Elective
- SB Crse Attr: NYU Shanghai: Mathematics Constrained Math Elective

MATH-SHU 234 Mathematical Statistics (4 Credits)
Typically offered occasionally
This course offers an introduction to mathematical statistics. It covers the essential topics of statistics including point estimation, interval estimation, Bayesian inference, hypothesis testing, and linear and logistic regression. This class requires a good prior understanding of probability theory, calculus, and linear algebra. Prerequisite: Grade C or better in either MATH-SHU 140 (Linear Algebra) or MATH-SHU 141 (Honors Linear Algebra I), and grade C or better in either MATH-SHU 235 (Probability and Statistics) or MATH-SHU 233 (Theory of Probability). Fulfillment: Honors Math Electives, Math Additional electives; DS Data Analysis or concentration in Math.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Data Science Required Data Analysis
- SB Crse Attr: NYU Shanghai: Honors Mathematics Math Elective
- SB Crse Attr: NYU Shanghai: Mathematics Additional Mathematics Elective

MATH-SHU 235 Probability and Statistics (4 Credits)
Typically offered Fall and Spring
This course comprises a combination of the theory of probability and the mathematical foundations with techniques of modern statistical analysis. It is designed to acquaint the student with both probability and statistics in the context of their applications to the sciences. In probability: mathematical treatment of chance; combinatorics; binomial, Poisson, and Gaussian distributions; law of large numbers and the normal distribution; application to coin-tossing, radioactive decay, and so on. In statistics: sampling; normal and other useful distributions; testing of hypotheses; confidence intervals; correlation and regression; and applications to scientific, industrial, and financial data. Prerequisite: MATH-SHU 131 Calculus or 210 Honors Calculus. Not open to students who have taken MATH-SHU 238 Honors Theory of Probability and/or MATH-UA 234 Mathematical Statistics. Equivalency: This course counts for MATH-UA 235. Fulfillment: Math required course, Social Science Methods, Business Core, CS & CE & EE required, Data Science foundational, Economics required, PHYS required, IMB Business elective.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No

- SB Crse Attr: NYU Shanghai: BUSF Business Core
- SB Crse Attr: NYU Shanghai: BUSM Business Core
- SB Crse Attr: NYU Shanghai: Computer Science Required
- SB Crse Attr: NYU Shanghai: Computer Systems Engineering Required
- SB Crse Attr: NYU Shanghai: Data Science Foundational
- SB Crse Attr: NYU Shanghai: Economics Required
- SB Crse Attr: NYU Shanghai: Electrical and Systems Engineering Required
- SB Crse Attr: NYU Shanghai: IMB Business Elective
- SB Crse Attr: NYU Shanghai: Mathematics Required Mathematics Course
- SB Crse Attr: NYU Shanghai: Physics Required
- SB Crse Attr: NYU Shanghai: Social Science Methods Course

MATH-SHU 238 Honors Theory of Probability (4 Credits)
Typically offered Spring
This course is an introduction for mathematics majors to the mathematical treatment of random phenomena occurring in the natural, physical, and social sciences. Topics covered include axioms of mathematical probability, combinatorial analysis, the binomial distribution, Poisson and normal approximation, random variables, probability distributions, generating functions, and Markov chains and their applications. Prerequisite: Grade C or better in either MATH-SHU 151 (Multivariable Calculus) or MATH-SHU 329 (Honors Analysis II), and grade C or better in either MATH-SHU 140 (Linear Algebra) or MATH-SHU 141 (Honors Linear Algebra I). Equivalency: This course counts for MATH-UA 233. Non-Shanghai students need to get the instructors' permission to enroll in classes. Fulfillment: Math required; Honors Math required; CS, CE, EE required; DS Foundational course or concentration in Math; Economics required .
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No

- SB Crse Attr: NYU Shanghai: Computer Science Required
- SB Crse Attr: NYU Shanghai: Computer Systems Engineering Required
- SB Crse Attr: NYU Shanghai: Data Science Foundational
- SB Crse Attr: NYU Shanghai: Economics Required
- SB Crse Attr: NYU Shanghai: Electrical and Systems Engineering Required
- SB Crse Attr: NYU Shanghai: Honors Mathematics Required Mathematics Course
- SB Crse Attr: NYU Shanghai: Mathematics Required Mathematics Course

MATH-SHU 241 Number Theory (4 Credits)
Typically offered occasionally
This course builds on the ideas of abstract algebra, but also employs analytic techniques. Topics include valuations, Dedekind domains, Minkowski's theorem, ramification, the Riemann-Roch theorem and Riemann-Hurwitz formula, connections to Riemann surfaces and algebraic curves, reciprocity, zeta functions, and the prime number theorem. Prerequisite: Grade of C or better in MATH-SHU 349. Fulfillment: Math Additional elective.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No

- SB Crse Attr: NYU Shanghai: Mathematics Additional Mathematics Elective

MATH-SHU 250 Mathematics of Finance (4 Credits)
Typically offered occasionally
Introduction to the mathematics of finance. Topics: linear programming with application to pricing. Interest rates and present value. Basic probability, random walks, central limit theorem, Brownian motion, log-normal model of stock prices. Black-Scholes theory of options. Dynamic programming with application to portfolio optimization. Prerequisites: Grade C or better in either MATH-SHU 151 (Multivariable Calculus) or MATH-SHU 329 (Honors Analysis II), and grade C or better in either MATH-SHU 235 (Probability and Statistics) or MATH-SHU 233 (Theory of Probability) Fulfillment: BUSF Finance elective; BUSM Finance track; IMB Business elective; Math Additional elective; Honors Math elective.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: BUSF Finance Elective
- SB Crse Attr: NYU Shanghai: Honors Mathematics Math Elective
- SB Crse Attr: NYU Shanghai: IMB Business Elective
- SB Crse Attr: NYU Shanghai: Mathematics Additional Mathematics Elective

MATH-SHU 251 Introduction to Math Modeling (4 Credits)
Typically offered occasionally
Formulation and analysis of mathematical models. Mathematical tools include dimensional analysis, optimization, simulation, probability, and elementary differential equations. Applications to biology, economics, other areas of science. The necessary mathematical and scientific background is developed as needed. Students participate in formulating models as well as in analyzing them. Pre-requisites: Grade C or better in either MATH-SHU 151 (Multivariable Calculus) or MATH-SHU 201 (Honors Calculus), and grade C or better in either MATH-SHU 140 (Linear Algebra) or MATH-SHU 141 (Honors Linear Algebra I). Fulfillment: MATH additional elective; Honors MATH elective.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Honors Mathematics Math Elective
- SB Crse Attr: NYU Shanghai: Mathematics Additional Mathematics Elective

MATH-SHU 252 Numerical Analysis (4 Credits)
Typically offered occasionally
In numerical analysis, one explores how mathematical problems can be analyzed and solved with a computer. This has very broad applications in mathematics, physics, engineering, finance, and the life sciences. This course gives an introduction to numerical analysis for mathematics majors. Theory and practical examples using Matlab will be combined to study a range of topics, from simple root-finding procedures to differential equations and the finite element method. Prerequisite: Grade C or better in either MATH-SHU 131 (Calculus) or MATH-SHU 201 (Honors Calculus,) and grade C or better in either MATH-SHU 140 (Linear Algebra) or MATH-SHU 141 (Honors Linear Algebra I). Fulfillment: CORE AT; Math Additional elective; Honors Math elective.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Algorithmic Thinking
- SB Crse Attr: NYU Shanghai: Honors Mathematics Math Elective
- SB Crse Attr: NYU Shanghai: Mathematics Additional Mathematics Elective

MATH-SHU 262 Ordinary Differential Equations (4 Credits)
Typically offered occasionally
This course introduces the main ideas of ordinary differential equations. Topics include vector fields, existence and uniqueness of solutions to first-order linear differential equations, stability, higher order differential equations, the Laplace transform and numerical methods, linear and nonlinear systems, and Sturm-Liouville theory. Prerequisite: Grade C or better in either MATH-SHU 131 (Calculus) or MATH-SHU 201 (Honors Calculus), and grade C or better in either MATH-SHU 140 (Linear Algebra) or MATH-SHU 141 (Honors Linear Algebra I). Anti-requisite: Students who have taken MATH-SHU 362 Honors Ordinary Differential Equations are not eligible. Equivalency: This course counts for MATH-UA 262. Fulfillment: Math required course.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Mathematics Required Mathematics Course

MATH-SHU 263 Partial Differential Equations (4 Credits)
Typically offered Spring
Many laws of physics are formulated as partial differential equations. This course discusses the simplest examples, such as waves, diffusion, gravity, and static electricity. Nonlinear conservation laws and the theory of shock waves are discussed, as well as further applications to physics, chemistry, biology, and population dynamics. Prerequisite: Grade C or better in either MATH-SHU 262 (Ordinary Differential Equations) or MATH-SHU 362 (Honors Differential Equations),AND grade C or better in either MATH-SHU 151 (Multivariable Calculus) or MATH-SHU 329 (Honors Analysis II). Equivalency: This course counts for MATH-UA 263. Fulfillment: Math Additional Math elective; Honors Math elective.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Honors Mathematics Math Elective
- SB Crse Attr: NYU Shanghai: Mathematics Additional Mathematics Elective

MATH-SHU 265 Linear Algebra and Differential Equation (4 Credits)
Typically offered Fall and Spring
This course is an introduction to linear algebra and ordinary differential equations. Topics covered include the fundamental concepts of linear algebra such as matrix theory, determinants, vector spaces, subspaces, basis, linear transformations, eigenvectors, eigenvalues and the inner product spaces, as well as the fundamental techniques of ordinary differential equations such as first order differential equations, linear differential equations (and systems). Pre-requisites: Calculus OR Honors Calculus. Anti-requisites: MATH-SHU 140, MATH-SHU 141, MATH-SHU 262, or MATH-SHU 362. Fulfillment: PHYS additional required; CE required; EE required; DS Math required.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Computer Systems Engineering Required
- SB Crse Attr: NYU Shanghai: Data Science Required Mathematics
- SB Crse Attr: NYU Shanghai: Electrical and Systems Engineering Required
- SB Crse Attr: NYU Shanghai: Physics Required

MATH-SHU 270 Optimal Control with Engineering Applications (4 Credits)
Typically offered Summer term
This course provides brief introductions to optimal control for systems with known and unknown dynamics and applications to engineering. It considers deterministic and stochastic problems for both discrete and continuous systems. It covers solution methods including dynamic programming, variational calculus, and approaches based on Pontryagin's maximum principle. Examples and applications of the theory will be given in different contexts such as data assimilation, finance, and material science. Pre-req: MATH-SHU 140 Linear Algebra and MATH-SHU 151 Multivariable Calculus. Fulfillment: Math Additional Math Elective
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Mathematics Additional Mathematics Elective

MATH-SHU 282 Functions of a Complex Variable (4 Credits)
Typically offered Spring
Complex variables and functions play an essential role in many branches of mathematics and science. In this course, we cover basic aspects of the theory, including differentiation of complex functions, the Cauchy-Riemann equations, Cauchy's theorem and integral formula, singularities, Laurent series, conformal mapping, analytic continuous, and applications to fluid flow. Prerequisite: Grade C or better in either MATH-SHU 151 (Multivariable Calculus) or MATH-SHU 329 (Honors Analysis II). Equivalency: This course counts for MATH-UA 282. Fulfillment: Math constrained Math elective; Honors Math required course.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Honors Mathematics Required Mathematics Course
- SB Crse Attr: NYU Shanghai: Mathematics Constrained Math Elective

MATH-SHU 328 Honors Analysis I (4 Credits)
Typically offered Spring
This course is a continuation of Honors Calculus. Topics covered include integration techniques, trigonometric functions, the logarithm, exponential functions, approximation by polynomials, sequences, series, convergence, uniform convergence, power series, Taylor series, complex numbers and functions, Euclidean spaces, and basic topology. Prerequisite: Grade C or better in MATH-SHU 201 (Honors Calculus), or grade A- or better in MATH-SHU 131 (Calculus) Equivalency: This course counts for MATH-UA 328. Fulfillment: Math constrained Math elective; Honors Math required; DS required Mathematics course
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Data Science Required Mathematics
- SB Crse Attr: NYU Shanghai: Honors Mathematics Required Mathematics Course
- SB Crse Attr: NYU Shanghai: Mathematics Constrained Math Elective

MATH-SHU 329 Honors Analysis II (4 Credits)
Typically offered Fall
This course is a continuation of Analysis I, with emphasis on functions of several variables. Topics covered include the topology of Euclidean space, the Stone-Weierstrass theorem, the implicit and inverse function theorems in several variables, Jordan regions, linear transformations, differentiation of integrals, and integration of differential forms. Prerequisite: Grade of C or better in [MATH-SHU 328 Honors Analysis 1] AND [MATH-SHU 141 Honors Linear Algebra I or (MATH-SHU 140 Linear Algebra and MATH-SHU 143 Foundations of Mathematical Methods)] Equivalency: This course counts for MATH-UA 329. Fulfillment: Honors MATH Required, MATH Constrained Math electives, DS concentration in Math.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Honors Mathematics Required Mathematics Course
- SB Crse Attr: NYU Shanghai: Mathematics Constrained Math Elective

MATH-SHU 339 Real Variables (4 Credits)
Typically offered Fall and Spring
This is an introductory course on modern analysis. The topics to be discussed include: Lebesgue measure and integration, measurable functions and sets, convergence theorems, Lebesgue differentiation theorem, elements of Hilbert space and Banach space, Riesz's representation theorem, Sobolev space and its applications to partial differential equations. Prerequisite: Grade C or better in MATH-SHU 328 (Honors Analysis I) Fulfillment: Constrained Math elective; Honors Math elective.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Honors Mathematics Math Elective
- SB Crse Attr: NYU Shanghai: Mathematics Constrained Math Elective

MATH-SHU 345 Introduction to Stochastic Processes (4 Credits)
Typically offered occasionally
This is an introductory course in stochastic processes. Stochastic processes are widely used as modeling tools in many fields of application, including finance, physics, biology and engineering. The course will include an introduction to measure theory, thebasic theory of discrete and continuous time Markov chains,branching processes, Poisson point processes Brownian motion and martingales. In the final part of the course, more advanced topics such as stochastic integrals, free fields, Markov loops and Ising model may be included as time permits and according to the background of the students. Pre-requisites: Grade B or better in either MATH-SHU 140 (Linear algebra) or MATH-SHU 141 (Honors Linear Algebra I), and grade B or better in either MATH-SHU 235 (Probability and Statistics) or MATH-SHU 233 (Theory of Probability) Fulfillment: Honors Math Electives, Math Additional electives; DS Concentration in Math.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Honors Mathematics Math Elective
- SB Crse Attr: NYU Shanghai: Mathematics Additional Mathematics Elective

MATH-SHU 348 Honors Algebra I (4 Credits)
Typically offered occasionally
This introduction to abstract algebra is a rigorous study of groups and rings. Topics covered include symmetric and linear groups, the Sylow theorems, classification of finitely generated abelian groups, polynomial and quotient rings, ideals, principal ideal domains, unique factorization, and the Nullstellensatz. Prerequisites: Grade C or better in MATH-SHU 141 (Honors Linear Algebra I, or grade B or better in MATH-SHU 140 (Linear Algebra) Fulfillment: Math constrained Math elective; Honors Math required course.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Honors Mathematics Required Mathematics Course
- SB Crse Attr: NYU Shanghai: Mathematics Constrained Math Elective

MATH-SHU 349 Abstract Algebra I (4 Credits)
Typically offered occasionally
This introduction to abstract algebra introduces the notions of group, ring, and field. Topics covered include symmetric and linear groups, the Sylow theorems, polynomial and quotient rings, ideals, unique factorization, the Nullstellensatz, field extensions and finite fields. Prerequisite: >=Grade C in MATH-SHU 141 Honors Linear Algebra I, or >=grade B in MATH-SHU 140 Linear algebra and >=grade C in either MATH-SHU 201 Honors Calculus or MATH-SHU 143 Foundations of Mathematical Methods, or instructor consent Fulfillment: Math Constrained Math Elective; Honors Math elective.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Honors Mathematics Math Elective
- SB Crse Attr: NYU Shanghai: Mathematics Constrained Math Elective

MATH-SHU 350 Probability Limit Theorems (4 Credits)
Typically offered every year
The goal of this course is to introduce the main ideas of advanced probability: rigorous treatment of conditional expectation and martingales, weak convergence, strong law of large numbers, central limit theorem, convergence to infinitely divisible distributions, law of iterated logarithm, Markov Chains, stationary stochastic processes, ergodic theorems. Prerequisite: Grade C or better in MATH-SHU 328 (Honors Analysis 1). Fulfillment: Math Constrained Math elective; Honors Math elective.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Honors Mathematics Math Elective
- SB Crse Attr: NYU Shanghai: Mathematics Constrained Math Elective

MATH-SHU 351T Mathematical Models in Biology and Finance (4 Credits)
This is a two part course that will expose students to current mathematical models based on stochastic differential equations, both from the mathematical and numerical points of view. Students will learn the notion of stochastic differential equation and study different equations proposed to describe biological phenomenon and the evolution of financial markets. Students will compare different methods to integrate numerically these equations and illustrate them in some concrete applications Prerequisite: None. Fulfillment: Math Constrained Math elective; Honors Math elective.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Honors Mathematics Math Elective
- SB Crse Attr: NYU Shanghai: Mathematics Constrained Math Elective

MATH-SHU 362 Honors Ordinary Differential Equations (4 Credits)
Typically offered occasionally
This course introduces the main ideas of ordinary differential equations, with a particular emphasis on proofs, in comparison with the course MATH-SHU 262. It will cover vector fields, proof of local existence and uniqueness of solutions of first-order differential equations by Picard's fixed point iteration, stability, higher order linear differential equations and their set of fundamental solutions (with proof of characterization by the Wronskian), Series Solutions of second order linear differential equations (ordinary points, proof of Fuchs Theorem, regular singular points and indicial equation), Laplace transform and numerical methods, nonlinear systems, boundary value problems. Prerequisite: Grade C or better in MATH-SHU 201 (Honors Calculus), or MATH-SHU 131 (Calculus) and MATH-SHU 143 (Foundations of Mathematical Methods), and grade C or better in either MATH-SHU 140 (Linear Algebra) or MATH-SHU 141 (honors Linear Algebra I). Fulfillment: Math Required; Honors Math Required.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Honors Mathematics Required Mathematics Course
- SB Crse Attr: NYU Shanghai: Mathematics Required Mathematics Course

MATH-SHU 375 Topology (4 Credits)
This course presents the basic ideas of point-set topology, as well as their interactions with analysis and algebra. Topics covered include topological spaces, metric spaces, compactness, Tychonoff's theorem, separation axioms, Urysohn's lemma, covering spaces, fundamental groups, and homotopy groups. Prerequisite: Grade of C or better in MATH-SHU 328. Fulfillment: Math Constrained Math elective; Honors Math elective.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No

MATH-SHU 377 Differential Geometry (4 Credits)
Typically offered occasionally
This course investigates the differential properties of curves and surfaces. Topics covered include differential manifolds and Riemannian geometry. Prerequisite: Grade of C or better in MATH-SHU 329. Fulfillment: Math Constrained Math elective; Honors Math elective.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No
- SB Crse Attr: NYU Shanghai: Honors Mathematics Math Elective
- SB Crse Attr: NYU Shanghai: Mathematics Constrained Math Elective

MATH-SHU 395 Special Topics in Math (4 Credits)
Typically offered occasionally
Topics vary yearly. Detailed course descriptions are available during preregistration.Covers topics not offered regularly: experimental courses and courses offered on student demand. Prerequisite: None. Fulfillment: general elective.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: Yes

MATH-SHU 997 Independent Study: Mathematics (2-4 Credits)
Typically offered Fall and Spring
Students majoring in mathematics are permitted to work on an individual basis under the supervision of a full-time or visiting faculty member in the department if they have maintained an overall GPA of 3.0 and a GPA of 3.5 in mathematics and have a study proposal that is approved by a mathematics professor. Students are expected to spend about two to three hours a week per credit (a 4-credit IS would involve about ten to twelve hours a week) on their project. Prerequisite: None. Department consent is needed. Fulfillment: Math Additional Math elective; Honors Math elective.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: Yes
- SB Crse Attr: NYU Shanghai: Honors Mathematics Math Elective
- SB Crse Attr: NYU Shanghai: Mathematics Additional Mathematics Elective

MATH-SHU 998 Independent Study: Mathematics (2-4 Credits)
Typically offered Spring
Students majoring in mathematics are permitted to work on an individual basis under the supervision of a full-time or visiting faculty member in the department if they have maintained an overall GPA of 3.0 and a GPA of 3.5 in mathematics and have a study proposal that is approved by a mathematics professor. Students are expected to spend about two to three hours a week per credit (a 4-credit IS would involve about ten to twelve hours a week) on their project. Prerequisite: None. Department consent is needed.
Grading: Ugrd Shanghai Graded
Repeatable for additional credit: No