Mathematics

Graduates of the Mathematics major at Haigazian University receive the Bachelor of Science (B.S.) degree.

Students who complete the degree in Mathematics should be able to:
- Understand the role of axioms or assumptions and the basic rules of logic.
- Abstract general principles from examples.
- Analyze, model, and solve computational problems.
- Recognize which real-world problems are subject to mathematical reasoning.
- Formulate a mathematical statement precisely and write a coherent proof.
- Teach mathematics for high school students.
- Continue in graduate studies and conduct research in different fields of mathematics.

The Department of Mathematics offers the degree of Bachelor of Science (B.S.). In addition to the general university requirements, the Mathematics Department requires a minimum of 39 credits in mathematics, 12 credits in computer science, 7 credits in physics, and 6 credits in economics. All students majoring in mathematics must pass MAT 201 and MAT 202 with a minimum grade of 70.

Note : For a Normal Diploma (Teaching Diploma), all diploma requirements must be met. Total 200-level courses taken for the B.S. degree and the Normal Diploma should add up to 112 credits.

General Education (30 cr.)

Core requirements for all HU students are listed on page 58.

Core Requirements (27 cr.)

MAT 201	Calculus and Analytic Geometry III	3 cr.
MAT 202	Differential Equations	3 cr.
MAT 209	Fundamentals of Mathematics	3 cr.
MAT 213	Topics in Geometry	3 cr.
MAT 219	Linear Algebra I	3 cr.
MAT 223	Advanced Calculus I	3 cr.
MAT 227	Introduction to Complex Variables	3 cr.
MAT 233	Probability and Statistics for the Sciences	3 cr.
MAT 241	Abstract Algebra I	3 cr.

Elective Courses (12 cr.)

Four mathematics courses in the Department.

Computer Science Requirements	(12 cr.)
CSC 202 Computer Programming	3 cr.
CSC 204 Advanced Computer Programming & Data	3 cr.
Two elective courses from Computer Science	6 cr.

Physics Requirements	(7 cr.)
PHY 211 Electricity and Magnetism	3 cr.
PHY 213 Electricity and Magnetism Lab	1 cr.
PHY 217 Mechanics	3 cr.

Economics Requirements	(6 cr.)
ECO 201 Microeconomic Principles	3 cr.
ECO 202 Macroeconomic Principles	3 cr.

Mathematics Courses

MAT 100 Introductory Statistics (3 cr.)

This course provides the student with knowledge of the very basic elements of statistics, concentrating mainly on the descriptive component. Topics include: data and types of data, populations, random samples, types of random samples, tabular and graphical organization of raw data , frequency tables, and histograms and polygons, as well as quantitative descriptive measures: mean , mode, percentiles, variance and standard deviation, simple probability models and laws, some important probability distributions, and confidence intervals for a single population parameter.

MAT 101 Calculus and Analytic Geometry I (3 cr.)

Slope of a curve; limits; continuity; derivatives with application to curve plotting; Rolle's Theorem; Mean Value Theorem; L'Hopital's Rule; integration with application to areas and volumes; fundamental theorem of calculus.

MAT 102 Calculus and Analytic Geometry II (3 cr.)

Transcendental functions. Integration by substitution and by parts. Conic sections. Vectors, vector products. Equations of lines and planes. Notion of a vector field. Notion of complex numbers and differential equations. Prerequisite: MAT 101.

MAT 104 Mathematics for Business (3 cr.)

Sets, real number system, functions of real variables, the inverse function. Graphical representation. Linear curves. Quadratic curves. Limit of a function, continuity. Derivatives with applications; graphing of functions, L'Hopital's rule. Indefinite integration, definite integration with applications. Logarithmic and exponential functions.

MAT 201 Calculus and Analytic Geometry III (3 cr.)

Methods of integration. Hyperbolic functions. Polar co-ordinates. Partial differentiation with applications. Multiple integrals with applications. Infinite series.

MAT 202 Differential Equations (3 cr.)

First order differential equations. Linear differential equations. Systems of linear differential equations. Power series solutions. Laplace transforms. Prerequisite: 70 in MAT 201.

MAT 204 Mathematics for Business and Economic Analysis (3 cr.)

Mathematical topics covered: functions of several variables, partial derivates, optimisation over constraints, Lagrange multipliers. Matrices, determinants, inverse of a matrix, systems of linear equations. Business and Economic applications: supply and demand, cost analysis, revenue functions, break-even analysis, production cost. Integration and applications. Joint demand and cost functions. Consumer and producer surplus. Input-output analysis. Prerequisite: ECO 201, ECO 202, and MAT 104 for Technical Baccalaureate holders.

MAT 209 Fundamentals of Mathematics (3 cr.)

Axiomatic set theory, set identities, logic elements of a mathematical proof, mathematical induction, functions on arbitrary sets relations, binary operations, cardinality and basic counting principles.

MAT 213 Topics in Geometry (3 cr.)

The Euclidean postulates for geometry, Euclidean geometry in two dimensions, congruences and similitude, constructions, use of vectors and analysis in geometric proofs, extremal geometric problems ,introduction to spherical and hyperbolic geometries. Corequisite: MAT 201.

MAT 214 Topology (3 cr.)

Topological spaces, bases, and subbases. Separation properties. Connectedness. Compactness. Mappings of topological spaces. Product spaces. Prerequisite: MAT 201 and MAT 219.

MAT 219 Linear Algebra I (3 cr.)

Systems of linear equations. Matrices and determinants. Real vector spaces. Subspaces. Bases and dimension. Rank and nullity. Inner product spaces. Eigenvalues and eigenvectors. Linear transformations and the matrix of a linear transformation.

MAT 220 Linear Algebra II (3 cr.)

Vector spaces over fields. Determinants. Eigenvalue theory. Inner product spaces. Adjoint of a linear transformation. Prerequisite: MAT 219 and MAT 241.

MAT 222 Vector Analysis (3 cr.)

Vector algebra. Differentiation and integration of vector functions. Scalar, vector, and conservative fields. Line, surface, and volume integrals. Stocke's Theorem, Green's Integral Theorem, the Divergence Theorem. Curvilinear coordinate systems. Prerequisite: MAT 201.

MAT 223 Advanced Calculus I (3 cr.)

Real and complex number systems, metric spaces, compact sets, connected sets, sequences and series, continuity, differentiation, Riemann Stieltjes integrals. Prerequisite: MAT 201 and MAT 202 or consent of instructor.

MAT 224 Advanced Calculus II (3 cr.)

Sequences and series of functions, Stone Weierstrass' theorem, exponential, logarithmic, and gamma functions. Functions of several variables, inverse and implicit function theorem. Integration of differentiable forms. Prerequisite: MAT 223.

MAT 227 Introduction to Complex Variables (3 cr.)

Complex numbers and their elementary properties, analytic functions, continuity and differentiability, Cauchy-Riemann conditions, contour integration, line integrals, Morera's theorem, the fundamental theorem of algebra, power series, Taylor and Laurent series, residues and poles. Prerequisite: MAT 201.

MAT 233 Probability and Statistics for the Sciences (3 cr.)

Probability models, laws of probability, conditional probability, independent events. Random variables, expectations, moment generating functions, probability distributions, joint probability distributions. Famous discrete and continuous probability distributions, stochastic independence. Descriptive and some inferential statistical tools. Applications to various scientific fields. Prerequisite: MAT 201.

MAT 234 Statistical Inference and Nonparametric Statistics (3 cr.)

Distributions of functions of random variables, sampling distributions, the central limit theorem, estimation of parameters, general tests of hypothesis, nonparametric tests. Prerequisite: MAT 233.

MAT 241 Abstract Algebra I (3 cr.)

Groups, normal subgroups, isomorphism theorems. Permutation groups and Cayley's theorem. Automorphisms. Rings, ideals, and integral domains. Polynomial rings. Prerequisite: MAT 201 and Corequisite: MAT 219.

MAT 242 Abstract Algebra II (3 cr.)

Topics chosen from the following: module over a ring, the fundamental theorem on finitely generated modules over a Euclidean ring, algebras over a field, vector spaces, the dual space, linear transformations, characteristic roots, diagonable linear transformations, the triangular form theorem, Jordan and rational canonical forms. Group theory, Galois theory. Prerequisite: MAT 241.

MAT 251 Numerical Analysis (3 cr.) (Equivalent to CSC 251)

An introduction to scientific computing as illustrated in: number systems and errors, roots of equations, computational linear algebra, curve fitting, numerical integration and differentiation, and numerical differential equations. Programming assignments are required. Prerequisite: MAT 201 and MAT 202.

MAT 261 Number Theory (3 cr.)

General introduction to the theory of numbers. Theorems of divisibility and congruence. The Euclidean algorithm. Quadratic residues and the reciprocity law. Some diophantine equations. Binary quadratic forms. Simple continued fractions. Some number theoretic functions. Prerequisite: MAT 201.

MAT 270 Discrete Structures (3 cr.) (Equivalent to CSC 238)

Sets, relations, and functions. Mathematical induction, counting principles. Arithmetic in different bases. Difference equations and recurrence relations. Truth tables and switching circuits. Strings and languages. Graphs and trees.

MAT 271 Set Theory (3 cr.)

Introduction to metric spaces with emphasis on the real line. Baire's category. Cardinality and ordinality. The axiom of choice. Transfinite induction. Well-ordering principle.