

School	School of Arts & Science
Major	Mathematics

Core Requirements			
Code	Title	Credits	Description
PHYS360	Analytical Mechanics	3	Advanced Newtonian mechanics, Kepler's laws, Lagrangian, Hamiltonian, central forces, oscillations, coupled oscillations, motion of rigid bodies. Prerequisite(s): PHYS 210+ MATH 220+ MATH 270.
MATH210	Calculus II	3	The course material includes hyperbolic functions and their inverses and their derivatives integration techniques, improper integrals, sequences, infinite series, power series, Taylor and Maclaurin series and application of power series. The mathematical software Maple will be introduced and used in support of the comprehension of the material. Prerequisites: MATH160
PHYS210	Mechanics	3	Vectors, motion in one and two dimensions, Circular motion, Conservation of Energy and momentum, Gravitational Laws, Kepler's Laws, Fluids. Prerequisite(s): ENGL 150
PHYS250	Thermodynamic and Waves	3	Temperature, heat, laws of thermodynamics, heat engines, waves, sound waves, geometrical optics, interference and diffraction. Prerequisite(s): PHYS 200
PHYS280	Electricity and Magnetism	3	Electricity, electric field and electric potential, Electric current, Gauss law, capacitors, resistance, Ohm's law, Kirchoff's laws, magnetism, Ampere's law, Biot-Savart law, Faraday's law, and RLC circuits. Prerequisite(s): ENGL 150
MATH380	Complex Variables	3	Complex numbers and their elementary properties, analytic functions, continuity and differentiability, Cauchy-Riemann conditions, complex integration, Morera's theorem, the Fundamental Theorem of Algebra, power series, Taylor series, Laurent series, residues and poles, conformal mapping, Cauchy-Christoffel transformation. Prerequisite: MATH 220
MATH375	Numerical Methods for Scientists & Engineers	3	Bases and number representation, analysis of error propagation and error correction, roots for non-linear equations, computational linear algebra, polynomial interpolation, approximation of functions by polynomials, numerical differentiation and integration, numerical methods for solving differential equations, Runge-Kutta method, numerical methods for solving systems of equations and differential equations. Prerequisite: MATH 265 and CSCI 250.

MATH330	Partial Differential Equations	3	Classification of partial differential equations, Linear partial differential equations, separation of variables, closed form solutions, transform techniques and numerical methods, Fourier series and Fourier transform, the Dirichlet and Neumann problems. Prerequisite: MATH 270.
MATH260L	Discrete Mathematics Lab	1	Set theory, Logic, Relations, Functions, Induction, Classification of infinite sets, Cardinal numbers, Boolean Algebra.
MATH310	Probability & Statistics for Scientists & Engineers	3	The concept of probability and its properties, descriptive statistics, discrete and continuous random variables, expected value, distribution functions, the central limit theorem, random sampling and sampling distributions, Hypothesis testing. Prerequisite: MATH 170
MATH270	Ordinary Differential Equations	3	First-order equations, linear and non-linear differential, linearization, numerical and qualitative analysis, second-order equations, existence-uniqueness theorem, series solutions, Bessel's and Legendre's functions, Laplace transforms, systems of differential equations, applications and modeling of real phenomena. Prerequisite: MATH 220.
MATH225	Linear Algebra with Applications	3	Introduction to the systems of linear equations and matrices, Gaussian eliminations, matrix operations, inverses, types of matrices, determinants and their applications, vector spaces, subspaces, linear independence, basis and dimension, rank and nullity, inner product spaces and orthogonal bases, eigenvalues and eigenvectors, applications from other disciplines such as physics, computer science, and economics.
MATH220	Calculus III	3	This text covers basic topics on infinite series, lines and planes in space, cylinders and quadric surfaces, functions of several variables, limits and continuity, Partial derivatives, chain rule, directional derivatives, Gradient vector, tangent planes, double and triple integrals, areas, moments, center of mass, volumes, double integrals in polar forms, triple integrals in cylindrical and spherical coordinates, line integrals, vector fields Green's theorem, surface integrals, Stokes theorem, and the divergence theorem. Students are required to solve extensive number of problems and computer assignment using the mathematical software package Maple.
MATH260	Discrete Mathematics	3	Sets, elementary logic, method of proofs, induction, relations, functions, recurrence relations, difference equations, modular arithmetic, arithmetic in different bases, Boolean algebra, counting, combinatorial methods, complexity analysis, graphs, trees, algorithms, finite-state machines. Prerequisite: MATH 170 or Math Placement Test

MATH305	Programming Languages for Scientist	3	Programming Languages for Scientist
CSCI250	Introduction to Programming	3	This course introduces the basic concepts and principles of structured programming in Java. It starts by an introduction to Java showing its syntax and the structure of a program in Java then teaches simple data types, control structures, methods, arrays, and strings.
CSCI250L	Introduction to Programming Lab	1	This course is a co-requisite for the Introduction to Programming course (CSCI250). The students apply in the lab the fundamentals of programming, explained in CSCI250, by solving lab exercises. The objective of the lab is to implement programming problems using basic data types, selection and repetition structures, methods and arrays.
MATH345	Introduction to Real Analysis	3	Real numbers, Algebraic properties of the set of real numbers and the continuum property - Archimedean axiom, Sequences of real numbers, Inferior and superior limits Bounded sequences, Limits - Convergent sequences, Bolzano-Weierstrass Theorem, Cauchy sequences, Functions of a real variable, Limits of a function of a real variable, Continuous functions and Differentiable functions.

Major Requirements			
Code	Title	Credits	Description
MATH490	Modern Topics in Algebra	3	Theory of fields and related algebraic structures, extension fields, and Galois theory. Prerequisite: MATH 365.
MATH405	Number Theory	3	Divisibility of integers, congruencies, arithmetic functions, Diophantine equations, primitive roots, second order congruencies, quadratic residues, Legendre symbol, Jacobi symbol, higher order polynomial congruencies, as well as application to cryptography.
MATH420	Differential Geometry	3	Geometry of curves and surfaces in Euclidean three space, calculus on a surface, intrinsic geometry of surfaces, theory of differential manifold, topological groups, differential forms, Frenet's formulas, Gaussian curvature, Cartan's structure equations, local and global theory of parameterized curves, Gauss map, intrinsic geometry of surfaces. Prerequisite: MATH 320.
MATH455	Mathematical Analysis	3	A rigorous study of the theory of calculus: topology of the real line, sequences and series of real numbers, the completeness axiom, real-valued functions, limits, continuous functions, intermediate value theorem, uniform continuity, extreme values, differentiation, mean-value theorem, uniform convergence of sequences of functions, integration, the Riemann integral, the fundamental theorem of calculus. Prerequisite: MATH 220, MATH 250.
MATH492	Mathematical Seminar	1	Mathematical Seminar
MATH385	Introduction to Topology	3	Topological spaces, open sets, closed sets, subspaces, basis, continuous functions, connected spaces, compactness, product and quotient spaces. Prerequisite: MATH 200.
MATH365	Abstract Algebra	3	Groups, subgroups, cyclic groups, permutation groups, cosets, Lagrange's theorem, homomorphisms, normal subgroups and quotient groups, rings, ideals, homomorphisms and quotient fields, and Euclidean and principal ideal domains. Prerequisite: MATH 250.
MATH315	Advanced Linear Algebra	3	LU and QR-decomposition, orthogonal matrices, change of basis, similarity, diagonalization, orthogonal diagonalization, linear transformations, kernel, range, eigenvalues, eigenvectors, complex vector spaces, additional topics in linear algebra, applications of linear algebra to other fields.

General Education Requirements			
Code	Title	Credits	Description
ENGL251	Communication Skills	3	The objectives of this course are to improve students' writing skills for academic purposes by developing effective use of grammatical structures; analytical and critical reading skills; a sensitivity to rhetorical situation, style, and level of diction in academic reading and writing; and competence in using various methods of organization used in formal writing.
ENGL201	Composition and Research Skills	3	This course focuses on the development of writing skills appropriate to specific academic and professional purposes; the analysis and practice of various methods of organization and rhetorical patterns used in formal expository and persuasive writing; the refinement of critical reading strategies and library research techniques; and the completion of an academically acceptable library research paper. Prerequisites: ENGL150, ENGL151.
CULT200	Introduction to Arab - Islamic Civilization	3	The purpose of this course is to acquaint students with the history and achievements of the Islamic civilization. Themes will include patterns of the political and spiritual leadership; cultural, artistic, and intellectual accomplishments Prerequisites: ENGL051, ENGL101, ENGL151.
CSCI200	Introduction to Computers	3	The course aims at making students competent in computer-related skills. It is supposed to develop basic computer knowledge by providing an overview of the computer hardware and basic components as well as hands-on practice on common software applications such as Word, Excel, Power Point, Internet and Email. The student will learn how to use the new features of Microsoft Office 2010 mainly Word documents, Excel spreadsheets and PowerPoint presentations. On the surface, MS Office 2010 looks a lot different than previous versions (no more menus or toolbars!), but by learning to understand the dramatically changed, Ribbon-based interface, you'll quickly get back on the road to productivity.
ARAB200	Arabic Language and Literature	3	This course is a comprehensive review of Arabic Grammar, Syntax, major literature and poetry styles, formal and business letters.