Department of Mathematics

Chairperson:	Abu-Khuzam, Hazar M.
Professors:	Abi-Khuzam, Faruk F.; Abu-Khuzam, Hazar M.; Lyzzaik, Abdallah K.; Nahlus, Nazih S.; Nassif, Nabil R.
Associate Professors:	Haddad, John N.; Khuri-Makdisi, Kamal F.; Shayya, Bassam H.
Visiting Associate Professor:	Brock, Fridemann R.
Assistant Professor:	El Khoury, Sabine S.
Visiting Assistant Professor:	Gebran, Hicham G.
Lecturers:	[P]Daher, Wassim E.; [P]Fayyad, Dolly J; [P]Kobeissi, Mohammad A; Yamani, Hossam A.
Instructors:	[P]Abu-Diab, Sara A.; [P]Ashkar, Alice N.; [P]Bou Eid, Michella J.; [P]Farhat, Ahmad S; Fleihan, Najwa S.; Itani-Hatab, Maha S.; [P]Karam, Nuha N.; Khachadourian, Zadour A.; [P]Nassif, Rana G.; [P]Rahhal, Lina A; [P]Salam, Manal A.;[P]Tannous, Joumana A.

The Department of Mathematics offers programs leading to the degree of Master of Science (MS) and Master of Arts (MA) in Mathematics and Statistics.

Graduate Program

MA or MS in Mathematics

Students must complete the university requirements for graduate study in the Faculty of Arts and Sciences, and at least 24 credits at the graduate level and a thesis. These 24 credits must include MATH 303, MATH 314, and MATH 341.

MA or MS in Statistics

Students must complete the university requirements for graduate study in the Faculty of Arts and Sciences, and at least 24 credits at the graduate level and a thesis. At least 18 of the 24 credits must be taken in the department, and must include MATH 303, STAT 331, STAT 332, STAT 333, and STAT 334. Students interested in taking courses outside the department may do so after obtaining approval from the department.

P Part time

Graduate Courses

Mathematics

MATH 301/302 Graduate Tutorial Courses 1–3 cr.
Prerequisite: graduate standing or consent of instructor.

MATH 303 Measure and Integration 3.0; 3 cr.
A first course in measure theory, including general properties of measures, construction of Lebesgue measure in Rn, Lebesgue integration and convergence theorems, Lp-spaces, Hardy-Littlewood maximal function, Fubini's theorem, and convolutions. *Prerequisite: MATH 223. Annually.*

MATH 304 Complex Analysis 3.0; 3 cr.
A second course in complex analysis, covering the homotopy version of Cauchy's theorem, the open mapping theorem, maximum principle, Schwarz's lemma, harmonic functions, normal families, Riemann mapping theorem, Riemannian metrics, method of negative curvature, Picard's theorem, analytic continuation, monodromy, and modular function. *Prerequisite: MATH 227. Annually.*

MATH 305 Functional Analysis 3.0; 3 cr.
Vector spaces, Hamel basis, Hahn-Banach theorem, Banach spaces, continuous linear operators and functionals, Hilbert spaces, and weak topologies. *Prerequisite: MATH 223. Annually.*

MATH 306 Calculus on Manifolds 3.0; 3 cr.
Prerequisite: MATH 223. Offered Occasionally

MATH 307 Topics in Analysis 3.0; 3 cr.

MATH 314 Algebraic Topology I 3.0; 3 cr.
Closed surfaces, categories and functors, homotopy, the fundamental group functor, and covering spaces. *Prerequisites: MATH 214 and MATH 241. Annually.*

MATH 315 Algebraic Topology II 3.0; 3 cr.
Singular homology with applications to Euclidean spaces and an introduction to cohomology theory. *Prerequisite: MATH 314. Offered Occasionally*

MATH 316 Topics in Topology 3.0; 3 cr.

MATH 341 Modules and Rings 3.0; 3 cr.
Fundamental concepts of modules and rings, projective and injective modules, modules over a PID, Artinian and Noetherian modules and rings, semi-simplicity, and tensor products. *Prerequisite: MATH 241. Annually.*

MATH 342 Modules and Rings II 3.0; 3 cr.
A course covering more advanced topics in modules and rings. *Prerequisite: MATH 341. Annually.*

MATH 343 Field Theory 3.0; 3 cr.
Prerequisite: MATH 242.

MATH 344 Commutative Algebra 3.0; 3 cr.
Prerequisites: MATH 242 and MATH 341.

MATH 345 Topics in Algebra 3.0; 3 cr.

MATH 350 Discrete Models for Differential Equations 3.1; 3 cr.
A detailed study of methods and tools used in deriving discrete algebraic systems of equations for ordinary and partial differential equations: finite difference and finite element discretization procedures; generation and decomposition of sparse matrices, finite-precision arithmetic, ill-conditioning and pre-conditioning, scalar, vector, and parallelized versions of the algorithms. The course includes tutorial immersion sessions in which students become acquainted with state-of-the-art scientific software tools on standard computational platforms. *Prerequisite: Linear algebra and the equivalent of MATH/CMPS 251 (which can be taken concurrently) or consent of instructor. Same as CMPS 350. Annually.*

MATH 351 Optimization and Non-Linear Problems 3.1; 3 cr.
A study of practical methods for formulating and solving numerical optimization problems that arise in science, engineering, and business applications. Newton's method for nonlinear equations and unconstrained optimization. Simplex and interior-point methods for linear programming. Equality and inequality-constrained optimization. Sequential Quadratic Programming. Emphasis is on algorithmic description and analysis. The course includes an implementation component where students develop software and use state-of-the-art numerical libraries. *Prerequisite: MATH/CMPS 350 or consent of instructor. Same as CMPS 351. Annually.*

MATH 358 Introduction to Symbolic Computing 3.0; 3 cr.
Introductory topics in computer algebra and algorithmic number theory that includes fast multiplication of polynomials and integers, fast Fourier transforms, primality testing and integers factorization. Applications to cryptography and pseudo-random number generation. Linear algebra and polynomial factorization over finite fields. Applications to error-correcting codes. Introduction to Grobner bases. *Prerequisite: Good background in programming, linear algebra, discrete mathematics or consent of instructor. Same as CMPS 358. Annually.*

MATH 360 Special Topics in Computational Science 3.0; 3 cr.
A course on selected topics in computational science that changes according to the interests of visiting faculty, instructors, and students. Selected topics cover state-of-the-art tools and applications in computational science. *Prerequisite: Consent of instructor. Same as CMPS 360. Annually.*

MATH 395A/395B Comprehensive Exam 0 cr.
Prerequisite: Consent of adviser

MATH 399 MA or MS Thesis 6 cr.

Statistics

The graduate program in statistics is currently frozen. It is expected to be available in the near future.

STAT 331 Advanced Probability Theory 3.0; 3 cr.
Characteristic functions, types of convergence, limiting properties of distribution and characteristic functions, limit theorems, and multivariate functions. *Prerequisites: MATH 227, STAT 238, and MATH 303. Annually.*

STAT 332 Advanced Mathematical Statistics 3.0; 3 cr.
Distribution theory, decision theory, and advanced topics in estimation and inference. *Prerequisites: STAT 235 and STAT 238. Annually.*

STAT 333 Multivariate Analysis 3.0; 3 cr.
Multivariate distributions, correlation coefficients, classification and discrimination, Hotelling's T2, tests of hypotheses for multivariate distributions, and canonical variables. *Prerequisite: STAT 238. Annually.*

STAT 334 Advanced Topics in Statistics 3.0; 3 cr.
Annually.

STAT 335 Special Topics from Probability and Statistics 3.0; 3 cr.
May be repeated for credit. Annually.

STAT 395A/395B Comprehensive Exam 0 cr.
Prerequisite: Consent of adviser.

STAT 399 MA or MS Thesis 6 cr.