MASTER OF SCIENCE
MATHEMATICS

INTRODUCTION

The Department of Mathematics offers a graduate program that leads to Master of Science degree in **Mathematics**. The Program features a thesis and non-thesis option. The thesis option requires a successful conclusion of a thesis, and the non-thesis option requires the completion of a project. Passing a comprehensive examination is required for students who choose a non-thesis option.

According to the University Council decision dated 4/2/2007, Thesis students admitted with effect from September 2007 are exempted from the comprehensive examination.

PROGRAM REQUIREMENTS

The program requirements are (non-thesis option in parenthesis):

30 (33) TOTAL COURSE CREDITS

3 (6) COMPULSORY COURSES (3 credits each)

0410-510 Analysis I
0410-593 Project (for non-thesis option only)

6-12 (6-12) BASIC COURSES (3 credits each)

The student must take at least two courses from the following courses:

0410-501 Algebra
0410-512 Complex Analysis I
0410-513 Ordinary Differential Equations
0410-525 General Topology

6-12 (15-21)ELECTIVES* (3 credits each)

0410-508 Topics in Algebra
0410-515 Functional Analysis
0410-517 Special Functions
0410-520 Boundary value Problems
0410-521 Variational Methods and Eigen value Problems
0410-522 Financial Mathematics Modeling & Computation
0410-523 Topics in Applied Mathematics
0410-526 Algebraic Topology
0410-530 Foundations of Geometry

0410-531	Differentiable Manifolds
0410-532	Topics in Differential Equations
0410-535	Graphs and Hyper Graphs
0410-537	Combinatorics
0410-560	Numerical Solution of ODE's
0410-561	Computational Linear Algebra
0410-568	Topics in Numerical Mathematics

* With the approval of the Program Committee, the student can substitute up to (6) credit hours from 500-level courses from other graduate programs or 400-level courses from the undergraduate program in mathematics at Kuwait University for courses in the elective list.

9 COMPULSORY (Thesis)

0410-597	(0)
0410-598	(0)
2000-599	(9)

COURSE DESCRIPTION

0410-501: ALGEBRA
CR: 3

Sylow theorems. Direct Sums and free abelian groups. The dual groups and Jordan holder theorem. Rings and homomorphism, commutative rings. Modules, direct products and sums of modules. Finite algebraic extension, separable extensions. Galois theory. Finite fields.

0410-508: TOPICS IN ALGEBRA
CR: 3

Topics may differ from time to time, the course may be repeated for credit provided the topics are different.

0410-510: ANALYSIS I
CR: 3

Riemann-Stieltjes integral, sequences and series of functions, functions of several variables, Lebesgue measure and integration on the real line.

0410-512: COMPLEX ANALYSIS I
CR: 3

Analytic continuation, Harmonic function, Mapping theorems. The modular function, Entire function.

0410-513: ORDINARY DIFFERENTIAL EQUATIONS
CR: 3

Existence and uniqueness of solutions to initial value problems in n-dimensions.
Continuation (extendibility) of solutions and continuity with respect to initial conditions and parameters. Stability theory, linearization and Lyapunov methods. Sturmian theory and self-adjoint boundary value problems.

0410-515: FUNCTIONAL ANALYSIS
CR: 3

Normed linear spaces, Hilbert spaces, Hahn-Banach extension theorems, Banach-Steinhaus theorem, closed graph and open mapping theorem, topics selected from spectral theory.

0410-517: SPECIAL FUNCTIONS
CR: 3

Asymptotic expansions. Bessel functions and related functions, hypergeometric, confluent hypergeometric and generalized hypergeometric functions. Jacobi polynomials, Meijer's G-functions.

0410-520: BOUNDARY VALUE PROBLEMS
CR: 3

Partial differential equations of mathematical physics and engineering, the well posed problem, Dirichlet, Neumann and the mixed problems, methods of solution, Green's function, integral equations, integral transforms.

0410-521: VARIATIONAL METHODS AND EIGEN VALUE PROBLEMS
CR: 3

Linear operators in Hilbert space, Generalized functions, eigenfunction expansions, the Raleigh-Ritz method, the Galerkin method, Methods of least squares, eigenvalue problems, lower and upper bounds, the Weinstein method, applications.

0410-522: FINANCIAL MATHEMATICS – MODELING & COMPUTATON
CR: 3

'Finance' is one of the fastest developing areas in the modern banking and corporate world. This, together with the sophistication of modern financial products, provides a rapidly growing impetus for new mathematical models and modern mathematical methods. The course describes the modeling of financial derivative products, through analysis to elementary computaton. Topics include: basic option theory, tree models, continuous time models and Black-Scholes, analytic approach to Black-Scholes, hedging numerical and binomial methods, bonds and interest rate derivatives models, computational methods for bonds, further theory of exotic and path-dependent options, foreign currency markets and exchange risks.

0410-523: TOPICS IN APPLIED MATHEMATICS
CR: 3

Topics may differ time to time, the course may be repeated for credit whenever the topics are different.

0410-525: GENERAL TOPOLOGY
CR: 3

Abstract topological spaces; connectedness, compactness, continuous functions. Metric spaces, complete metric spaces and metrizable spaces.

0410-526: ALGEBRAIC TOPOLOGY
CR: 3

Fundamental groups, surfaces, and homology theory.

0410-530: FOUNDATIONS OF GEOMETRY
CR: 3

Coordinatization, planar ternary rings and their algebraic properties, coordinatizing the dual plane, conditions for linearity, division rings with inverse properties, alternative division rings, the Artin-Zorn theorem, quasi fields and translation planes, division ring planes, some non-desarguesian planes.

0410-531: DIFFERENTIABLE MANIFOLDS
CR: 3

Manifolds, the topology of manifolds, differentiation on a manifold, vector fields, linear and affine connections, distributions, Riemannian manifolds.

0410-532: TOPICS IN DIFFERENTIAL EQUATIONS
CR: 3

Special topics not covered in other courses. May be repeated for credit under different subtitles.

0410-535: GRAPHS AND HYPER GRAPHS
CR: 3

The path problem, the flow problems,Vizing theorem, the Shannon theorem, chromatic number, chromatic polynomials, perfect graphs, hyper graphs.

0410-537: COMBINATORICS
CR: 3

System of distinct representatives of a family of sets, Hall's theorem and its generalizations, transversals, common transversals. Designs, Steiner Triple Systems, sufficient conditions for existence of a block design. Latin squares, orthogonal Latin squares.

0410-560: NUMERICAL SOLUTION OF ODE'S
CR: 3

Concepts of discretization (initial value problems, boundary value problems, integral equations). Difference methods and Galerkin methods.

Consistency, stability and convergence. Linear multistep methods, stability theory, spline collocation methods, stiff equations. Two-point boundary value problems, difference methods, shooting techniques, finite elements.

0410-561: COMPUTATIONAL LINEAR ALGEBRA
CR: 3

Basic concepts, Gaussain Elimination and LU-decomposition, QR-Factorization and Lease Square problems, Eigenvalue problems and SVD, Iterative Methods.

0410-568: TOPICS IN NUMERICAL MATHEMATICS
CR: 3

Topics may differ time to time, the course may be repeated for credit provided the topics are different.

0410-593: PROJECT
CR: 3

0410-597: THESIS
CR: 0

0410-598: THESIS
CR: 0

2000-599: THESIS
CR: 9