

Master of Science in Mathematics

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GENERAL INFORMATION

Introduction

The Master of Science in Mathematics program at the Royal University of Phnom Penh provides high-level mathematical training to postgraduate students. The degree takes a broad approach to mathematical training, with students taking courses in both pure and applied mathematics.

The first year of the M.Sc. (Mathematics) provides students with training in subjects including linear algebra, differential geometry, discrete mathematics, probability, real, complex and numerical analysis, statistics and differential equations. The second year of the degree is currently being developed to allow students to specialize in those subjects which will be greatest benefit to the Cambodian context. It is envisioned that this course will focus on applied mathematics, training Cambodian human resources for specialized fields such as financial and economic mathematics, cryptography and mathematics for science, among others.

Whilst the Masters in Mathematics program aims to train students for future careers in mathematics-related fields, it also seeks to build capacity within the Royal University of Phnom Penh. To this end, the M.Sc. (Mathematics) has implemented a unique counterpart system within its teaching program. Under this system, each course is taught by a recognized international mathematician, with the assistance of a Cambodian counterpart from the Department of Mathematics at the Royal University of Phnom Penh. This close association between foreign experts and Cambodian staff benefits both parties, building RUPP's resources and experience in postgraduate teaching, and allowing international professors to build a closer association with RUPP and Cambodia.

International professors teaching at RUPP come from institutions including the Université Paris VI, Université d'Aix Marseille and Université de Nice Sophia-Antipolis (France), the University of Marrakech (Morocco) and other American and Japanese universities. The International

Mathematical Union and the United States National Committee on Mathematics will also support several mathematicians in teaching at RUPP.

In addition to the support of these institutions, the Master of Science in Mathematics at the Royal University of Phnom Penh has been developed thanks to the assistance of several international organizations. Its primary sponsors are the Centre International de Mathématiques Pures et Appliquées (CIMPA), the International Mathematical Union (IMU), the US National Committee on Mathematics, the Agence Universitaire pour la Francophonie (AUF), the French Embassy, Phnom Penh and the Toyota Foundation.

Course Structure

The M.Sc. (Mathematics) is taught through a series of intensive, subject-specific modules of 45 hours, each taken over a period of roughly three weeks. Students take eight of these modules in their first year, seven of which are compulsory, and one of which is an elective.

All courses are taught by recognized professors from overseas universities, in association with a member of staff from the Department of Mathematics at the Royal University of Phnom Penh.

Enrollment

Students can enroll in one of three ways. Students who have completed the pre-Masters program in Mathematics at RUPP to a high standard can be selected by members of the Department, in association with the vice-rector, for automatic entry into the Master of Science in Mathematics program.

Similarly, outstanding students from the Mathematics and Physics summer program at the Institute of Technology, Cambodia, can be selected for automatic entry into the degree program.

Other applicants must sit an examination set by the organizing committee of the M.Sc. (Mathematics) at RUPP.

Application

All potential applicants must be in possession of a Bachelor’s degree in a related field from a recognized university.

Method of Instruction

All courses are taught in English. However, due to the strong support of French institutions and universities, outstanding students in the M.Sc. (Mathematics) program are encouraged to pursue further study of the French language, which they will find beneficial in future applications for a Ph.D. or further training in France.

CURRICULUM

YEAR ONE			
Subject	Months	Course Code	Teaching Hours
Linear Algebra	November 2007	MMA101	45
Differential Geometry	December 2007	MMA102	45
Discrete Mathematics	January 2008	MMA103	45
Probability	February 2008	MMA104	45
Real Analysis	March 2008	MMA105	45
Complex Analysis	Mid-April – Mid-May 2008	MMA106	45
Differential Equations	Mid May-June 2008	MMA107	45
Numerical Analysis (Elective) OR	June-July 2008	MMA108	45
Statistics (Elective)	March- Mid-April 2008	MMA109	45
YEAR TWO			
To Be Developed			

COURSE DESCRIPTIONS

MMA101 Linear Algebra

Mr. Xavier Bressaud

Year I

Students begin by examining the functions of linear equations, including elementary row operations, row echelon form and reduced row echelon form, solving a system of linear equations, homogenous systems, applications and geometric interpretations. They then go on to study matrices, including systems of linear equations, matrix multiplication, finding inverses by elementary row operations, the criteria for invertibility, applications and more abstract settings; determinants, including definitions, properties, elementary row operations and applications to geometry; vectors, including in 2-space and 3-space, and vector products; vector spaces, including real vector spaces, subspaces, linear combinations, linear independence, basis and dimension, rank of a matrix,

solutions of non-homogenous systems and complex vector spaces; linear transformation, including Euclidean linear transformations, elementary properties, change of basis, kernel and range, inverse linear transformations, and change of basis; and finally eigenvalues and eigenvectors, including the diagonalization problem and their applications.

MMA102 Differential Geometry

Mr. Pierre Schapira

Year I

In this course, students explore general topology, including metric, compact and Banach spaces; differentiable maps, plotting from finite dimensional real Banach spaces to other spaces; definitions; compositions; partial derivatives and the Jacobian matrix. Students also learn about the necessary conditions for local extremum, explore many

applications of these conditions, and study the local inversion theorem and embedded submanifolds.

MMA103 Discrete Mathematics

Mr. Pierre Arnoux

Year I

Topics covered include the theories of graphs, including graph theory and problems associated with graphing; and the theory of codes, including cyclic groups, and vector spaces. Throughout the course, students make intensive use of linear algebra, matrix applications and vectors. Although this course is taught primarily in English, students will also study mathematical vocabulary in French, building their capacity to work with mathematical concepts across cultures.

MMA104 Probability

TBA

Year I

This course will be taught by a visiting professor from a Japanese university. Students will explore advanced concepts in probability, including probability theory and applied probability.

MMA105 Real Analysis

TBA

Year I

In this course, students examine the system of real numbers, the concept of a function and the basic tools and theorems of calculus, and seek to place the subject on a firm logical basis. The course also covers additional techniques including power series and the most important special functions which arise in great numbers of applications. The course is designed for students who have a working knowledge of calculus.

MMA106 Complex Analysis

Michel Waldschmidt

Year I

Students cover the analytic functions of complex variables, including Holomorphic functions, Cauchy-Riemann equations and harmonic functions. They inspect examples including polynomials, the exponential and trigonometric functions and complex logarithms. Students also explore power series, analytic functions, integration on paths, Cauchy's theory, singularities, residues, meromorphic functions, series and the products of analytic or meromorphic functions.

MMA107 Differential Equations

Mr. Hassan Hisid

Year I

In this course, taken by a professor from the University of Marrakech, students examine advanced-level differential equations.

MMA108 Numerical Analysis (Elective)

TBA

Year I

In this elective course, students undertake an examination of the theory, practice and applications of numerical analysis.

MMA109 Statistics (Elective)

TBA

Year I

This elective course allows students to explore the applications of advanced mathematical knowledge. Statistics are used in many fields of study, for various purposes. Here, students probe the theory and applications of statistics, and practice performing advanced statistical analysis.