MSc Mathematics - SC503

1. Specific Titles

(a) MSc Mathematics
(b) Postgraduate Diploma in Mathematics

2. Objectives

This MSc programme equips the student with a sound understanding and skills of advanced Mathematics suitable as a foundation for a career user of Mathematics as well as for progression to a research degree (MPhil/PhD).

The objective is to offer a significant deepening of knowledge and enthusiasm for Mathematics. A student who has obtained a Master of Science degree in Mathematics possesses a thorough theoretical basis, knows how to work in a multi-disciplinary environment, and is able to operate well on the international market. A variety of modules are offered at a high level, and the programme ends with a major project dissertation.

3. General Entry Requirements

Successful completion of an undergraduate degree with

- at least a Second Class or 50%, whichever is applicable or
- a GPA not less than 2.5 out of 4 or equivalent, from a recognised higher education institution.

OR alternative qualifications acceptable to the University of Mauritius.

4. Programme Requirements

BSc (Hons) Mathematics, or BSc (Joint Hons) Degree with Mathematics as one of the subjects or a degree with a major component in Mathematics, or equivalent qualifications acceptable to the University of Mauritius.

5. General and Programme Requirements – Special Cases

The following may be deemed to have satisfied the General and Programme requirements for admission:

(i) Applicants who do not satisfy any of the requirements as per Regulations 3 and 4 above but who submit satisfactory evidence of having passed examinations which are deemed by the Senate to be equivalent to any of those listed.

(ii) Applicants who do not satisfy any of the requirements as per Regulations 3 and 4 above but who in the opinion of Senate submit satisfactory evidence of the capacity and attainments requisite to enable them to pursue the programme proposed.

(iii) Applicants who hold a full practising professional qualification obtained by examination.

6. Programme Duration

The Programme is offered either on a full-time and/or a part-time basis. The duration of the Postgraduate Programme should normally not exceed 4 years (8 semesters) for part-time and 2 years (4 semesters) for full-time.

	Part-Time		Full-Time	
	Normal	**Maximum**	**Normal**	**Maximum**
Master's Degree:	4 Semesters	8 Semesters	2 Semesters	4 Semesters
Postgraduate Diploma:	4 Semesters	8 Semesters	2 Semesters	4 Semesters

7. Credits per Semester:

A minimum of one module to be studied per semester, i.e., with a minimum of 3 credits subject to Regulation 6.

8. Minimum Credits Required for Awards

Master’s Degree:	36
Postgraduate Diploma:	24

Breakdown as follows:

	Core Taught Modules	Project	Electives
Master’s Degree:	18 credits	6 credits	12 credits
Postgraduate Diploma:	18 credits		6 credits

9. Assessment

Students are required to register for modules which they intend to follow in a given semester on date(s) specified by the Faculty.

Each module of 45 hours duration carries 3 credits.

Each module will carry 100 marks and will be assessed as follows (unless otherwise specified):

Written examination of 3-hour duration and continuous assessment of 10% to 30% of total marks. All written examinations will be held at the end of each semester where the module is taught.

Continuous assessment may be based on laboratory work, seminars, and/or assignments and should include at least one class test.

For a student to pass a module, a minimum of 40 % should be attained in both of Continuous Assessment and Written Examination separately, with an overall total of a minimum of 50% in that module.

All modules carry equal weighting.

Projects

The Project carries 6 credits.

Type of programme	Start of Project
Full Time	Start of Semester 2
Part Time	Start of Semester 3

Submission Deadlines for Dissertation

- First Draft: End of July of Final Year.
- Final Copy: Last working day of August of Final Year.

10. Plan of Study

Students are required to submit at the end of Semester 1 a Plan of Study for their whole Programme of Studies, indicating the list of elective modules and in which semester each of them will be taken.

The University reserves the right not to offer a given elective module if the critical number of students is not attained and/or for reasons of resource constraints.

11. Important Note

The rules as stipulated in this Programme Structure and Outline Syllabus will replace all other rules and regulations found in previous Programme Structures.

12. List of Modules

Code	Module Name	Hrs/Wk L+P	Credits
CORE MODULES			
MATH 6001(1)	Measure and Integral	3+0	3
MATH 6002(1)	Statistical Inference	3+0	3
MATH 6003(1)	Operator Theory	3+0	3
MATH 6004(1)	Stochastic Calculus	3+0	3
MATH 6005(1)	Adv. Numerical Techniques	3+0	3
MATH 6006(1)	Advanced PDEs	3+0	3
PROJECT			
MATH 6000(1)	Research Project	-	6
ELECTIVES			
MATH 6020(1)	C* Algebras	3+0	3
MATH 6021(1)	Topology	3+0	3
MATH 6022(1)	Mathematics of Finance	3+0	3
MATH 6023(1)	Asymptotic Methods	3+0	3
MATH 6024(1)	Advection-Diffusion Equations	3+0	3
MATH 6025(1)	Statistical Learning using R	3+0	3
MATH 6026(1)	Applied Statistical Methods	3+0	3
MATH 6027(1)	Sample Surveys & Experimental Designs	3+0	3
MATH 6028(1)	Advanced Fluid Dynamics	3+0	3
MATH 6029(1)	Dynamical Systems	3+0	3
MATH 6030(1)	Advanced Optimisation	3+0	3
MATH 6031(1)	Mathematical Modelling in Biology and Health	3+0	3
MATH 6032(1)	Stochastic & Deterministic Methods and Applications	3+0	3
MATH 6033(1)	Operational Research	3+0	3

13. Programme Plan - MSc Mathematics

Full-Time:

YEAR 1

Semester 1 Code	Module Name	Hrs/Wk L+P	Credits	Semester 2 Code	Module Name	Hrs/Wk L+P	Credits
CORE				**CORE**			
				MATH 6000(1)	Project	-	6
MATH 6001(1)	Measure & Integral	3+0	3	MATH 6004(1)	Stoch. Calculus	3+0	3
MATH 6002(1)	Stat. Inference	3+0	3	MATH 6005(1)	Adv. Num. Tech.	3+0	3
MATH 6003(1)	Operator Theory	3+0	3	MATH 6006(1)	Adv. PDEs	3+0	3

ELECTIVES

Minimum of 4 electives with at least one elective to be taken each semester

NOTE: Normally, the programme plan will be as above, but the Department reserves the right to choose the electives to be run in each semester. Some electives may not be on offer. The list of modules is not exhaustive.

Part-Time

YEAR 1

Semester 1 Code	Module Name	Hrs/Wk L+P	Credits	Semester 2 Code	Module Name	Hrs/Wk L+P	Credits
CORE				**CORE**			
MATH 6001(1)	Measure and Integral	3+0	3	MATH 6004(1)	Stoch. Calculus	3+0	3
MATH 6002(1)	Stat. Inference	3+0	3	MATH 6005(1)	Adv. Num. Tech.	3+0	3
ELECTIVES				**ELECTIVES**			
At least one elective				At least one elective			

YEAR 2

Semester 1 Code	Module Name	Hrs/Wk L+P	Credits	Semester 2 Code	Module Name	Hrs/Wk L+P	Credits
CORE				**CORE**			
MATH 6000(1)	Project	-	-	MATH 6000(1)	Project	-	6
MATH 6003(1)	Operator Theory	3+0	3	MATH 6006(1)	Adv. PDEs	3+0	3
ELECTIVES				**ELECTIVES**			
At least one elective				At least one elective			

14. Outline Syllabus

This outline syllabus is not prescriptive and is intended to serve as a guide only.

MATH 6000(1) - PROJECT
The student must undertake a research project work.

MATH 6001(1) - MEASURE AND INTEGRAL
Measurable functions in $\Re^n$. Integrals over measurable sets. Convergence Theorem. Fourier Analysis. Extensions of Measures. Fubini's Theorem.

MATH 6002(1) - STATISTICAL INFERENCE
Discrete and continuous parametric models and likelihood based inference, non-parametric models and analyses. Bayesian inference.

MATH 6003(1) - OPERATOR THEORY
Elementary properties of Hilbert and Banach spaces, Orthonormal bases, Riesz representation theorem, the adjoint, orthogonal projections. Spectrum, Compact operators, Spectral theory of bounded linear operators. Spectral theorem for bounded linear operators. Spectral theorem for compact operators. Applications.

MATH 6004(1) - STOCHASTIC CALCULUS
Probability Theory and Conditional Expectations. Brownian Motion and The Martingale Property. Ito's Integral and the Ito-Doeblin Formula. Risk Neutrality and the Girsanov's Theorem. Stochastic Differential Equations. Applications to Option Pricing and Term Structure Models.

MATH 6005(1) - ADVANCED NUMERICAL TECHNIQUES
Partial Differential Equations. Fast Fourier transform. Stability Analysis, Numerical Solution for hyperbolic, parabolic and elliptic equations. Projection. Krylov Spaces. Iterative Methods for Linear Systems. Preconditioning. Eigenvalue problems. Arnoldi and Implicitly restarted Arnoldi.

MATH 6006(1) - ADVANCED PARTIAL DIFFERENTIAL EQUATIONS
Initial value problems and initial boundary value problems for hyperbolic and parabolic equations. Method of characteristics. Wave phenomena. Elliptic equations, Harmonic functions, Green's functions. Maximum principles. Variational principles.

MATH 6020(1) - C* ALGEBRAS
Basics of Functional Analysis, Banach algebra, C* algebra, Gelfand-Mazur theorem, Spectral mapping theorem, Gelfand map and Gelfand-Naimark theorem.

MATH 6021(1) - TOPOLOGY
Metric space concepts. Topological space concepts. Connectedness, Compactness, Identification spaces. Fundamental group.

MATH 6022(1) - MATHEMATICS OF FINANCE
Forward prices, discounting, arbitrage-free pricing; binomial trees, derivatives pricing in discrete time by use of binomial lattices, geometric Brownian motion, volatility and drift, martingales and conditional expectation, hedging portfolios, replication, Black-Scholes model, put-call parity. Risk premium, risk-neutral measure. Jump-diffusion models.

MATH 6023(1) - ASYMPTOTIC METHODS
Asymptotic series, sequences and expansions. Asymptotic evaluation of integrals. Laplace's method for integrals; Watson's lemma. Method of stationary phase. Poincare expansions; sources of non-uniformity. Method of matched asymptotic expansions. Boundary layers.

MATH 6024(1) - ADVECTION-DIFFUSION EQUATIONS
Time Integration Methods. Discretisations. Splitting Methods. Exponential differencing methods. Explicit Runge-Kutta Methods.

MATH 6025(1) - STATISTICAL LEARNING USING R
Programming in R. Linear Methods for Classification. Neural Networks. Support Vector Machines. Hidden Markov Models.

MATH 6026(1) - APPLIED STATISTICAL METHODS
Regression Models. Multivariate Techniques. Time Series Analysis.

MATH 6027(1) - SAMPLE SURVEYS AND EXPERIMENTAL DESIGNS
Strategies and methods of survey data collection, sampling techniques, non-sampling errors and biased responses. Experimental design models and applications.

MATH 6028(1) - ADVANCED FLUID DYNAMICS
Index notation. Tensors. Navier-Stokes equations. Reynolds number. Dynamical similarity. Some exact solutions of Navier-Stokes equations. Introduction to laminar boundary layers.

MATH 6029(1) - DYNAMICAL SYSTEMS
Linear Systems. Non-linear Systems. Equilibrium Solutions. Fixed Points. Stability. Asymptotic behaviour of solutions of dynamical systems. Lyapunov functions. The Poincare-Bendixon theorem. Centre manifolds. Normal forms. Bifurcation theory.

MATH 6030(1) - ADVANCED OPTIMISATION
Convex optimisation. Optimality conditions and Duality: Algorithms and their convergence. Mathematical programming techniques.
The mathematical modelling problems followed by the design and analysis of efficient algorithms for their solutions. Applications: Optimal routing, optimal design in water management, telecommunication, transport and logistics, control, etc.

MATH 6031(1) - MATHEMATICAL MODELLING IN BIOLOGY AND HEALTH
Continuous and discrete population models for a single/multiple species. Michaelis-Menten model for enzyme-substrate kinetics. Biological pattern formation. Simple models for the spread of disease.

MATH 6032(1) - STOCHASTIC AND DETERMINISTIC METHODS AND APPLICATIONS
Monte Carlo method. PDEs. Stochastic Networks. Production Systems.

MATH 6033(1) - OPERATIONAL RESEARCH
Multiobjective programming problems. Network Optimisation. Game Theory. Case studies.