



UNIVERSITY
of
TECHNOLOGY,
MAURITIUS

School of Innovative Technologies and Engineering

Department of Applied Mathematical Sciences

BSc (Hons) Financial Engineering

PROGRAMME DOCUMENT

VERSION 1.0
BFE V1.0
May 2017

BSc (Hons) Financial Engineering

A. Programme Information

Financial engineering is a multidisciplinary field, based on mathematical finance, statistic and computational techniques. Throughout this programme, students will be equipped with the necessary skills to create and price financial securities and to assess financial risks from a mathematical perspective. Financial engineers have the necessary aptitude to make hedging, investment, portfolio management decision and may amongst others find employment in banks, investment firms, insurance companies and energy firms. Moreover, full time students will be required to undergo a work placement at the second level of the programme of study.

B. Programme Aims

This programme has been designed to provide students with the necessary abilities to solve the ever complicated financial instruments and financial strategies approaches, as well as bridging the gap between highly advanced theoretical financial mathematics and current practice. It also provides students, the awareness of broader concepts of quantitative finance and computational finance.

C. Programme Objectives

Upon successful completion of the programme, students should be able to

- understand, develop and implement mathematical models and computational techniques for pricing of financial and risky assets;
- assimilate a sound understanding of the types of risks associated with these models;
- efficiently put in practice the computational tools developed in mathematical finance to solve real world problems;
- create financial securities for local and international markets;
- acquire necessary skills to implement computational methods for solving various financial problems.

PART I - Regulations

D. General Entry Requirements

As per UTM'S Admission Regulations, and 'Admission to Programmes of Study at Degree Level' or APL / APEL requirements

E. Programme Entry Requirements

'A' Level in Mathematics

F. Programme Mode and Duration

Full Time: Minimum 3 Years, Maximum 6 Years (Minimum 6 Semesters, Maximum 12 Semesters)
Part Time: Minimum 4 Years, Maximum 7 Years (Minimum 8 Semesters, Maximum 14 Semesters)

G. Teaching and Learning Strategies

- Lectures, Tutorials and Practical Laboratory Sessions;
- Class Tests, Assignments and Dissertation;
- Structured Discussions and Self-Directed Study;
- Workshops and Seminars;
- Case Study of real world problems;
- Work Placement (full time mode only);
- Mini Project (part time mode only).

H. Student Support and Guidance

Each cohort of the programme is allocated a Programme Coordinator who acts as a liaison between the students and school management and provides support for academic management of the programme.

I. Attendance Requirements

As per UTM's Regulations and Policy.

J. Credit System

For the award of

- a Certificate, a minimum of 36 credits are required;
- a Diploma, a minimum of 70 credits are required;
- an Ordinary Degree, a minimum of 96 credits are required;
- an Honours Degree, a minimum of 105 credits are required.

K. Student Progress and Assessment

The programme is delivered mainly through lectures, tutorials, and practical laboratory sessions. Students are expected to be as autonomous and research oriented as possible and activities may include reading research papers, delivering presentations, taking part in quizzes, case-studying amongst others. Each module carries 100 marks and unless otherwise specified, will be assessed as follows:

- written and/or practical examination, and coursework carrying up to 40% of total marks;
- coursework can be based on a combination of assignments, field study, workshops, practical and class tests;
- module 'Computer Programming I' will be assessed by 100% coursework. The coursework must consist of a minimum of one class test and one assignment;

- for the Mini Project in the part time version of the programme structure, the student are required to work on a project with significant mathematical/statistical/computational content geared towards financial engineering. Upon completion of the Mini Project, the student must submit a report. Moreover, each student must present his/her work in an oral presentation, with opportunity for questions from the examiner(s).

Module grading structure:

Grade	Marks x (%)
A	$70 \leq x \leq 100$
B	$60 \leq x < 70$
C	$50 \leq x < 60$
D	$40 \leq x < 50$
F	$x < 40$
A-D	Pass
F	Fail

L. Evaluation of Performance

The % mark at Level 1 contributes a 20% weighting towards the degree classification.

The % mark at Level 2 contributes a 30% weighting towards the degree classification.

The % mark at Level 3 contributes a 50% weighting towards the degree classification.

M. Award Classification

Overall weighted mark y (%)	Classification
$70 \leq y \leq 100$	1 st Class Honours
$60 \leq y < 70$	2 nd Class 1 st Division Honours
$50 \leq y < 60$	2 nd Class 2 nd Division Honours
$45 \leq y < 50$	3 rd Class Honours
$40 \leq y < 45$	Pass Degree
$y < 40$	No Award

N. Programme Organisation and Management

Programme Director: Dr Arshad Ahmud Iqbal PEER

Contact Details:

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PART II - Programme Structure

O. BSc (Hons) Financial Engineering – Full Time (Version 1.0)

YEAR 1 (Level 1)							
Semester 1				Semester 2			
Code	Modules	Hrs/Wk L+T/P	Credits	Code	Modules	Hrs/Wk L+T/P	Credits
MATH 1305C	Calculus Fundamentals	2+1	3	MATH 1306C	Matrices and Multivariable Calculus	2+1	3
ECON 1103C	Principles of Microeconomics	2+1	3	ECON 1102C	Macroeconomics	2+1	3
STAT 1202C	Statistics Essentials	2+1	3	STAT 1203C	Statistical Models	2+2	4
QFIN 1102C	Financial Concepts	2+1	3	QFIN 1213C	Mathematics of Finance	2+2	4
ACCF 1101C	Accounting	2+1	3	COMM 1115C	Communication Skills	2+1	3
COMP 1101C	Computer Programming I	2+2	4				

YEAR 2 (Level 2)							
Semester 1				Semester 2			
Code	Modules	Hrs/Wk L+T/P	Credits	Code	Modules	Hrs/Wk L+T/P	Credits
MATH 2302C	Differential Equations	2+1	3	STAT 2304C	Time Series Models	2+2	4
MATH 2325C	Numerical Analysis	2+2	4	QFIN 2104C	Investment Instruments and Analysis	2+1	3
QFIN 2105C	Derivatives and Financial Markets	2+1	3	QFIN 2103C	Bonds and Derivatives	2+1	3
STAT 2204C	Applied Probability Models	2+1	3	PROJ 2119C	Work Placement		4
QFIN 2109C	Corporate and Legal Finance	2+1	3				
UTM 2101	Life Skills and Good Practices	2+2	4				

YEAR 3 (Level 3)							
Semester 1				Semester 2			
Code	Modules	Hrs/Wk L+T/P	Credits	Code	Modules	Hrs/Wk L+T/P	Credits
MATH 2307C	Mathematical Programming and Optimisation	2+1	3	QFIN 3106C	Credit Product and Credit Risk	2+2	4
QFIN 3203C	Financial Risk Forecasting	2+2	4	QFIN 3205C	Discrete Financial Modelling	2+2	4
STAT 2306C	Multivariate Analysis	2+2	4	STAT 3307C	Actuarial Regression Models	2+2	4
QFIN 3204C	Valuation of Financial Derivatives	2+2	4				
PROJ 3112C	Dissertation						8

P.BSc (Hons) FINANCIAL ENGINEERING – Part Time (Version 1.0)

YEAR 1							
→ Start of Level 1							
Semester 1				Semester 2			
Code	Modules	Hrs/Wk L+T/P	Credits	Code	Modules	Hrs/Wk L+T/P	Credits
MATH 1305C	Calculus Fundamentals	2+1	3	ACCF 1101C	Accounting	2+1	3
ECON 1103C	Principles of Microeconomics	2+1	3	COMP 1101C	Computer Programming I	2+2	4
STAT 1202C	Statistics Essentials	2+1	3	MATH 1306C	Matrices and Multivariable Calculus	2+1	3
QFIN 1102C	Financial Concepts	2+1	3	ECON 1102C	Macroeconomics	2+1	3

YEAR 2							
				→ Start of Level 2			
Semester 1				Semester 2			
Code	Modules	Hrs/Wk L+T/P	Credits	Code	Modules	Hrs/Wk L+T/P	Credits
STAT 1203C	Statistical Models	2+2	4	MATH 2302C	Differential Equations	2+1	3
QFIN 1213C	Mathematics of Finance	2+2	4	MATH 2325C	Numerical Analysis	2+2	4
COMM 1115C	Communication Skills	2+1	3	QFIN 2105C	Derivatives and Financial Markets	2+1	3
				STAT 2204C	Applied Probability Models	2+1	3
				QFIN 2109C	Corporate and Legal Finance	2+1	3
				PROJ 2118C	Mini Project		-
End of Level 1 →							

YEAR 3							
				→ Start of Level 3			
Semester 1				Semester 2			
Code	Modules	Hrs/Wk L+T/P	Credits	Code	Modules	Hrs/Wk L+T/P	Credits
UTM 2101	Life Skills and Good Practices	2+2	4	MATH 2307C	Mathematical Programming and Optimisation	2+1	3
STAT 2304C	Time Series Models	2+2	4	QFIN 3203C	Financial Risk Forecasting	2+2	4
QFIN 2104C	Investment Instruments and Analysis	2+1	3	STAT 2306C	Multivariate Analysis	2+2	4
QFIN 2103C	Bonds and Derivatives	2+1	3				
PROJ 2118C	Mini Project		4				
End of Level 2 →							

YEAR 4							
Semester 1				Semester 2			
Code	Modules	Hrs/Wk L+T/P	Credits	Code	Modules	Hrs/Wk L+T/P	Credits
QFIN 3204C	Valuation of Financial Derivatives	2+2	4	QFIN 3205C	Discrete Financial Modelling	2+2	4
QFIN 3106C	Credit Product and Credit Risk	2+2	4	STAT 3307C	Actuarial Regression Models	2+2	4
PROJ 3112C	Dissertation						8
End of Level 3 →							

Q. MODULE OUTLINE

COMP 1101C: COMPUTER PROGRAMMING I

Introduction to computer programming. Pseudo-codes and problem formulation. Basic data types, I/O. Control structures: selection and loops. Coding, testing and debugging. Simple file processing. Arrays and strings. Basic recursion. Implementation of simple algorithms.

MATH 1305C: CALCULUS FUNDAMENTALS

Functions, limits, derivatives and Mean Value Theorem. Differential Calculus: further differentiation of trigonometric and inverse trigonometric functions, Taylor's Theorem. Indeterminate forms. Hyperbolic functions. First order differential equations: separable equations, homogeneous equations, integrating factors. Linear ordinary differential equations of second and higher order. Complex numbers. Polar coordinates.

ECON1103C: PRINCIPLES OF MICROECONOMICS

Supply and demand. Elasticity. Utility theory. Productivity and costs. Market structures and competition. Factor markets. Risk and insurance. Introduction to game theory: Nash equilibrium, subgame perfect equilibrium, and asymmetric information.

ACCF 1101C: ACCOUNTING

Basic principles of accounting. The role of accounting standards. Different types of business entity. Basic structure of company accounts. Interpretation and limitation of company accounts. Principles of double entry book-keeping. Preparation of financial statements: final account and cash flow as per IAS1. Interpretation of financial statements. Management information for decision making. Cost classification. Cost control. Budget and budgetary control. Constructing flexible and cash budgets.

STAT 1202C: STATISTICS ESSENTIALS

Data representation, group and ungrouped data. Measures of central tendency and dispersion. Kurtosis, skewness. Permutation and combination. Axioms of probability, total law of probability, conditional probability and independence. Bayes' theorem. Conditional Expectations. Characteristic functions. Moment generating functions. Discrete and continuous distributions. Central limit theorem, sample and estimations. χ^2 , t- and F- distributions. Confidence intervals. Hypothesis testing.

QFIN 1102C: FINANCIAL CONCEPTS

Time value of money. Interest rates and discount rates. Annuities: Simple, General and Perpetuities. Common Stock. Amortisation and sinking funds. Spreadsheet skills in Finance: Goal Seek, Accessing DLLs

MATH 1306C: MATRICES AND MULTIVARIATE CALCULUS

Matrices, Determinants, Inverse and Rank. Solution of linear systems of equations. Eigenvalues and eigenvectors. Diagonalisation and the Cayley Hamilton Theorem. Dot product, cross product, lines and planes. Directional derivatives, gradient, divergence, curl. Polar, cylindrical and spherical coordinates. Partial differentiation. Multiple integrals and change of variables. Green's Theorem, Stokes' Theorem and the Divergence Theorem.

ECON 1102C: MACROECONOMICS

Introduction to Macroeconomics. Determinants and measurement of national income. Macroeconomic dynamics, the multiplier effect, business cycle and economic growth. Unemployment and inflation. Fiscal and monetary policies. Exchange rate and balance of payments. International trade & finance.

STAT 1203C: STATISTICAL MODELS

Linear regression. Regression diagnostics. Multiple linear regression. Analysis of variance. Generalized linear models. Structural equation models. R practical.

QFIN 1213C: MATHEMATICS OF FINANCE

Binomial trees. Replicating portfolios. Arbitrage and hedging. Risk neutrality. Risk free trading strategies. Stochastic differential equations. Ito's Lemma. Girsanov theorem. Black-Scholes model.

COMM 1115C: COMMUNICATION SKILLS

Introduction to communication: the nature, basic concepts, forms and models of communication. Literary communication - specialised forms of writing: letter, editing and proof reading, minutes, reports, memos. Spoken communication: introduction, speaker, effective speaking, public speaking, persuasive speaking. Accent neutralisation: correct pronunciations of English vowels, intonation. Listening as communication: skills for effective listening. Internet and communications: introduction, issues to watch out for. Techniques for presentation, interviewing, report-writing, meetings, negotiations, drafting of contracts and tender/marketing document. Quantitative appraisal of documentation: FOG index.

MATH 2302C: DIFFERENTIAL EQUATIONS

Laplace transforms. Fourier series. Classification and solution to partial differential equations. Heat, wave, and potential equations on bounded domains. Fourier integral applied to problems on unbounded domains.

MATH 2325C: NUMERICAL ANALYSIS

Nonlinear equations. System of linear equations. Interpolation and spline. Numerical differentiation. Numerical integration and quadrature. Initial value problems for ordinary differential equations. Finite difference method for boundary value problems. Monte Carlo methods.

QFIN 2105C: DERIVATIVE AND FINANCIAL MARKETS

Financial Markets and Financial Institutions. Market of Fixed income, debt, derivatives and equity. International financial and foreign exchange markets.

STAT 2204C: APPLIED PROBABILITY MODELS

Probability generating functions. Random walk. Markov chains. Poisson process. Brownian motion. Jump-diffusion model. Mean-reversion process.

QFIN 2109C: CORPORATE AND LEGAL FINANCE

Concept of shareholders' wealth. Capital markets. Valuation of securities. Risk and return. Dividend policy and dividend valuation model. Efficient market hypothesis. Capital asset pricing model. Interpretation of financial statements. Capital structure. Investment fundamentals. Negotiable instruments: distinction between assignability and negotiability, bills of exchange, cheques, promising notes, bankruptcy, receivership, liquidity.

UTM 2101: LIFE SKILLS AND GOOD PRACTICES

Employability development skills. Good governance. Prevention of corruption. Personal development skills and role of youth in addressing societal challenges. Coping skills. Addressing societal challenges including substance abuse, poverty, climate change, social media and family problems.

STAT 2304C: TIME SERIES MODELS

Characteristics of Time Series. Exponential smoothing. Decomposition methods. Seasonality trend, cyclical components. Seasonal and non-seasonal. Autoregressive models. ARIMA models. Non-stationary Time Series. Use of R package.

QFIN 2103C: BONDS AND DERIVATIVES

Derivative Instruments and their applications. Forward options. Bonds: bonds analytics and bonds securities. Fixed Income securities. Risk Management using Fixed Income Derivatives and Credit Derivatives.

QFIN 2104C: INVESTMENT INSTRUMENTS AND ANALYSIS

Financial investment theory. Calculation of risk and return. Market efficiency. Risk and return. Pricing of financial securities. Capital budgeting, NPV, IRR. Mean-variance portfolio theory.

MATH 2119C: WORK PLACEMENT

As per the Work Placement Guidelines of the University.

PROJ 2118C: MINI PROJECT

Demonstration of the ability to conduct rigorous research and reach to comprehensive conclusions for a specific problem. Topics to be covered: research process, ethics of research, research problems, developing research questions/hypotheses, choosing a research method, presenting & analysing findings and writing a research report. The teaching strategies will include 45 hours of face-to-face contact hours spread over two semesters.

MATH 2307C: MATHEMATICAL PROGRAMMING AND OPTIMISATION

Linear programming. Simplex method. Transport and assignment problems. Lagrange multipliers. Quadratic programming. Conjugate gradient methods. Decision making under uncertainty and risk.

QFIN 3203C: FINANCIAL RISK FORECASTING

Financial Markets and Stylized facts of Asset Returns. Univariate Models for Volatility. GARCH Modelling. Risk Forecasting. Value at Risk for Options and Bonds.

STAT 2306C: MULTIVARIATE ANALYSIS

Multivariate and Multi-normal Distribution. Multivariate Regression Analysis. Principal Component Analysis. Factor Analysis. Discriminant Analysis.

QFIN 3204C: VALUATION OF FINANCIAL DERIVATIVES

Option pricing models. Equity derivatives. Term structure models. Interest rate derivatives. Martingale Pricing of Financial Derivatives. LIBOR market models.

QFIN 3106C: CREDIT PRODUCTS AND RISK

Credit risk management and modelling. Asset value models. Alternative risk measures and allocation. Value at Risk. Credit Derivatives.

QFIN 3205C: DISCRETE FINANCIAL MODELLING

Single-Period and Multi Period Financial Markets. Modelling and Portfolio Optimisation. Risk-neutral probability measures. Martingale measures. Pricing contingent claims. Cox-Ross-Rubinstein model.

STAT 3307C: ACTUARIAL REGRESSION MODELS

Longitudinal data models. Nonlinear Regression. Categorical Dependent Variables. Survival Models. Frequency-Severity Models. Fat-Tailed Regression Models. Claims Triangles.

PROJ 3112C: DISSERTATION

Dissertation guidelines will be given in the Dissertation Handbook.