Quantitative Management

(offered by the Department of Decision Sciences)
Telephone number 012 429 4012

1 Introduction

1.1 What is Quantitative Management?

Quantitative Management (also known as Operations Research) offers a systematic and scientific approach to problem solving and decision making in complex environments and situations of uncertainty and conflict. The discipline is characterised by a search for an optimal (best) answer for a problem by using quantitative (numerical) models. The use of mathematical models enables a decision maker to better understand the problems facing him/her and provides a tool for making informed and reasoned judgements.

Quantitative Management is a practical field. It can be applied in many areas: manufacturing, businesses management, banking, environmental planning, mining, housing and engineering projects, management consultancy – in fact, in every situation where numerical data are available and management or decision making takes place.

The aim of the undergraduate programme in Quantitative Management is to give a student a substantive theoretical background in Quantitative Management, and – at the same time – to inculcate modelling skills and systematic thinking when solving decision making problems. At the conclusion of each year of the curriculum a student would be equipped with a variety of techniques and the skill of applying them to problems that arise in practice.

Quantitative Management is a multi-disciplinary subject that can be usefully combined with any other subject in this College.

1.2 Requirements for admission to postgraduate studies

To be admitted to studies for the Honours BCom degree in Quantitative Management a student must:
(a)   hold a BCom or BCompt degree or another approved degree in Economic and Management Science;
(b)   have passed Quantitative Management as a major subject (or the equivalent thereof) – see 4; or in a related discipline with the approval of the head of the department.
(c)   have access to a computer suitable for scientific programming as outlined in the departmental brochure on the Honours BCom degree in Quantitative Management.

NB

Admission to studies for the Honours degree must be approved by the Head of the Department.

2 General Information

- Students who have already passed Operations Research (OPS) modules and want to change to Quantitative Management (QMS) modules for a BCom degree with specialisation in Quantitative Management will be exempted from the equivalent QMS modules.
- Students who have already passed Operations Research (OPS) modules and want to change to Quantitative Management (QMG) modules for a general BCom degree will be exempted from the equivalent QMG modules.
- Students who have already passed Quantitative Management (QMS) modules for the BCom degree with specialisation in Quantitative Management and want to change to the general BCom degree will be exempted from the equivalent QMG modules.

3 Transitional Arrangements

- As from 2005, students will have to meet the current prescribed Prerequisite and Co-requisites for all modules offered by the Department of Decision Sciences. These modules include QMG, QMS and OPS.
- As from 2005 students who prior to 2000 passed papers of the previous course structure in Quantitative Management or Operations Research (QMN and OPE) will forfeit such credits for degree purposes if they wish to register for modules on a higher level. Students will first have to pass the necessary Prerequisite before being allowed to register for the desired modules.
- Note that if the module QMG/QMS203 has already been passed, then the module QMG/QMS301 may not be taken.

4 Quantitative Management as a Major Subject

For the BCom (General)

First level: QMG101, 102
Second level: QMG201, 202, 205
Third level: Any FIVE of QMG301, 302, 303, 304, 305, 306

For the BCom (with specialisation in Quantitative Management)

First level: QMS101, 102

5	**Syllabus**

FIRST-LEVEL MODULES

FOR THE BCOM DEGREE IN GENERAL

QMG101P   Quantitative modelling I (S1 and S2)
Purpose: to introduce the student to basic mathematical modelling and computational skills for application in the business world.

QMG102Q   Introductory financial mathematics (S1 and S2)
Purpose: to enable the student to derive and apply the fundamental formulae of financial mathematics.

FOR THE BCOM DEGREE WITH SPECIALISATION IN QUANTITATIVE MANAGEMENT

QMS101D   Mathematical modelling I (S1 and S2)
Prerequisite:
(a)   At least 50% in Mathematics HIGHER GRADE *or*
(b)   QMG101 or an equivalent examination in Mathematics
Purpose: to equip the student with the mathematical skills necessary for other modules. The focus is on key aspects of pre-calculus, calculus and linear algebra.

QMS102E   Introductory financial mathematics (S1 and S2)
Purpose: to enable the student to derive and apply the fundamental formulae of financial mathematics.

FOR OTHER BCOM DEGREES WHERE RECOMMENDED

QMI101X   Elementary quantitative methods (S1 and S2)
Purpose: to introduce the student to elementary mathematical modelling, financial mathematics, elementary descriptive statistics and index numbers.

SECOND-LEVEL MODULES

FOR THE BCOM DEGREE IN GENERAL

QMG201S   Mathematical programming (S1 and S2)*
Prerequisite: QMG101 or QMS101
Purpose: to enable the student to model and solve optimisation problems with techniques of differential calculus, linear and nonlinear programming.

QMG202T   Rational decision-making (S1 and S2)*
Prerequisite: QMG101 or QMS101
Purpose: to introduce the student to basic statistics and to familiarise the student with the use of selected techniques from operations research, including decision analysis, project management and network modelling.

QMG205W Financial modelling (S1 and S2)
Prerequisite: QMG102 or QMS102
Purpose: to introduce the student to the essential approaches and concepts of financial management, analysis and decision-making.

FOR THE BCOM DEGREE WITH SPECIALISATION IN QUANTITATIVE MANAGEMENT

QMS201G   Mathematical programming (S1 and S2)*
Prerequisite: QMS101
Purpose: to enable the student to model and solve optimisation problems with techniques of differential calculus, linear and nonlinear programming.

QMS202H   Rational decision-making (S1 and S2)*
Prerequisite: QMS101
Co-requisite: STS111, 112
Purpose: to familiarise the student with the use of selected techniques from operations research, including decision analysis, project management, network modelling and Markov chains.

QMS204K   Mathematical modelling II (S1 and S2)*
Prerequisite: QMS101
Purpose: to provide the student with a wide-ranging overview of elementary mathematical modelling in the economic and financial environments.

QMS205L   Financial modelling (S1 and S2)
Prerequisite: QMS102
Purpose: to introduce the student to the essential approaches and concepts of financial management, analysis and decision-making.

THIRD-LEVEL MODULES

FOR THE BCOM DEGREE IN GENERAL

Prerequisite: QMG201, 202

QMG301V   Production modelling (S1 and S2)*
Advice: Students who have passed QMG203 will receive exemption from QMG301 and must register for QMG205 if Quantitative Management is selected as a major subject.
Purpose: to familiarise the student with a mathematical approach to operations management in a production environment. The emphasis is on mathematical management models for quality, inventory, capacity, material requirements and scheduling.

QMG302W   Optimisation of resources (S1 and S2)*
Purpose: to equip the student with the skills to formulate, solve and analyse the results of linear, goal and integer programming models.

QMG303X   Simulation (S1 and S2)*
Purpose: to provide the student with a theoretical basis for structuring and solving simulation models in practice.

QMG304Y   Models for strategic decision-making (S1 and S2)*
Purpose: to introduce the student to the theory and practice of multi-criteria decision-making.

QMG3053   Risk analysis techniques (S1 and S2)
Purpose: to introduce the student to principles and methodologies for the treatment of uncertainty and risk.

QMG3064   Selected topics in Operations Research (S1 and S2)*
Purpose: to familiarise the student with the philosophy of Operations Research and some aspects of heuristics, game theory and forecasting.

FOR THE BCOM DEGREE WITH SPECIALISATION IN QUANTITATIVE MANAGEMENT

QMS301K   Production modelling (S1 and S2)*
Prerequisite: QMS201, 202
Advice: Students who have passed QMS203 will receive exemption from QMS301 and must register for QMS205.
Purpose: to familiarise the student with a mathematical approach to operations management in a production environment. The emphasis is on mathematical management models for quality, inventory, capacity, material requirements and scheduling.

QMS302L   Optimisation of resources (S1 and S2)*
Prerequisite: QMS201, 202
Purpose: to equip the student with the skills to formulate, solve and analyse the results of linear, goal and integer programming models.

QMS303M   Simulation (S1 and S2)*
Prerequisite: QMS201, 202
Co-requisite: STA202
Purpose: to provide the student with a theoretical basis for structuring and solving simulation models in practice.

QMS304N   Models for strategic decision-making (S1 and S2)*
Prerequisite: QMS201, 202
Purpose: to introduce the student to the theory and practice of multi-criteria decision-making.

QMS305P   Financial risk modelling (S1 and S2)*
Prerequisite: QMS201, 202, 204, 205
Co-requisite: STA202
Purpose: to introduce the student to principles and methodologies for the treatment of uncertainty, and probabilistic and discrete time models of risk with applications in financial modelling.

QMS306Q   Selected topics in Operations Research (S1 and S2)*
Prerequisite: QMS201, QMS202
Purpose: to familiarise the student with the philosophy of Operations Research and some aspects of heuristics, game theory and forecasting.

HONOUR'S LEVEL

HONASMB   Applied stochastic modelling
Co-requisite: HONSM1A
Purpose: to familiarise students with the applications of stochastic theory in practical situations.

HONDANE   Decision analysis
Purpose: to familiarise students with modelling techniques for solving decision problems in practice.

HONFIN6   Financial mathematics
Purpose: to enable students to do advanced interest rate calculations; specifically annuity and yield calculations (including the effects of capital gains tax).

HONFORP   Forecasting
Purpose: to familiarise students with forecasting techniques that enable them to fit the most appropriate forecasting model to a given data set.

HONINV4   Investment management
Prerequisite: HONMD1Y
Purpose: to familiarise students with investment analysis and scientifically based portfolio decisions.

HONLINR   Linear programming
Purpose: to familiarise students with the simplex method and related topics and enable them to solve concrete linear programming problems.

HONMD1Y   Introduction to the mathematical modelling of derivatives I
Purpose: to introduce students to the derivative investment environment; including the mathematical models used in pricing the instruments and the use of the instruments to increase profits and reduce risk.

HONMD23   Introduction to the mathematical modelling of derivatives II
Prerequisite: HONSM1A, HONMD1Y
Purpose: to develop in students the ability to derive and determine the movement of asset prices (and the prices of derived instruments based on them) by using certain stochastic processes, including the Wiener and Poisson processes.

HONNNSH   Neural networks
Purpose: to familiarise students with the theoretical background and various models of artificial neural networks.

HONOPTR   Optimisation
Purpose: to introduce students to combinatorial optimisation and the study of efficient algorithms as applied to networks and other discrete problems.

HONPR1B   Project I
Purpose: to introduce students to research and to hone technical writing skills.

HONPR2C   Project II
Prerequisite: HONPR1B
Purpose: to introduce students to the application of Operations Research techniques to real-life problems.

HONSIMG   Simulation
Purpose: to familiarise students with the modelling and operational analysis of industrial processes through simulation.

HONSM1A   Stochastic modelling I
Purpose: to familiarise students with stochastic processes and their applications in discrete Markov chains and queuing theory.

HONSM2B   Stochastic modelling II
Prerequisite: HONSM1A
Purpose: to familiarise students with continuous time Markov chains, martingales and other Markov processes.

HONCS1Y   Capita selecta
Purpose: to familiarise students with modern developments in Operations Research which may have a great impact on technology in the near future.

6   Practical Work

Quantitative Management is a practical subject which requires that students attain certain computer skills.
- A calculator is required for the modules QMI101, QMG101, QMG102 and QMS102. The specifications of the prescribed calculator will appear in Tutorial Letter 301.
- For all other modules access to a personal computer with spreadsheet software is a prerequisite. Access to a printer is also required. Students must be able to do basic spreadsheet calculations.
- Admission to second and third-level modules is restricted to students who have access to a micro-computer.
- Students who register for BCom with specialisation in Quantitative Management must do INF205 and must therefore have access to microcomputer with a CD-ROM.
- Knowledge of a programming language like Turbo Pascal or Delphi is required for QMG303 and QMS303.