Introduction

1.1 What is Operations Research?

Operations Research (OR) is exciting, practical and interesting. OR addresses practical problems in business and elsewhere, seeking for optimal or near optimal answers. These problems can be as diverse as your imagination can take you. They may concern the calculation of how many units of each product should be manufactured in a particular factory to maximise profit, or the scheduling of work in an assembly plant or factory, or even the best way to cut cloth for dresses from a roll of fabric so that there is a minimum of waste. Because OR has to do with the solution of problems with such diversity, it is multi-disciplinary, challenging and dynamic. Every problem is different, every problem teaches you something more. The electronic revolution we are currently experiencing is taking the developed world from the industrial era into the information era, and people who can derive meaningful answers from the growing volumes of available data will have a distinct advantage. The study of Operations Research can help the student to achieve this.

OR relies, to a large extent, on tools from the basic disciplines of mathematics, statistics and computer science, although there is much more to OR than simply a set of tools from these three disciplines. OR is the application of these and other areas of knowledge in a systematic and structured manner. OR requires a searching and inquisitive mind but most of all OR requires integrity and objectivity.

In the College of Economic and Management Sciences, OR is taught as the subject Quantitative Management. It is also often referred to as Management Science. This plethora of names for the subject best illustrates the diversity and dynamism which is so integral to this modern living subject which is Operations Research.

If you require more information on OR please feel free to contact any member of the Department of Decision Sciences who would only be too pleased to help you.

1.2 Requirements for Admission to Postgraduate Studies

To be admitted to studies for the Honours BSc degree in Operations Research a student must:
(a) hold a Bachelor’s degree;
(b) have passed Operations Research 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 BSc degree in Operations Research.

NB
Admission to studies for the Honours degree rests with the Head of the Department.

2 General Information

- Information relating to QMG- and/or QMS-modules appears under the subject chapter ‘Quantitative Management’.
- Students are advised to include as many Mathematics and Statistics modules in their curriculum as possible.
- QMI101, QMG101 and 102 may NOT be taken for the BSc degree or the National Certificate in Datametrics. Students who have already passed Quantitative Management (QMS) modules and want to change to Operations Research (OPS) modules for a BSc degree or the National Certificate in Datametrics, will be exempted from the equivalent OPS modules.
- The use of a programmable pocket calculator is permissible in the examinations of ALL modules and papers.

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 OPS203 has already been passed, then the module OPS301 may not be taken.

4 Operations Research as a Major Subject

Compulsory modules for a major subject combination:
First level: OPS101, 102
Second level: OPS201, 202, 205
Third level: At least FOUR of OPS301, 302, 303, 304, 305, 306

**Syllabus**

### FIRST-LEVEL MODULES

**OPS101G**  
**Introduction to the business world (S1 and S2)**  
*Prerequisite:* ONE of the following:  
(a) Mathematics Higher Grade at matriculation level passed with at least 40% (E-symbol)  
(b) Mathematics Standard Grade at matriculation level passed with at least 50% (D-symbol)  
(c) Mathematics at matriculation level passed prior to differentiation  
(d) An equivalent examination in Mathematics  
(e) MAT110  
(f) MAT011 passed with at least 75%  
*Purpose:* to introduce students to business concepts which will be useful in their professional careers.

### SECOND-LEVEL MODULES

**OPS201K**  
**Mathematical programming (S1 and S2)**  
*Prerequisite:* OPS101, 102 and (QMS101 or any TWO of MAT101, 102, 112, 113 and 103)  
*Purpose:* to enable the student to model and solve optimisation problems with techniques of differential calculus, linear and nonlinear programming.

**OPS202L**  
**Rational decision making (S1 and S2)**  
*Prerequisite:* OPS101, 102  
*Advice:* It is recommended that STS111 and STS112 be taken before or together with this module.  
*Purpose:* to familiarise the student with the use of selected techniques from operations research, including decision analysis, project management, network modelling and Markov chains.

**OPS204N**  
**Mathematical modelling II**  
*Prerequisite:* OPS101, 102, ECS101, 102 and (QMS101 or any two of MAT101, 102, 112, 113 and 103)  
*Purpose:* to provide the student with a wide-ranging overview of elementary mathematical modelling in the economic and financial environments.

**OPS205P**  
**Financial modelling (S1 and S2)**  
*Prerequisite:* OPS101, 102  
*Purpose:* to introduce the student to the essential approaches and concepts of financial management, analysis and decision-making.

### THIRD-LEVEL MODULES

**OPS301N**  
**Production modelling (S1 and S2)**  
*Prerequisite:* OPS201, 202  
*Advice:* Students who have passed OPS203 will receive exemption from OPS301 and must register for OPS205 if Operations Research 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.

**OPS302P**  
**Optimisation of resources (S1 and S2)**  
*Prerequisite:* OPS201, 202  
*Purpose:* to equip the student with the skills to formulate, solve and analyse the results of linear, goal and integer programming models.

**OPS303Q**  
**Simulation (S1 and S2)**  
*Prerequisite:* OPS201, 202  
*Co-requisite:* STA202  
*Purpose:* to provide the student with a theoretical basis for structuring and solving simulation models in practice.

**OPS304R**  
**Models for strategic decision-making (S1 and S2)**  
*Prerequisite:* OPS201, 202  
*Purpose:* to introduce the student to the theory and practice of multi-criteria decision-making.

**OPS305S**  
**Financial risk modelling (S1 and S2)**  
*Prerequisite:* OPS201, 202, 205, STA202 and (MAT211 or COS233)  
*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.
**OPS306T  Selected topics in Operations Research (S1 and S2)**

*Prerequisite: OPS201, 202*

*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.

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**Practical Work**

Operations Research is a practical subject which requires that students attain certain computer skills.

- Students who wish to register for QMS101 must have access to a suitable microcomputer.
- Admission to second and third-level modules are restricted to students who have access to a microcomputer. Access to a printer is also required.
- Students must be able to do basic spreadsheet calculations.
- Knowledge of a programming language like Turbo Pascal or Delphi is required for OPS303.

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**Origin and Foundations of South African Law**

*(offered by the Department of Jurisprudence)*
1

**Transitional Arrangements**

- Students who have passed Roman Law I (RLW200) but have not yet passed the LLB paper General legal history (LJU401 or LWE401) MUST register for FLS101.
- Students who have passed the LLB paper General legal history (LJU401 or LWE401) but have not yet passed Roman Law I (RLW200) MUST register for FLS102.

2

**Syllabus**

**FLS101V The origins of South African law (S1 and S2)**

*Purpose:* to provide an overview of the origins of the South African legal system, focussing on the Western or European, the African and the human rights traditions.

**FLS102W Foundations of South African law (S1 and S2)**

*Purpose:* to provide an overview of the Roman origin and foundations of the law of property and the law of obligations, with reference to the interaction of the various legal traditions studied in FLS101 and comparable institutions in modern South African law.