Year offered: 2011
Admissions: Yes
CRICOS code: 046044G
Course duration (full-time): 1 semester (0.5 year)
Course duration (part-time): 2 semesters (1 year)
Domestic Fees (indicative): 2011: Full fee tuition $7,500 (indicative) per semester
International Fees (indicative): 2011: $11,125 (indicative) per semester
Domestic Entry: February, July or Summer Program
International Entry: February and July
Total credit points: 48
Standard credit points per full-time semester: 48
Standard credit points per part-time semester: 24
Course coordinator: Dr Troy Farrell
Discipline coordinator: Dr Troy Farrell (Course Coordinator), Dr James McGree (Assistant Course Coordinator)
Campus: Gardens Point

Overview
These courses enable graduates from any discipline to develop their knowledge and skills in one or more areas of the mathematical sciences. Strands available include mathematical modelling/applied mathematics, computational mathematics, statistics/statistical modelling, quantitative analysis/financial mathematics and operations research.

These courses recognise that students may not have studied mathematics for some time.

Course Design
The program of study for an individual student will be decided in consultation with the course coordinator and will take into account the student's background and area of interest within the mathematical sciences.

In the Graduate Certificate, at least 36 credit points must be taken from postgraduate mathematics units and up to 12 credit points can be taken from units other than mathematics units.

Further Information
For further information about this course, please contact:

Troy Farrell (Course Coordinator) or James McGree (Assistant Course Coordinator)
Phone: +61 7 3138 2782
Email: enquiry.scitech@qut.edu.au

Course structure
- Total credit points: 48
- At least 36 credit points must be taken from postgraduate mathematics units.
- Up to 12 credit points can be taken from units other than mathematics units.
- The units recommended will depend upon your mathematics background from secondary school or tertiary studies, length of time since you have studied mathematics, and your areas of interest.

Units available:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAN101</td>
<td>Statistical Data Analysis 1</td>
</tr>
<tr>
<td>MAN105</td>
<td>Preparatory Mathematics</td>
</tr>
<tr>
<td>MAN120</td>
<td>Algebra and Calculus</td>
</tr>
<tr>
<td>MAN121</td>
<td>Calculus and Differential Equations</td>
</tr>
<tr>
<td>MAN122</td>
<td>Algebra and Analytic Geometry</td>
</tr>
<tr>
<td>MAN200</td>
<td>Mathematical Foundations</td>
</tr>
<tr>
<td>MAN201</td>
<td>Mathematics</td>
</tr>
<tr>
<td>MAN210</td>
<td>Statistical Modelling 1</td>
</tr>
<tr>
<td>MAN220</td>
<td>Computational Mathematics 1</td>
</tr>
<tr>
<td>MAN281</td>
<td>Mathematics for Computer Graphics</td>
</tr>
<tr>
<td>MAN311</td>
<td>Advanced Calculus</td>
</tr>
<tr>
<td>MAN312</td>
<td>Linear Algebra</td>
</tr>
<tr>
<td>MAN313</td>
<td>Mathematics of Finance</td>
</tr>
<tr>
<td>MAN314</td>
<td>Statistical Modelling 2</td>
</tr>
<tr>
<td>MAN315</td>
<td>Operations Research 2</td>
</tr>
<tr>
<td>MAN413</td>
<td>Differential Equations</td>
</tr>
<tr>
<td>MAN414</td>
<td>Applied Statistics 2</td>
</tr>
<tr>
<td>MAN420</td>
<td>Computational Mathematics 2</td>
</tr>
<tr>
<td>MAN422</td>
<td>Mathematical Modelling</td>
</tr>
<tr>
<td>MAN461</td>
<td>Discrete Mathematics</td>
</tr>
<tr>
<td>MAN480</td>
<td>Introduction to Scientific Computation</td>
</tr>
<tr>
<td>MAN521</td>
<td>Applied Mathematics 3</td>
</tr>
<tr>
<td>MAN522</td>
<td>Computational Mathematics 3</td>
</tr>
<tr>
<td>MAN524</td>
<td>Statistical Inference</td>
</tr>
<tr>
<td>MAN525</td>
<td>Operations Research 3A</td>
</tr>
<tr>
<td>MAN533</td>
<td>Statistical Techniques</td>
</tr>
<tr>
<td>MAN536</td>
<td>Time Series Analysis</td>
</tr>
<tr>
<td>MAN613</td>
<td>Partial Differential Equations</td>
</tr>
</tbody>
</table>
MAN623  Financial Mathematics
MAN624  Applied Statistics 3
MAN625  Operations Research 3B
MAN672  Advanced Mathematical Modelling
MAN700  Project
MAN717  Minor Project
MAN761  Analysis
MAN764  Applied Mathematical Modelling
MAN765  Bayesian Data Analysis
MAN766  Applied Time Series Analysis
MAN768  Advanced Techniques in Operations Research
MAN769  Mathematics of Finance
MAN771  Computational Mathematics 4
MAN774  Perturbation Methods
MAN775  Statistical Modelling of Financial Processes
MAN777  Mathematics of Fluid Flow
MAN778  Applications of Discrete Mathematics

Potential Careers:
Actuary, Mathematician, Quantitative Analyst, Statistician.

UNIT SYNOPSISES

MAN101 STATISTICAL DATA ANALYSIS 1
The aim of this unit is to provide you with an essential grounding in statistical reasoning, and in basic methods for the analysis of data and interpretation of variation in all areas of modern science, social science, technology, industry and associated fields. The unit also provides you with key statistical knowledge to apply in many advanced units and projects which involve data and influences of random variation. Fundamental quantitative methods which inform and support statistical knowledge are also provided. **Antirequisites:** MAB101, MAB141, BSB123, EFB101, MAB233 **Assumed knowledge:** Grade of at least Sound Achievement in Senior Mathematics B (or equivalent) or MAN105 or MAB105 is assumed knowledge **Credit points:** 12 **Contact hours:** 4 per week **Campus:** Gardens Point **Teaching period:** 2011 SUM-2, 2011 SEM-1 and 2011 SEM-2

MAN120 ALGEBRA AND CALCULUS
A sound understanding of the language and techniques of mathematics is essential for any quantitative discipline. This unit provides an introduction to the aspects of mathematics especially applicable to science, technology and business and is directed at those postgraduate students whose mathematics preparation does not include Maths C or an equivalent. This unit is not available to students in MA75 or MA85. This unit introduces you to the fundamental mathematical ideas of functions, calculus, vectors and matrices, through the use of contextualized problems. In solving these problems you will develop both an understanding of the mathematical concepts and competency in appropriate solution methods. **Antirequisites:** MAB100, MAB120, MAB180, MAB125 **Assumed knowledge:** Grade of at least Sound Achievement in Senior Mathematics B (or equivalent) or MAN105 or MAB105 **Credit points:** 12 **Contact hours:** 4 per week **Campus:** Gardens Point **Teaching period:** 2011 SEM-1, 2011 SEM-2 and 2011 SUM

MAN105 PREPARATORY MATHEMATICS
This unit is intended to cater for the needs of students whose background in mathematics is either weak or does not reach the equivalent of Senior Mathematics B. It is intended to provide the concepts and skills needed for successful study of those units within the university which assume a background equivalent to Senior Mathematics B. This unit is incompatible with a grade of High Achievement in Senior Mathematics B. To develop your mathematical skills in and understanding of algebra, functions and graphing, differential and integral calculus of one variable and to interpret and solve simple, real world problems using these skills. **Antirequisites:** MAB105 **Assumed knowledge:** Year 10 Level 6 Mathematics is assumed knowledge **Credit points:** 12 **Contact hours:** 4 per week **Campus:** Gardens Point **Teaching period:** 2011 SEM-1 and 2011 SEM-2
MAN122 ALGEBRA AND ANALYTIC GEOMETRY
Building upon the foundations established in MAN120 or Senior Maths C, this unit addresses the significant role of mathematical modelling using vectors, matrices and multivariable calculus for the description and resolution of simple and complex problems relevant in the real world. The formulation and solution of such problems is supported by appropriate advanced mathematical concepts used for function approximation, differentiation and integration. Undertaking this unit will allow you to develop your problem solving skills, especially in the context of advanced mathematical techniques applied to vectors, matrices and multivariable functions used to model real world problems. Antirequisites: MAB112, MAB122, MAB127, MAB132 Assumed knowledge: Grade of at least Sound Achievement in Senior Mathematics C (or equivalent) or MAN120 or MAB120 or MAB100 or MAB125 is assumed knowledge. Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2011 SEM-1, 2011 SEM-2 and 2011 SUM

MAN200 MATHEMATICAL FOUNDATIONS
The unit is intended to cater for those students who may not have studied mathematics for some years, hence there is a need to update their mathematics background and fill in gaps. It is designed for a mature learning style and may include directed reading and study and/or attendance at lectures. While much of the material may be in common with certain undergraduate mathematics units, postgraduate students should be able to proceed at a faster pace than undergraduate students and with less direction after the initial re-acquaintance period. This unit is only available to students within the postgraduate coursework programs offered by Mathematical Sciences. Other requisites: Unit coordinator approval is required to enrol. Credit points: 12 Contact hours: 4 per week Campus: Gardens Point

MAN201 MATHEMATICS
This unit follows on from MAN200 Mathematical Foundations although it may be taken in parallel if topics are appropriate. It is intended for postgraduate coursework students in mathematical sciences who require more than one unit to provide them with the necessary background to undertake more advanced units. Students taking this unit will typically be either attending lectures or using lecture material from undergraduate units as part of a formal project but will be directed to extension material or may cover material from more than one unit. This unit is only available to students within the postgraduate coursework programs offered by Mathematical Sciences. Other requisites: Unit coordinator approval is required to enrol. Credit points: 12 Contact hours: 4 per week Campus: Gardens Point

MAN210 STATISTICAL MODELLING 1
This unit is intended for all mathematics degree students, all double degree students with mathematics, secondary education students with mathematics as a teaching area, and quantitatively-oriented students in other courses, particularly in Science, Information Technology, Engineering and areas of Business. The unit will provide you with fundamental skills and operational knowledge for all further study in statistics, and highly relevant foundations for other areas of mathematics such as mathematical modelling and operations research. The unit will also help you develop fundamental problem-solving skills in statistics and mathematics. Prerequisites: MAB121 or MAB122. Antirequisites: MAB210. Assumed knowledge: Grade of at least Sound Achievement in Senior Mathematics C (or equivalent) or MAB120 is assumed knowledge. Students are advised to enrol in either MAB121 or MAB122 in the same semester if not previously completed. Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2011 SEM-1 and 2011 SEM-2

MAN220 COMPUTATIONAL MATHEMATICS 1
Many real world problems are not solvable analytically, meaning that it is necessary to develop computational methods that can be used to solve these problems. Additionally, to be able to apply these methods to large problems, they must be implemented as algorithms in a computer language such as MATLAB. This unit addresses both the theoretical development of computational methods and their implementation in MATLAB. The aim of this unit is to provide you with the introductory concepts, computational techniques and programming skills that will allow you to solve many real world problems. It is also designed to prepare you for study in further units in computational mathematics. Antirequisites: MAB220. Assumed knowledge: Grade of at least Sound Achievement in Senior Mathematics B (or equivalent) or MAB105 and corequisite MAB120 or MAB125 or MAB100 or MAB180 if you don’t have Senior Mathematics C Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2011 SEM-1 and 2011 SEM-2

MAN281 MATHEMATICS FOR COMPUTER GRAPHICS
Computer graphics is a rapidly growing field of the computer science industry. It has applications in computer games, virtual reality, CAD systems and geometric modelling. Fundamental to all of these applications is mathematics. Thus, to be a working professional in this area you will need a working knowledge of the basic mathematics and concepts that are central to this field. This unit is also ideal
for non-specialists as it demonstrates some of the various fields of applications of mathematics in everyday life. The aim of this unit is to introduce you to the mathematics of computer graphics and relate this to the solutions of problems that arise in the many applications of computer graphics.

**Assumed knowledge:** Grade of at least Sound Achievement in Senior Mathematics B (or equivalent) or MAB105 / MAN105 is assumed knowledge  
**Credit points:** 12  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**MAN311 ADVANCED CALCULUS**

This unit includes the following: polar coordinates; parametric equations; conic sections; quadric surfaces; vector-valued functions; Fourier series; functions of several variables; graphs; partial derivatives; total derivatives; extrema; Lagrange multipliers; Taylor series for multivariable functions; double and triple integrals; Green's theorems; line and surface integrals; divergence theorem; Stoke's theorem; applications.  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**MAN312 LINEAR ALGEBRA**

This unit covers the following broad topics from linear algebra: matrix analysis; eigenvalues and eigenvectors; vector spaces; inner product spaces.  
**Prerequisites:** (MAN121 or MAB111 or MAB121) and (MAN122 or MAB112 or MAB122)  
**Antirequisites:** MAB312  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**MAN313 MATHEMATICS OF FINANCE**

Finance provides one of the significant areas for the application of mathematics. Understanding the fundamental principles involved will enhance your general preparation for life and provide an essential tool for those of you who intend to pursue further studies or careers in the financial area. The aim of this postgraduate unit is to provide you with an introduction to the methods used in obtaining relevant solutions to financial and business problems.  
**Prerequisites:** MAB111 or MAB121 or MAN121 (which can be concurrently enrolled)  
**Antirequisites:** MAB313  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**MAN314 STATISTICAL MODELLING 2**

This unit includes: models for stochastic processes and statistical methods, which have applications in engineering, information technology, finance, and physical and life sciences. Markov chains; random walks; branching processes; queueing processes; long-term behaviour of processes; use of generating functions; bivariate and conditional distributions; transformations of random variables; beta and gamma distributions; mixture distributions; order statistics, minimum and maximum.  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**MAN315 OPERATIONS RESEARCH 2**

This unit introduces the essential features of operations research methods. It develops a number of basic mathematical techniques to solve generic problems and the theoretical foundations of these techniques. Students should develop the ability to apply various operations research methods, algorithms and techniques in the solution of practical problems. Students will also look at the applications of operations research techniques to real-world problems.  
**Prerequisites:** MAB210 and (MAB112 or MAB122)  
**Antirequisites:** MAB315  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**MAN413 DIFFERENTIAL EQUATIONS**

Differential Equations are among the most important aspects of the theoretical developments of any branch of science. It is often the case that the formulation of mathematical models of real world problems leads to an equation in which a function and its derivatives play a major role. Such equations are examples of differential equations. This unit builds on prior studies of differential equations and provides a framework for studying partial differential equations and other aspects of applied mathematics in later semesters. This unit aims to provide you with a basis for understanding differential equations, their solutions and solution strategies. The mathematical theory of differential equations, skills in the application of this theory, and the relevance of the material in this unit to problem solving and interpretation will all be developed.  
**Prerequisites:** MAB311 or MAB312 or MAN311 or MAN312  
**Antirequisites:** MAB413  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**MAN414 APPLIED STATISTICS 2**

This unit includes: Simple linear regression (revision), multiple linear regression, making inferences from regressions, choosing a model, checking model assumptions, general linear models - analysis of covariance, ANOVA revisited, designing experiments, issues in designing experiments, analysing experimental results, further experimental designs, assumptions, and how to cope if they aren't met, simulations.  
**Prerequisites:** MAN101  
**Assumed knowledge:** Recommended MAB112  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2
MAN420 COMPUTATIONAL MATHEMATICS 2
This unit provides you with the opportunity to employ a number of the skills that you have developed in the disciplines of computational mathematics and linear algebra, combining them in a coherent manner for resolving topical and relevant real world problems. You will become familiar with the methodologies for developing numerical algorithms that can be employed for either the direct solution or the iterative solution of large, sparse linear systems.
Prerequisites: (MAN220 or MAB220) and (MAN312 or MAB312) Antirequisites: MAB420 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2011 SEM-2

MAN422 MATHEMATICAL MODELLING
In this unit you will develop skills in the formulation and interpretation of mathematical models of ‘real-world’ problems drawn from the literature, the media and the lecturer’s own research areas. You will also develop and extend your skills in the use of mathematical software to investigate solutions of some of these models. By emphasising the need to write clear mathematical arguments and to explain in logical and clear English the conclusions drawn from the mathematical models developed in the unit, you will also develop your written communication skills.
Prerequisites: MAN121 Antirequisites: MAB422 Assumed knowledge: MAN220 is recommended for prior/concurrent study for exposure to MATLAB Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2011 SEM-2

MAN461 DISCRETE MATHEMATICS
Discrete mathematics is playing an ever increasingly important role in society. We live in an electronic age where information security is of paramount importance, and it is discrete mathematics in the main that provides this security. In addition, many real world systems are discrete in nature and therefore lend themselves to a discrete analysis. These methods are therefore vital to the professional mathematician and useful to those with an interest in mathematics. This unit will provide you with an introduction to discrete and combinatorial mathematics, and give you a mathematical perspective that is different from the traditional coverage in other mathematics units. It will also provide you with valuable methods to apply in other areas of science and computer science.
Prerequisites: MAN122 or MAB112 or MAB122 Antirequisites: MAB461, MAB621 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2011 SEM-2

MAN480 INTRODUCTION TO SCIENTIFIC COMPUTATION
This unit teaches students how to implement a mathematical algorithm in a modern scientific computing environment (eg Matlab). A case-study approach is used with an emphasis on writing efficient code. Also an overview of other software packages used in mathematics will be given.
Antirequisites: ITB849, MAB480 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point

MAN521 APPLIED MATHEMATICS 3
Topics selected from: partial differential equations such as the wave, heat and Laplace equations; special functions (gamma, delta, Bessel and error functions, Legendre polynomials); vector analysis and applications (vector algebra, vector calculus, fields, grad, div, curl, line and surface integrals, divergence theorem, Stoke’s theorem, applications); functions of a complex variable (analytic functions, contour integrals, Laurent series, residues).
Prerequisites: MAN311 or MAB311 Antirequisites: MAB521 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2011 SEM-2

MAN522 COMPUTATIONAL MATHEMATICS 3
This unit includes: deriving the basic equations that describe fluid motion; the finite volume method for solving PDEs (application to the generalised diffusion equation, cell-centred and vertex-centred schemes, handling of boundary and initial conditions); solution of systems of nonlinear equations (Newton’s method, Inexact Newton methods, Globally convergent methods).
Prerequisites: (MAN311 or MAB311) and (MAN420 or MAB420) Antirequisites: MAB522 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2011 SEM-1

MAN540 INTRODUCTION TO SCIENTIFIC COMPUTATION
This unit teaches students how to implement a mathematical algorithm in a modern scientific computing environment (eg Matlab). A case-study approach is used with an emphasis on writing efficient code. Also an overview of other software packages used in mathematics will be given.
Antirequisites: ITB849, MAB480 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point

MAN524 STATISTICAL INFERENCE
This unit includes: maximum likelihood estimation, confidence intervals and hypothesis tests, introduction to Bayesian inference, prior and posterior distributions, Bayesian inference for binomial data, Poisson count data and normal data, simulation techniques for sampling from distributions. Use of software Matlab and R. Assumed knowledge: exposure to introductory ideas of statistical inference, including parameter estimation, confidence intervals and hypothesis testing, such as provided by a first course in statistics or data analysis.
Prerequisites: MAN314 or MAB314 Antirequisites: MAB524 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point

MAN525 OPERATIONS RESEARCH 3A
This unit develops problem-solving skills and sharpens analytical skills. This unit introduces the technical issues
involved in applying operations research principles, methods and algorithms in the solution of real-world problems.

**Prerequisites:** MAB315 or MAN315  
**Antirequisites:** MAB525  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**MAN533 STATISTICAL TECHNIQUES**

This unit builds on your knowledge and skills of statistical techniques and aims to provide you with an understanding and a working knowledge of some more specialised statistical techniques and their applications. Topics covered include quality management concepts and tools for statistical process control, modelling and analysis of reliability (for inanimate objects) and survival (for living entities), and multivariate techniques such as principal components analysis, discriminant analysis and cluster analysis.

**Prerequisites:** MAN210 and MAN414  
**Antirequisites:** MAB533  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**MAN536 TIME SERIES ANALYSIS**

Data in business, economics, engineering and the natural sciences often occur in the form of time series. Time Series Analysis provides models and methods for the analysis of such series of correlated observations. The ability to forecast optimally, to understand causal relationships between variables, and to analyse dynamic systems is of great practical importance. For example, optimal sales forecasts are needed for business planning, transfer function models are needed for improving the design and control of a process plant, and vector time series models are used to represent the relationships and interactions of macroeconomic variables in any economy.

**Prerequisites:** MAB314 and MAB414  
**Antirequisites:** MAB536, MAN526  
**Credit points:** 12  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**MAN613 PARTIAL DIFFERENTIAL EQUATIONS**

Partial differential equations are the classical foundation of mathematical models used to unambiguously describe processes exhibiting spatial and temporal variation. There exist numerous modern important examples of such so-called continuum models and so it is essential for any practicing mathematician to be conversant with both the background, formulation and solution of such equations. This unit aims to develop your understanding of the construction, analysis, solution and interpretation of partial differential equation models of real-world processes.

**Prerequisites:** (MAN311 or MAB311) and (MAN413 or MAB413)  
**Antirequisites:** MAB613  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**MAN623 FINANCIAL MATHEMATICS**

This unit includes the following: quantitative techniques in business, economics and finance; theory and structure of interest rates; general accumulation and discounting functions; force of interest; discounting including Modern Portfolio theory and extension; varying interest; general annuities; varying annuities; continuous varying annuities; mathematical analysis of financial transactions in money and capital markets; life annuities and life assurances; the life table; basic life table functions; life annuities and assurances; policy values; paid up policy values; changes to policies; use of life table; superannuation.

**Prerequisites:** (MAN313 or MAB313) and (MAN311 or MAB311)  
**Assumed knowledge:** EFB210 is highly recommended prior study  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**MAN624 APPLIED STATISTICS 3**

Applied statistics provides methods for investigating relationships between variables that arise in data from a variety of areas including science, technology and commerce. The planning of the collection of the data, using ideas of experimental design, and the analysis of the resulting data, using methods based on statistical inference, are fundamental aspects of the statistical process. In addition, communication of results with clear reporting of the conclusions of the analysis is very important. These activities are an important part of decision making processes whatever the context of the application. This unit is concerned with building on the experimental design and statistical analysis methods presented in undergraduate units in order to advance your knowledge of modern statistical methods. Additionally, the use of statistical software to carry out analyses and the reporting of conclusions are emphasised.

**Prerequisites:** MAB414 or MAN414  
**Antirequisites:** MAB624  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**MAN625 OPERATIONS RESEARCH 3B**

Operations research techniques are used in most industries that are concerned with the application of scientific methods in decision making, especially the allocation of resources. There is thus a need for graduate students who can make decisions on the most appropriate technology to solve a particular problem and implement it. This unit will build on the foundation of previous Operations Research units to develop knowledge and skills in using advanced techniques, tools and methods.

**Prerequisites:** MAN315  
**Equivalents:** MAB625  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2
MAN672 ADVANCED MATHEMATICAL MODELLING
Models are developed beginning with the description of 'real world' problems. Emphasis is on the mathematical modelling and not on the development of new mathematical techniques. The unit includes: mathematical modelling; model formulation; dimensional analysis and re-scaling; curves of pursuit; bungy jumping; modelling with systems of ordinary differential equations; phase plane methods for analysing systems of ODEs; bacterial growth in a chemostat; predator-prey models with harvesting; limit cycles; oscillations and excitable media; modelling with partial differential equations; motion of a continuum; continuity; traffic flow; aggregation of slime mould amoebae; momentum; ideal gas dynamics; quasi-linear PDEs.
Prerequisites: MAN422 or MAB422
Assumed knowledge: MAN311. Also recommend: MAN413
Credit points: 12
Teaching period: 2011 SEM-1

MAN700 PROJECT
This unit aims to provide a framework for you to apply the mathematically-founded analytical methods and quantitative techniques learned in other units in the course to real world problems relevant to you. You will gain expertise in problem formulation, problem solving and communication, involving mathematical techniques. Permission to enrol in this unit must be obtained from the Course Coordinator.
Other requisites: Unit coordinator approval is required to enrol
Credit points: 24
Teaching period: 2011 SEM-1, 2011 SEM-2 and 2011 SUM

MAN717 MINOR PROJECT
Research in the Mathematical and Statistical Sciences can be intellectually challenging and rewarding and generally requires a knowledge base and a range of generic capabilities to be developed to a level that is not normally achieved in a bachelor degree of three years duration. This unit offers you the opportunity to acquire this knowledge and these capabilities. By undertaking a minor research project in a field which is of interest to you, undertaking advanced level coursework in a discipline related to your area of Mathematical interest, or both. Permission to enrol in this unit must be obtained from the Course Coordinator.
Other requisites: Unit coordinator approval is required to enrol
Credit points: 12
Teaching period: 2011 SEM-1, 2011 SEM-2 and 2011 SUM

MAN761 ANALYSIS
This unit includes: convergence in R; uniform convergence; Lebesgue integral; convergence theorems; L^p-spaces; metric spaces; completeness and compactness; contraction mappings; normed and Banach spaces; dual spaces; linear operators; Hilbert spaces; Hilbert-adjoint operator; linear operator equations; spectrum of a linear operator.
Prerequisites: MAB311 and MAB312
Credit points: 12
Teaching period: 2011 SEM-1

MAN764 APPLIED MATHEMATICAL MODELLING
Through the investigation of case studies and the development and practice of techniques and skills related to the formulation of mathematical models and their numerical solution, this unit provides you with the opportunity to employ these skills you have developed in your studies in mathematics, combining them in a coherent manner for solving topical and relevant problems. You will become familiar with methodologies for developing mathematically based theoretical tools for the solution of problems that may well be outside your core discipline area and in communicating the results of your theoretical study to a diverse audience.
Prerequisites: MAB613 and MAB672
Credit points: 12
Teaching period: 2011 SEM-2

MAN765 BAYESIAN DATA ANALYSIS
This subject builds on the foundations of Bayesian analysis laid in MAB524 to extend modelling and computational approaches to real world problems. Skills in using statistical computing platforms for Bayesian analysis, model development and comparison, and extending computational approaches will be developed. You are encouraged to apply skills to data modelling tasks motivated by their work or research areas.
Prerequisites: MAB524 or MAN524
Credit points: 12
Teaching period: 2011 SEM-1

MAN766 APPLIED TIME SERIES ANALYSIS
This unit introduces you to the modern tools of Time Series Analysis. It covers both linear and nonlinear time series models; state-space models; generalised state-space models; the Kalman recursions for filtering, prediction and smoothing; applications to business and financial time series. The unit will develop the mathematical and statistical concepts and show how these concepts are then applied in practical situations.
Prerequisites: (MAN524 or MAB524) and (MAN536 or MAB536)
Credit points: 12
Teaching period: 2011 SEM-1

MAN768 ADVANCED TECHNIQUES IN OPERATIONS RESEARCH
This unit includes the following: inventory systems modelling, material requirement planning, just-in-time production; production planning and scheduling, including static and dynamic methods, aggregate planning.
LP/LDR/SDR techniques; resources allocation; heuristics; operations scheduling, including sequencing and balancing techniques, job shop scheduling, assembly line balancing; NP-completeness.

**Prerequisites:** (MAN525 or MAB525) and (MAN625 or MAB625)  
**Credit points:** 12  
**Contact hours:** 3 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**MAN769 MATHEMATICS OF FINANCE**

This unit will present to you the essential elements of mathematical finance including the development of stochastic calculus which is essential for a quantitative treatment of mathematical finance. Computational approaches will be developed for simulating various financial instruments. In addition, the application of models and methods developed in some key problems of mathematical finance will be demonstrated to you.

**Prerequisites:** MAN623 or MAB623 or MAN522 or MAB522  
**Credit points:** 12  
**Contact hours:** 3 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**MAN771 COMPUTATIONAL MATHEMATICS 4**

An essential skill for practicing applied mathematicians and engineers is the derivation and implementation of computational models for solving the equations that govern many of the physical processes encountered in research and industry. Through the investigation of specific case studies developed in Matlab, the derivation of numerical techniques, the implementation of efficient algorithms and the visualisation of the simulation results, students undertaking this unit will develop an understanding of the value of computational mathematics. The aim of this unit is to provide you with the opportunity to employ a number of the skills that you have developed in the discipline of computational mathematics, combining them in a coherent manner for solving topical and relevant real world problems.

**Prerequisites:** (MAB522 or MAN522) and (MAB613 or MAN613)  
**Credit points:** 12  
**Contact hours:** 3 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**MAN774 PERTURBATION METHODS**

This unit includes: regular and singular perturbation expansions; asymptotic expansions, strained coordinates; boundary layer analysis and matched asymptotic expansions; selected examples from industrial applications and mathematics applied in medicine and biology.

**Prerequisites:** (MAN413 or MAB413) and (MAN521 or MAB521)  
**Credit points:** 12  
**Contact hours:** 3 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**MAN775 STATISTICAL MODELLING OF FINANCIAL PROCESSES**

Postgraduate students pursuing a career in finance will find that financial modelling is a major area of application of mathematics and statistics. In fact, its models and methods, which draw on recent developments in diverse areas of mathematical sciences such as stochastic analysis, partial differential equations and probability theory, provide needed tools for quantitative modelling and financial analysis. In fact, its fundamental principles enhance a general education for life. This unit is one of a suite of units in statistics and operations research/Decision Science, which will equip you with essential skills for pursuing a career in business and finance.

**Prerequisites:** MAB524 and MAN536  
**Credit points:** 12  
**Contact hours:** 3 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**MAN777 MATHEMATICS OF FLUID FLOW**

The mathematics of fluid flow involves solving ordinary and partial differential equations arising as simplifications of the Navier-Stokes equations. Approximation techniques for flows in thin layers are also considered as well as approximations of flows of low and high viscosity. Questions addressed include: why a spinning cricket ball swerves in the air; how much does a blockage in an artery or vein increase the pressure; and why is there no solution for flow past a cylinder for zero Reynolds number.

**Prerequisites:** MAN613 or MAB613  
**Credit points:** 12  
**Contact hours:** 3 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**MAN778 APPLICATIONS OF DISCRETE MATHEMATICS**

This unit has two main areas of study. One is the application of graph theory to a number of practical problems including trees and shortest path algorithms. The other area is advanced number theory and includes the topics of divisibility, congruence, multiplicative functions, primitive roots, quadratic residues and applications to cryptology including the RSA algorithm.

**Prerequisites:** MAN461 or MAB621  
**Credit points:** 12  
**Contact hours:** 3 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1