Bachelor of Mathematics (MA54)

Year offered: 2011
Admissions: Yes
CRICOS code: 049433D
Course duration (full-time): 3 Years
Course duration (part-time): 6 Years
Domestic Fees (indicative): 2011: CSP $2,178 (indicative) per semester
International Fees (indicative): 2011: $11,375 (indicative) per semester
Domestic Entry: February and July
International Entry: February and July
QTAC code: 418701
Past rank cut-off: 81
Past OP cut-off: 10
OP Guarantee: Yes
Assumed knowledge: English (4, SA) and Maths B (4, SA)
Preparatory studies: For information on acquiring assumed knowledge visit http://www.qut.edu.au/assumed-knowledge

Overview
Mathematical sciences provide powerful tools for analysis of today’s complex world and give an insight into many real-world problems of significant importance. Mathematics and statistics graduates use their analytical and problem-solving skills in a vast array of roles and settings.

Mathematicians and statisticians can develop new financial products in the banking industry, optimise transportation schedules in today’s busy world, or help understand customer value in the commercial world. Mathematicians can aid scientific research by data mining to discover genetic links and pathways or help to understand disease transmission of a pandemic. Computer simulation and visualisation techniques can be used in many research projects including bone fracture and wound healing, and modelling saltwater intrusion in coastal systems. Mathematicians play integral roles in the workplace, where they develop mathematical models and numerical algorithms to answer what-if scenarios, and design experiments to help guide research and improve processes.

Why Choose This Course
The course’s flexible structure allows you to choose to study only mathematics units, or include some units from another area of interest, such as science, business or information technology. You will be able to design a program to suit your interests and career aspirations by combining advanced units from a number of mathematical specialisations.

Financial Support
You should consider applying for an industry-sponsored mathematics bursary to help you financially throughout your studies. For further information visit scholarships.

Your Course
Year 1
You will study core units in mathematics and statistics. These core units include studies in calculus, algebra, vectors and matrices, computational mathematics, data analysis and statistical modelling.

Year 2
You will build on your core studies by advancing to more specialised topics such as advanced calculus, linear algebra, differential equations, operations research, data visualisation, statistics or modelling. Your practical assignments will tackle problems faced in the real world. You can choose to study only mathematics units or include units from another area of interest, such as science, business, information technology or a language.

Year 3
Refine your studies by combining advanced units from the following specialisations:
• applied mathematics: using mathematical techniques to solve real-world problems
• computational mathematics: using computers and numerical techniques to find solutions to complex problems which cannot be solved analytically
• discrete mathematics: the mathematics of numbers, including sets, fields, rings and groups which is used extensively in information security
• financial mathematics: applying a wide variety of mathematical techniques for use in a range of financial areas
• mathematical modelling: using mathematical techniques to develop a model or explanation of a real-world problem which can then be tested
• operations research: optimising complex systems including queuing, scheduling or allocation of resources
• scientific computation and visualisation: large-scale scientific modelling and creating graphical representations using visualisation techniques
• statistics: collecting data in an appropriate format, experimental design, analysis of data and using data to make predictions
• statistical modelling: building and analysing models of systems involving probability and variables.

Limits on grades of 3
A new policy concerning grades of 3 came into effect from 1 January 2009 (QUT MOPP C/5.2). With effect from this date grades of 3 are no longer considered a conceded or low pass but are classified as a fail grade. Any grades of 3 awarded prior to 1 January 2009 retain the conceded pass status and will be counted for graduation purposes up to the maximum number of grades of 3 permitted for your course. Grades of 3 incurred in units that commence after 1 January 2009 will not count towards your degree. Further information is available on the Student Services website.

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

Course Coordinator
Dr Glenn Fulford
Phone: +61 7 3138 5196
Email: sms.ma54coord@qut.edu.au

Course structure - Bachelor of Mathematics

Students complete at least 192 credit points (16 twelve credit point units) of Mathematics units according to the following requirements:

Level 1 Mathematics Units

Students must complete the following Level 1 Mathematics units:

- MAB101 Statistical Data Analysis 1
- MAB120 Algebra and Calculus
- MAB121 Calculus and Differential Equations
- MAB122 Algebra and Analytic Geometry
- MAB210 Statistical Modelling 1
- MAB220 Computational Mathematics 1

Note: MAB120 is for students who do not have an exit assessment of at least Sound Achievement in four semesters of both Senior Mathematics B and Senior Mathematics C. Students with at least Sound Achievement in both Mathematics B and C (or equivalent) may select a level 2 Mathematics unit instead of MAB120.

Level 2 and 3 Mathematics Units

At least 120 credit points (10 twelve credit point units) must be taken from Level 2 and Level 3 Mathematics units with at least 48 credit points (4 twelve credit point units) from Level 3.

mathematics units

Students must complete:

- MAB311 Advanced Calculus
- MAB312 Linear Algebra

Other Units - Complementary Studies

Up to a maximum of 96 credit points may be taken as electives with not more than 48 credit points from first level units.

Suggested Program for February Entry

STUDENTS WITH AN EXIT ASSESSMENT OF AT LEAST SOUND ACHIEVEMENT IN BOTH SENIOR MATHEMATICS B AND SENIOR MATHEMATICS C (OR EQUIVALENT)

Year 1, Semester 1

- MAB101 Statistical Data Analysis 1
- MAB121 Calculus and Differential Equations
- MAB122 Algebra and Analytic Geometry

ONE additional unit from:

- BSB110 Accounting
- MAB220 Computational Mathematics 1
- SCB110 Science Concepts and Global Systems

Other first level unit (see below and later in document for other suggestions)

Year 1, Semester 2

- MAB210 Statistical Modelling 1

THREE additional units from:

- MAB220 Computational Mathematics 1
- MAB281 Mathematics for Computer Graphics
- MAB313 Mathematics of Finance
- MAB422 Mathematical Modelling
- MAB480 Introduction to Scientific Computation
- BSB113 Economics
- PQB250 Mechanics and Electromagnetism
- PQB251 Waves and Optics
- SCB111 Chemistry 1
- SCB112 Cellular Basis of Life

Other first level elective units (see later in document for other suggestions)

PLEASE NOTE: MAB220 is a compulsory unit. In this instance, it appears as optional in either
Year 2, Semester 1

MAB311 Advanced Calculus
MAB312 Linear Algebra
TWO additional units from mathematics units or elective units

Year 2, Semester 2

FOUR units from mathematics units or elective units (see course structure)

Year 3, Semester 1

FOUR units from mathematics units or elective units (see course structure)

Year 3, Semester 2

FOUR units from mathematics units or elective units (see course structure)

Mathematics Units

Students should not enrol in Mathematics units other than those listed below:

Level 1 Mathematics Units

MAB101 Statistical Data Analysis 1
MAB120 Algebra and Calculus

TWO additional units from:

BSB110 Accounting
BSB113 Economics
SCB110 Science Concepts and Global Systems
SCB111 Chemistry 1
SCB112 Cellular Basis of Life
Other first level elective unit (see later in document for other suggestions)

Level 2 Mathematics Units

MAB311 Advanced Calculus
MAB312 Linear Algebra
MAB313 Mathematics of Finance
MAB314 Statistical Modelling 1
MAB210 Statistical Modelling 1
MAB220 Computational Mathematics 1

Level 3 Mathematics Units

MAB521 Applied Mathematics 3
MAB522 Computational Mathematics 3
MAB524 Statistical Inference
MAB525 Operations Research 3A
MAB533 Statistical Techniques
MAB536 Time Series Analysis
MAB613 Partial Differential Equations
MAB623 Financial Mathematics
MAB624 Applied Statistics 3
MAB625 Operations Research 3B
MAB640 Industry Project
MAB672 Advanced Mathematical Modelling
MAB681 Advanced Visualisation and Data Analysis (Future offering expected after 2011.)

Other Units
Up to a maximum of 96 credit points (8 twelve credit point units) can be taken from other units, with not more than 48 credit points (4 twelve credit point units) from first level units. A first level unit is classified as a unit that is normally taken in the first year of a single degree.

OTHER UNIT - FIRST LEVEL: This unit can only be taken in MA54 after recommendation from the Course Coordinator. This unit cannot be included in the minimum of 16 mathematics units required for the course.

MAB105 Preparatory Mathematics

OTHER UNIT - ADVANCED LEVEL: This unit cannot be included in the minimum of 16 mathematics units required for the course, but can be counted as an elective.

MAB281 Mathematics for Computer Graphics

Potential Careers:
Actuary, Computer Game Programmer, Market Research Manager, Mathematician, Quantitative Analyst, Statistician.

UNIT SYNOPSES

BSB110 ACCOUNTING
Accounting data is the basis for decision making in any organisation. Accordingly, the aim of this unit is to provide students with a basic level of knowledge of modern financial and managerial accounting theory and practice so that they can understand how accounting data is used to help make decisions in organisations. The unit covers financial procedures and reporting for business entities, analysis and interpretation of financial statements and planning, control and business decision making.

Assumed knowledge: Year 10 Level 6 Mathematics is assumed knowledge
Credit points: 12
Contact hours: 3 per week
Campus: Gardens Point and Caboolture
Teaching period: 2011 SEM-1, 2011 SEM-2 and 2011 SUM

MAB113 ECONOMICS
This unit introduces students to the key economic concepts and their practical applications. It comprises twelve topics each focusing on a current economic issue. Microeconomic topics include demand and supply, elasticity, production and cost theory and market structure. Macroeconomic topics include measuring GDP, inflation and unemployment, money and banking, and fiscal and monetary policy.

Assumed knowledge: Grade of at least Sound on Senior Mathematics B (or equivalent) or MAB105
Credit points: 12
Contact hours: 3 per week
Campus: Gardens Point and Caboolture
Teaching period: 2011 SEM-1, 2011 SEM-2 and 2011 SUM

MAB101 STATISTICAL DATA ANALYSIS 1
Experiments, observational studies, sampling, and polls; data and variables; framework for describing and manipulating probability; independence; Binomial and Normal distributions; population parameters and sample statistics; concepts of estimation and inference; standard error; confidence intervals for means and proportions; tests of hypotheses on means and proportions (one sample and two independent samples); inference using tables of counts; modelling relationships using regression analysis; model diagnosis; use of statistical software.

Assumed knowledge: Grade of at least Sound Achievement in Senior Mathematics B (or equivalent) or MAB105
Credit points: 12
Contact hours: 4 per week
Campus: Gardens Point

MAB105 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.

Assumed knowledge: A Year 10 Level 6 Mathematics is assumed knowledge
Credit points: 12
Contact hours: 3 per week
Campus: Gardens Point

MAB120 ALGEBRA AND CALCULUS
This unit introduces and reviews the elementary concepts of function, calculus, matrices and vectors with special reference to applications in science, technology and business where appropriate. Topics covered include the
algebra of complex numbers, elementary functions (polynomial, trigonometric, exponential and logarithmic) and their properties, differentiation and integration methods and principles, geometric and algebraic applications of vectors and the solution of linear systems using matrices.

**Antirequisites:** MAN120  **Assumed knowledge:** Grade of at least Sound Achievement in Senior Mathematics B (or equivalent) or MAB105 is assumed knowledge

**Equivalents:** MAB100, MAB125, MAB180  **Credit points:** 12  **Contact hours:** 4 per week  **Campus:** Gardens Point  **Teaching period:** 2011 SEM-1, 2011 SEM-2 and 2011 SUM

**MAB121 CALCULUS AND DIFFERENTIAL EQUATIONS**

Building upon the foundations established in MAB120 or Senior Maths C, this unit addresses the significant role of mathematical modelling using differential equations for the description and resolution of simple and complex problems relevant to real world situations. 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 ordinary differential equations used to model real world problems. You will also gain a deeper understanding of the concepts of the derivative and the integral, and how these may be used in applied contexts.

**Antirequisites:** MAN121  **Assumed knowledge:** Grade of at least Sound Achievement in Senior Mathematics C (or equivalent) or MAB120 or MAB100 or MAB125  **Equivalents:** MAB111, MAB126, MAB131, MAB182  **Credit points:** 12  **Contact hours:** 4 per week  **Campus:** Gardens Point  **Teaching period:** 2011 SEM-1, 2011 SEM-2 and 2011 SUM

**MAB122 ALGEBRA AND ANALYTIC GEOMETRY**

Building upon the foundations established in MAB120 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.  

**Assumed knowledge:** Grade of at least Sound Achievement in Senior Mathematics C (or equivalent) or MAB120 or MAB100 or MAB125  

**Equivalents:** MAB112, MAB127, MAB132  

**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1, 2011 SEM-2 and 2011 SUM

**MAB210 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:** MAN210  
**Assumed knowledge:** Grade of 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

**MAB220 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 the advanced units in computational mathematics.

**Antirequisites:** MAN220  
**Assumed knowledge:** Grade of at least Sound Achievement in Senior Mathematics C (or equivalent) or MAB105 and corequisite MAB120 or MAB125 or MAB100 or MAB180 if you don’t have Senior Mathematics C, this unit addresses the significant role of computational mathematics.  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1 and 2011 SEM-2

**MAB281 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 geometrical 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
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 is assumed knowledge.  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**MAB311 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.  
**Prerequisites:** (MAB111 or MAB121) and (MAB112 or MAB122)  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**MAB312 LINEAR ALGEBRA**  
This unit covers the following broad topics from linear algebra: matrix analysis; eigenvalues and eigenvectors; vector spaces; inner product spaces.  
**Prerequisites:** (MAB111 or MAB121) and (MAB112 or MAB122)  
**Antirequisites:** MAN312  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**MAB313 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 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 (which can be concurrently enrolled)  
**Antirequisites:** MAN313  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**MAB314 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.  
**Prerequisites:** MAB112 and MAB210  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

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

**MAB413 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 studies of differential equations in first year and provides a framework for studying partial differential equations and other aspects of applied mathematics in later semesters.  
**Prerequisites:** MAB311 or MAB312  
**Antirequisites:** MAN413  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**MAB414 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:** MAB101  
**Assumed knowledge:** MAB112 is recommended prior study  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**MAB420 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:** MAB220 and MAB312  
**Antirequisites:** MAN420  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**MAB422 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:** MAB121  
**Antirequisites:** MAN422  
**Assumed knowledge:** MAB220 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

**MAB461 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 second level 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:** MAB112 or MAB122  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**MAB480 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  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**MAB521 APPLIED MATHEMATICS 3**

This unit includes: 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:** MAB311  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**MAB522 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:** MAB311 and MAB420  
**Antirequisites:** MAN522  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**MAB524 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.

**Prerequisites:** MAB314  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**MAB525 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  
**Antirequisites:** MAN525  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**MAB533 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: MAB210 and MAB414  Antirequisites: MAB523  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-1

MAB536 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 an economy. This unit is concerned with the building of time series models and the use of such models for practical applications such as optimal forecasting, simulation, causality analysis, and analysis of dynamic systems.

Prerequisites: MAB314 and MAB414  Antirequisites: MAN536, MAB528  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-2

MAB613 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 that any practising mathematician 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: MAB311 and MAB413  Antirequisites: MAN613  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-2

MAB623 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: MAB313 and MAB311  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-2

MAB624 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 aims to build on the introductory experimental design and statistical analysis methods presented to you in Applied Statistics 2 in order to introduce modern statistical methods. Additionally, the use of statistical software to carry out analyses and the reporting of conclusions are emphasised.

Prerequisites: MAB414  Antirequisites: MAN624  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-2

MAB625 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: MAB315  Equivalents: MAN625  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-2

MAB640 INDUSTRY PROJECT
In a holistic and systematic approach to problem solving, it is important that you learn to apply analytical methods and quantitative techniques encountered in a classroom environment to real world issues in industry. The aim of this unit is to allow you to utilise your knowledge of problem solving procedures and develop your communication and interactive skills by completing a specified project in industry under controlled supervision, providing a summary of your findings in a seminar and presenting a formally written detailed report.

Other requisites: Unit coordinator approval is required to
enrol    Credit points: 24    Campus: Gardens Point    Teaching period: 2011 SEM-1 and 2011 SEM-2

MAB672 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; bungee 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: MAB422    Antirequisites: MAN672
Assumed knowledge: MAB311. Also recommend: MAB413
Credit points: 12    Contact hours: 4 per week    Campus: Gardens Point    Teaching period: 2011 SEM-1

SCB10 SCIENCE CONCEPTS AND GLOBAL SYSTEMS
You will undertake interdisciplinary study of the physical, geological and biological concepts relating to the origins of life; from the creation of matter and planets, to the emergence of life in all its complexity, culminating in evolution of earth ecosystems. Human influences, overlaid upon earth’s complex systems, will be examined as to their type, extent, and impact. In counterpoint, you will explore the breadth of philosophical developments underlying our search for knowledge; fundamental thoughts and ideas that span the last 2,500 years of human history. Ultimately, these concepts evolved through the development of a scientific method and we explore its workings in relation to the ongoing enterprise of human understanding.
Credit points: 12    Contact hours: 4.5 per week    Campus: Gardens Point    Teaching period: 2011 SEM-1

SCB111 CHEMISTRY 1
Chemistry is the central science. It affects society as well as the individual. It is the language and principal tool of the physical sciences, the biological sciences, the health sciences and the agricultural and earth sciences. A basic knowledge of chemistry is essential to all students in these areas. Knowledge of chemistry allows a better understanding of the human body and of the environment in which we live. The aim of this unit is to introduce you to the basic concepts of general, inorganic, analytical and physical chemistry.
Antirequisites: SCB113    Credit points: 12    Contact hours: 4.5 per week    Campus: Gardens Point    Teaching period: 2011 SEM-1 and 2011 SEM-2

SCB112 CELLULAR BASIS OF LIFE
Scientists from all disciplines need an appreciation and a broad overview of the characteristics and functioning of the five groups of living organisms (bacteria, protists, fungi, plants and animals), and their interactions with the inanimate world. SCB112 Cellular Basis of Life is a first semester unit that is essential for many students undertaking courses requiring biological knowledge. Through integrated lecture and laboratory classes, this unit provides you with a foundation for later more advanced studies in your course or major (eg such as medical science, biomedical science, pharmacy, optometry, biochemistry, biotechnology, microbiology, geosciences, ecology, business and education among others). The aim of this unit is to introduce you to the wide diversity of living organisms while emphasising the unity of life processes at the cellular, biochemical and biophysical levels.
Antirequisites: LQB182, LSB118    Credit points: 12    Contact hours: 4 per week    Campus: Gardens Point

PQB250 MECHANICS AND ELECTROMAGNETISM
The experimental means by which we have arrived at our modern understanding of the universe is central to the scientific philosophy. Students of physics and physics related areas need to possess skills in quantitative handling, processing, communication and evaluation of data. Higher level studies in specialised areas of Physics require a familiarity with a range of fundamental topics in Physics and an ability to apply critical thinking and advanced mathematical techniques to the analysis and solution of Physical problems. This first-level unit lays the foundation for these higher level studies by introducing the fundamental topic areas of mechanics and electromagnetism.
Assumed knowledge: Senior Maths B is assumed knowledge.
Credit points: 12    Contact hours: 4.5 hours per week    Campus: Gardens Point    Teaching period: 2011 SEM-2

PQB251 WAVES AND OPTICS
Wave phenomena are used to describe and explain many of the physical processes in the universe. Sound and light are the most commonly experienced of these and have far-reaching human applications, including their use as experimental tools for science. The study of wave phenomena has led to the development of quantum mechanics, a cornerstone of modern scientific thought. This first-level unit lays the foundation for discussion of wave phenomena in higher level studies, but will also be relevant to those not considering progressing to a Physics major but wishing to understand more of the Physical world in which we live.
Assumed knowledge: Senior Maths B is assumed knowledge.
Credit points: 12    Contact hours: 4.5 hours per week    Campus: Gardens Point    Teaching period: 2011 SEM-2
Teaching period: 2011 SEM-1 and 2011 SEM-2