Bachelor of Applied Science (Honours) (SC60)

Year offered: 2010
Admissions: Yes
CRICOS code: 009041G
Course duration (full-time): 1 Year
Course duration (part-time): 2 Years
Domestic fees (indicative): 2010: CSP $2,150 (indicative) per semester
International Fees (indicative): 2010: $12,000 (indicative) per semester
Domestic Entry: February and July
International Entry: February and July
Total credit points: 96
Standard credit points per full-time semester: 48
Course coordinator: Associate Professor Peter Mather
Discipline coordinator: Dr John Bartley (Chemistry Major); Dr David Hurwood (Ecology Major); Associate Professor Peter Mather (Environmental Science Major); Dr Gregg Webb (Geology Major); Associate Professor Terry Walsh (Life Science Major); Dr Troy Farrell (Mathematics Major); Dr Esa Jaatinen (Physics Major)
Campus: Gardens Point

Career Outcomes
The Bachelor of Applied Science (Honours) program is designed for graduates who have excelled in their degree from a recognised tertiary institution, with major studies in a relevant discipline. The course not only enhances your professional employability in your chosen discipline but also prepares you for a research career. The Honours qualification opens a direct pathway to postgraduate studies, qualifying you for entry into Doctor of Philosophy and Master of Applied Science courses.

Entry Requirements
To be eligible for admission, you should have completed QUT's Bachelor of Applied Science or equivalent and should have attained a grade point average (GPA) of at least 5 (on a 7-point scale), including grades of at least 5 in all units directly relevant to the proposed Honours program. Application for admission should normally be made at the end of the pass degree, or within 18 months of completing that degree.

If you do not satisfy the above conditions but who have demonstrated outstanding performance in only the final year of a degree, or your application is based on other factors including work experience or involvement in research, you may be admitted at the discretion of the Executive Dean of Faculty.

Please note that for the Mathematics major, other degrees with major studies in Mathematics (including Statistics) may provide suitable entry to the program.

Course Structure
The Honours year comprises coursework and a major research project supervised by QUT staff, in some cases in conjunction with local industry. Majors are offered in Chemistry, Ecology, Environmental Science, Geology, Life Science, Mathematics and Physics.

Professional Recognition
Relevant scientific professional bodies include Australasian Association of Clinical Biochemists, Australasian Institute of Mining and Metallurgy, AusBiotech Ltd, Australian Institute of Geoscientists, Australian Institute of Physics, Australian Mathematical Society, Australian Society for Biochemistry and Molecular Biology, Australian Society for Medical Research, Australian Society for Microbiology, Australian Society for Operations Research, Ecological Society of Australia, Geological Society of Australia, Royal Australian Chemical Institute, and Statistical Society of Australia. Eligibility for membership is based on the combination of units undertaken in the degree and the Bachelor of Applied Science course that underpins it.

Further Information
Course Coordinator
Associate Professor Peter Mather
Phone: +61 7 3138 1737
Email: p.mather@qut.edu.au

Discipline Coordinators
Chemistry
Dr John Bartley
Phone: +61 7 3138 2266
Email: j.bartley@qut.edu.au

Ecology
Dr David Hurwood
Phone: +61 7 3138 5072
Email: d.hurwood@qut.edu.au

Environmental Science
Associate Professor Peter Mather
Phone: +61 7 3138 1737
Email: p.mather@qut.edu.au

Geology
Dr Gregg Webb
Phone: +61 7 3138 2804
Email: ge.webb@qut.edu.au
Course structure - Major in Chemistry

Year 1, Semester 1
PCB700-1 Research Project
PCB700-2 Research Project
PCB742 Elective Unit
PCB780-1 Advanced Topics in Chemistry 1

Year 1, Semester 2
PCB700-3 Research Project
PCB700-4 Research Project
PCB700-5 Research Project
PCB780-2 Advanced Topics in Chemistry 1

NOTE: Students wishing to apply for entry into BAppSc(Hons) should consult with the contact person for the relevant science discipline before applying (see contact details link above).

Course structure - Major in Mathematics

Year 1, Semester 1
MAN787-1 Project
  36 credit points of elective units selected from the list below*

Year 1, Semester 2
MAN787-2 Project
MAN787-3 Project
  24 credit points of elective units selected from the list below*

Elective List (Mathematics) - 60 credit points to be selected
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

NOTE: Students wishing to apply for entry into BAppSc(Hons) should consult with the contact person for the relevant science discipline before applying (see contact details link above).
Up to 12 credit points from the following lists can be included in the 60 credit points of electives:

- MAB522 Computational Mathematics 3
- MAB524 Statistical Inference
- MAB613 Partial Differential Equations
- MAB672 Advanced Mathematical Modelling
- MAN536 Time Series Analysis

Up to two units of a quantitative nature from another Faculty or School may be included with the permission of the Mathematics Coordinator. The unit(s) must be of honours level and relevant to the proposed program. Examples of suitable units are:

- EFN505 Financial Risk Management
- PCB706 Quantum Mechanics

* The Course Coordinator may approve a student taking 24 credit points of elective units (together with MAN787-1 and MAN787-2) in Semester 1 and 36 credit points of elective units (together with MAN787-3) in Semester 2.

NOTE: Students wishing to apply for entry to BAppSc(Hons) should consult with the contact person for the relevant science discipline before applying (see contact details link above).

**UNIT SYNOPSIS**

**EFN505 FINANCIAL RISK MANAGEMENT**
The unit covers the main areas of modern risk management. The focus is on measuring and managing risks in financial institutions. Particular attention is paid to developing understanding of the analytical techniques employed in the construction of hedging strategies and the interrelations between the main areas of risk management. The unit emphasises empirical applications and assessment of risk management techniques. Topics covered include the current state of prudential regulation of financial institutions, measurement and management of market risks, hedging strategies with derivatives and managing interest rate and exchange rate risks.

**Prerequisites:** EFN415  
**Credit points:** 12  
**Contact hours:** 3 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1 and 2010 SEM-2

**LSB850 RESEARCH STRATEGIES**
This unit is conducted over two semesters (full-time) and is the formal class component of the SC60 B. App. Sci (Hons) degree, comprising weekly lectures, a student seminar, and internal and external research seminar attendance.

**Corequisites:** LSB851-1, LSB852-1  
**Credit points:** 6  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1
and 2010 SEM-2

**LSB850 RESEARCH STRATEGIES**
This unit is conducted over two semesters (full-time) and is the formal class component of the SC60 B App. Sci (Hons) degree, comprising weekly lectures, a student seminar, and internal and external research seminar attendance.

**Corequisites:** LSB851-2, LSB852-2  **Credit points:** 6
**Campus:** Gardens Point  **Teaching period:** 2010 SEM-1 and 2010 SEM-2

**LSB851 READINGS IN LIFE SCIENCE 1**
This unit involves the preparation of a literature review of direct and associated relevance to the Honours research project under the guidance of the supervisor(s). This is presented as a grant proposal demonstrating a considerable knowledge, understanding and appreciation of the literature as well as a critical appraisal of future research requirements.

**Corequisites:** LSB850-1, LSB852-1  **Credit points:** 12
**Campus:** Gardens Point  **Teaching period:** 2010 SEM-1 and 2010 SEM-2

**LSB852 PROJECT**
This unit runs over two semesters (full-time) and is the core component of the SC60 BAppSc (Hons) degree, comprising the laboratory research project of the course and its reporting in written and oral formats.

**Corequisites:** LSB850-1  **Credit points:** 30  **Campus:** Gardens Point  **Teaching period:** 2010 SEM-1 and 2010 SEM-2

**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:** 2010 SEM-1

**MAB613 PARTIAL DIFFERENTIAL EQUATIONS**
This unit runs over two semesters (full-time) and is the core component of the SC60 BAppSc (Hons) degree, comprising the laboratory research project of the course and its reporting in written and oral formats.

**Corequisites:** LSB850-1, LSB852-1  **Credit points:** 12
**Campus:** Gardens Point  **Teaching period:** 2010 SEM-1 and 2010 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; 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:** MAB422 and MAB312  **Antirequisites:** MAN613  **Credit points:** 12  **Contact hours:** 4 per week  **Campus:** Gardens Point  **Teaching period:** 2010 SEM-2

**MAN536 TIME SERIES ANALYSIS**
The following core content will be covered: fundamentals of time series analysis; time series models; nonstationary processes; seasonal ARIMA models; vector autoregression; long-range dependence and fractional ARIMA models; co-integration of nonstationary processes. The computer package S-Plus will be used to implement and simulate the models and techniques developed throughout the unit.
Prerequisites: MAB314 and MAB414 Antirequisites: MAB536, MAN526 Credit points: 12 Campus: Gardens Point Teaching period: 2010 SEM-2

MAN717 MINOR PROJECT
This project may be related to that undertaken in MAN700 or in MAN787 or in a separate area. It must be self-contained and is assessed separately. 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 Campus: Gardens Point Teaching period: 2010 SEM-2, 2010 SEM-2 and 2010 SUM

MAN761 ANALYSIS
This unit includes: convergence in R; uniform convergence; Lebesgue integral; convergence theorems; Lp-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 Contact hours: 3 per week Campus: Gardens Point Teaching period: 2010 SEM-2

MAN764 APPLIED MATHEMATICAL MODELLING
This unit enables students to develop and practice mathematical modelling skills by considering topical problems from current research activities and beyond the discipline of mathematics. Some of the problems considered include the dispersion of a pollutant in a river, waves of pursuit and evasion, Turing mechanisms and the generation of spatial patterns in biological or biochemical systems. A notable emphasis of this unit is the collaborative development of mathematical models for novel problems. Prerequisites: MAB613 and MAB672 Credit points: 12 Contact hours: 3 per week Campus: Gardens Point Teaching period: 2010 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 Contact hours: 3 per week Campus: Gardens Point Teaching period: 2010 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 Contact hours: 3 per week Campus: Gardens Point Teaching period: 2010 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: 2010 SEM-1

MAN769 MATHEMATICS OF FINANCE
This unit introduces you to some modern tools of mathematical finance. It follows a basic and intuitive approach to understand the concepts of bond futures, mathematical modelling skills by considering topical problems from current research activities and beyond the discipline of mathematics. Some of the problems considered include the dispersion of a pollutant in a river, waves of pursuit and evasion, Turing mechanisms and the generation of spatial patterns in biological or biochemical systems. A notable emphasis of this unit is the collaborative development of mathematical models for novel problems. Prerequisites: MAB613 and MAB672 Credit points: 12 Contact hours: 3 per week Campus: Gardens Point Teaching period: 2010 SEM-2

MAN771 COMPUTATIONAL MATHEMATICS 4
Topics selected from: conservation equations for fluid motion; boundary and initial conditions; finite difference methods for diffusion equations (difference formulae, consistency, order, stability, convergence); finite volume methods (application to diffusion equations; cell-centred and vertex centred schemes); solution of advection-diffusion equations (monotonicity, stability, TVD schemes, upwinding, flux limiting); numerical optimisation (line search, trust region methods; Steepest descent, Newton, Quasi-Newton, Conjugate Gradients; constrained optimisation; KKT conditions; active set methods, penalty functions; specially structured problems; nonlinear least squares; quadratic programmes; the augmented Lagrangian; sequential quadratic programming algorithms). Prerequisites: MAB522 and MAB613 Credit points: 12 Contact hours: 3 per week Campus: Gardens Point Teaching period: 2010 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: 2010 SEM-1

MAN775 STATISTICAL MODELLING OF FINANCIAL PROCESSES
This unit includes the following: Wiener process; martingales; Markov processes; stochastic integrals and stochastic calculus; equivalent martingale measure; stochastic differential equations (SDE); the martingale-SDE approach to option pricing; replicating portfolio: statistical estimation of stochastic volatility via ARCH/GARCH-type models; quasi-likelihood estimation of long-range dependence and non-Gaussianity in financial processes.
Prerequisites: MAB524 and MAN536 Credit points: 12 Contact hours: 3 per week Campus: Gardens Point Teaching period: 2010 SEM-1 and 2010 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: 2010 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: 2010 SEM-1

MAN787 PROJECT
This project is research-based and involves writing a thesis and giving an oral presentation. Permission to enrol in this unit must be obtained from the Course Coordinator.

Credit points: 12 Campus: Gardens Point Teaching period: 2010 SEM-1, 2010 SEM-2 and 2010 SUM

MAN787 PROJECT
This project is research-based and involves writing a thesis and giving an oral presentation. Permission to enrol in this unit must be obtained from the Course Coordinator.
Credit points: 12 Campus: Gardens Point Teaching period: 2010 SEM-1, 2010 SEM-2 and 2010 SUM

NBR720 PROJECT
This unit is a substantial project in the appropriate area of science undertaken in conjunction with a supervisor and through interaction with lecturing and technical staff of the School of Natural Resource Sciences. The unit provides the opportunity for students to identify and solve scientific problems logically and creatively. Students are required to relate the project research to published work in the field of study. Each project is assessed on the basis of an extensive written report and a formal seminar or scientific poster. (60 credit points achieved at completion of NRB720-1, NRB720-2, NRB720-3, NRB720-4 and NRB720-5.)
Credit points: 12 Campus: Gardens Point Teaching period: 2010 SEM-1 and 2010 SEM-2

NBR720 PROJECT
This unit is a substantial project in the appropriate area of science undertaken in conjunction with a supervisor and through interaction with lecturing and technical staff of the School of Natural Resource Sciences. The unit provides the opportunity for students to identify and solve scientific problems logically and creatively. Students are required to relate the project research to published work in the field of study. Each project is assessed on the basis of an extensive written report and a formal seminar or scientific poster. (60 credit points achieved at completion of NRB720-1, NRB720-2, NRB720-3, NRB720-4 and NRB720-5.)
Credit points: 12 Campus: Gardens Point Teaching period: 2010 SEM-1 and 2010 SEM-2

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Credit points: 12 Campus: Gardens Point Teaching period: 2010 SEM-1 and 2010 SEM-2

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Credit points: 12 Campus: Gardens Point Teaching period: 2010 SEM-1 and 2010 SEM-2
study. Each project is assessed on the basis of an extensive written report and a formal seminar or scientific poster. (60 credit points achieved at completion of NRB720-1, NRB720-2, NRB720-3, NRB720-4 and NRB720-5.)

**Credit points:** 12  **Campus:** Gardens Point  **Teaching period:** 2010 SEM-1 and 2010 SEM-2

**NRB720 PROJECT**
This unit is a substantial project in the appropriate area of science undertaken in conjunction with a supervisor and through interaction with lecturing and technical staff of the School of Natural Resource Sciences. The unit provides the opportunity for students to identify and solve scientific problems logically and creatively. Students are required to relate the project research to published work in the field of study. Each project is assessed on the basis of an extensive written report and a formal seminar or scientific poster. (60 credit points achieved at completion of NRB720-1, NRB720-2, NRB720-3, NRB720-4 and NRB720-5.)

**Credit points:** 12  **Campus:** Gardens Point  **Teaching period:** 2010 SEM-1 and 2010 SEM-2

**NRB730 RESEARCH METHODS AND STRATEGIES**
This is a two semester unit with its main focus to develop the research planning, abilities and skills of the student. The major assessable components are a literature review, seminars, informal presentations and discussions on subjects relevant to the research topic, and advanced skills workshops and exercises. (24 credit points achieved at completion of NRB730-1 and NRB730-2.)

**Credit points:** 12  **Campus:** Gardens Point  **Teaching period:** 2010 SEM-1 and 2010 SEM-2

**NRB735 ADVANCED STUDIES IN RESOURCE SCIENCES**
This unit provides an in-depth examination of a topic or synthesis of a subject through lectures, tutorials, discussions, independent study, practicals and/or field excursion. This unit has general structure, which can be developed to the specific requirements of each section of the school. An important aim is to develop inquiring and analytical thought at an advanced level. The unit may be conducted in the first part of semester 1, or could be conducted over two semesters.

**Credit points:** 12  **Campus:** Gardens Point  **Teaching period:** 2010 SEM-1 and 2010 SEM-2

**PCB700 RESEARCH PROJECT**
Students undertaking Honours are required to select and undertake, in consultation with a supervisor, a substantial project in an appropriate area. Each project is assessed on the basis of an extensive written report and an oral presentation. (60 credit points achieved at completion of PCB700-1, PCB700-2, PCB700-3, PCB700-4 and PCB700-5.)

**Credit points:** 12  **Campus:** Gardens Point  **Teaching period:** 2010 SEM-1 and 2010 SEM-2

**PCB700 RESEARCH PROJECT**
Students undertaking Honours are required to select and undertake, in consultation with a supervisor, a substantial project in an appropriate area. Each project is assessed on the basis of an extensive written report and an oral presentation. (60 credit points achieved at completion of PCB700-1, PCB700-2, PCB700-3, PCB700-4 and PCB700-5.)

**Credit points:** 12  **Campus:** Gardens Point  **Teaching period:** 2010 SEM-1 and 2010 SEM-2

**PCB700 RESEARCH PROJECT**
Students undertaking Honours are required to select and undertake, in consultation with a supervisor, a substantial project in an appropriate area. Each project is assessed on
the basis of an extensive written report and an oral presentation. (60 credit points achieved at completion of PCB700-1, PCB700-2, PCB700-3, PCB700-4 and PCB700-5.)

Credit points: 12  Campus: Gardens Point  Teaching period: 2010 SEM-1 and 2010 SEM-2

PCB700 RESEARCH PROJECT

Students undertaking Honours are required to select and undertake, in consultation with a supervisor, a substantial project in an appropriate area. Each project is assessed on the basis of an extensive written report and an oral presentation. (60 credit points achieved at completion of PCB700-1, PCB700-2, PCB700-3, PCB700-4 and PCB700-5.)

Credit points: 12  Campus: Gardens Point  Teaching period: 2010 SEM-1 and 2010 SEM-2

PCB706 QUANTUM MECHANICS

Review of operators and their role in quantum mechanics, different representations, Dirac notations and linear vector space, matrix approach to quantum mechanics, eigenvalues and eigenvectors, unitary transformations, R- and P-representations, tensor product of states, six postulates of quantum mechanics, concept of measurements, quantum entanglement, density matrix, general theory of angular momentum, quantum oscillator, two-level systems, non-relativistic theory of spin, spinors, theory of scattering, Born approximation, perturbation theory.

Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2010 SEM-1

PCB708 ADVANCED TOPICS IN PHYSICS

No more than three topics are included. The content is determined by current research advances, availability of appropriate staff, visiting academics, etc and may vary from year to year.

Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2010 SEM-1 and 2010 SEM-2

PCB742 ELECTIVE UNIT

The subjects are chosen to suit individual students but the topics studied would normally be in specific areas of physical chemistry, analytical chemistry, inorganic chemistry or organic chemistry and would be chosen from subjects presently offered in the masters program or other post graduate programs. Relevant material from other accredited courses may be included as part or all of the requirement for this subject as directed by the Course Coordinator and Head of School.

Credit points: 12  Campus: Gardens Point  Teaching period: 2010 SEM-1 and 2010 SEM-2

PCB780 ADVANCED TOPICS IN CHEMISTRY 1

This is the second semester component of a two-semester unit covering a selection of advanced topics in the areas of physical, organic and inorganic chemistry. The topics offered reflect the expertise of the academic staff as well as the needs of the students. (24 credit points achieved at completion of PCB780-1 and PCB780-2.)

Credit points: 12  Contact hours: 6 per week  Campus: Gardens Point  Teaching period: 2010 SEM-2

PCB780 ADVANCED TOPICS IN CHEMISTRY 1

This is the first semester component of a two-semester unit covering a selection of advanced topics in the areas of physical, organic and inorganic chemistry. The topics offered reflect the expertise of the academic staff as well as the needs of the students. (24 credit points achieved at completion of PCB780-1 and PCB780-2.)

Credit points: 12  Contact hours: 6 per week  Campus: Gardens Point  Teaching period: 2010 SEM-1

PCN716 ADVANCED TOPICS IN PHYSICS 2

This unit provides a focused theoretical foundation for each students research program or other advanced topics in physics and develops a high level of theoretical understanding of the physical principles involved.

Credit points: 12  Campus: Gardens Point  Teaching period: 2010 SEM-1 and 2010 SEM-2