Bachelor of Applied Science (Chemistry) (SC01)

Year offered: 2011
Admissions: Yes
CRICOS code: 003502J
Course duration (full-time): 3 Years
Course duration (part-time): 6 Years
Domestic Fees (indicative): 2011: CSP $2,178 per semester (indicative)
International Fees (indicative): 2011: $12,250 (indicative) per semester
Domestic Entry: February and July
International Entry: February and July* (Conditions apply for July entry)
QTAC code: 418011
Past rank cut-off: 77
Past OP cut-off: 12
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
Total credit points: 288
Standard credit points per full-time semester: 48
Standard credit points per part-time semester: 24
Course coordinator: Dr Marion Bateson
Discipline coordinator: Dr Dennis Arnold
Campus: Gardens Point

Career Outcomes
Among a diverse range of employment opportunities, you may become an industrial chemist, materials scientist, environmental chemist, quality control analyst, laboratory supervisor, food chemistry, or an organic/inorganic chemist. Your interactions with QUT experts in current fields of interest including drug development, clay and minerals chemistry, renewable energy sources, nanotechnology, environmental monitoring, and applications of modern analytical instrumentation may lead to careers in these areas.

QUT graduates are sought after by police and other forensics laboratories because of their extensive practical training using modern analytical instrumentation.

With the addition of a postgraduate diploma in education, you may wish to pursue opportunities in the teaching profession.

Professional Recognition
Graduates completing the chemistry major with the chemistry for industry second major or forensic science major are eligible for membership of the Royal Australian Chemical Insitute (RACI).

Recommended Study
At least one of the sciences.

Chemistry Full-time Course Structure: First Semester Entry

Year 1, Semester 1
SCB110 Science Concepts and Global Systems
SCB111 Chemistry 1
SCB112 Cellular Basis of Life
   Plus ONE of:
   MAB101 Statistical Data Analysis 1
   MAB105 Preparatory Mathematics
   MAB120 Algebra and Calculus
   MAB121 Calculus and Differential Equations

NOTE:
1. Students without a Sound Achievement (4 semesters) in Maths A should enrol in MAB105.
2. Students with a Sound Achievement in Maths B and NOT wishing to major in Physics should enrol in MAB101.
3. Students with a Sound Achievement in Maths C and wishing to major in Physics should enrol in MAB121.
4. Students without a Sound Achievement in Maths B or Maths A should consult with the course coordinator.

Year 1, Semester 2 (Chemistry Pre-Major Strand)
SCB121 Chemistry 2
SCB123 Physical Science Applications
SCB131 Experimental Chemistry
   Plus either
   MAB120 Algebra and Calculus
   Or
SCB122 Cell and Molecular Biology
   Note: MAB120 is the preferred option for the Chemistry major. Only students taking Forensic Science, Microbiology, Biochemistry or Biotechnology as a second major should select SCB122 Cell and Molecular Biology

Year 2, Semester 1
PQB312 Analytical Chemistry For Scientists and
Technologists

PQB331  Structure and Bonding
Plus TWO other units selected according to the second major requirements

Year 2, Semester 2 *

PQB401  Reaction Kinetics, Thermodynamics and Mechanisms
PQB442  Chemical Spectroscopy
Plus TWO other units selected according to the second major requirements

Year 3, Semester 1 *

PQB502  Advanced Physical Chemistry
PQB531  Organic Mechanisms and Synthesis
Plus TWO other units selected according to the second major requirements

Year 3, Semester 2 *

PQB631  Advanced Inorganic Chemistry
PQB642  Chemical Research
Plus TWO other units selected according to the second major requirements

Recommended Second Majors:
Biochemistry, Biotechnology, Chemistry for Industry, Forensic Science

* Elective Unit for all Majors except Forensic Science:

SCB500  Industry Project

NOTE: SCB500 Industry Project is a unit that will be offered as an elective in all majors. This unit requires 84 credit points of Level 2 and/or 3 Science units, so it may only be taken at the completion of Year 2 in Summer or during Year 3.

Chemistry Full-time Course Structure: Mid-Year Entry

Mid-Year (July) Entry

FOR DOMESTIC STUDENTS: Due to the careful construction of scientific knowledge demanded in the SC01 degree, mid-year entry requires some compromises. There are two ways to construct a mid-year program:

1. Take foundation units and their follow-up units together, rather than in sequence. This will be very challenging, but will allow you to start second year units at the start of the next year. Please contact either the course coordinator or the discipline coordinator to devise a suitable program of study. Please note: as this option usually involves taking units from different levels concurrently, which may not timetable appropriately, in some cases it may not be possible to complete within the standard time frame.

2. Take three units per semester for the first three semesters, adding one semester to your degree completion time. This allows you to do your first year units in the correct sequence, at a slightly more leisurely pace, while still being officially a full-time student. You may enrol in a fourth unit (level 2 unit from your chosen major) provided you have the necessary pre-requisites. This is the recommended option.

FOR INTERNATIONAL STUDENTS: Mid-year entry is only available under certain circumstances. Please contact the Course Coordinator to discuss available midyear entry and advance standing options on a case by case basis.

Year 1, semester commencing July

SCB111  Chemistry 1
SCB112  Cellular Basis of Life
Plus either
MAB101  Statistical Data Analysis 1
Or
MAB105  Preparatory Mathematics

Year 2, semester commencing February

MAB120  Algebra and Calculus
SCB110  Science Concepts and Global Systems
SCB121  Chemistry 2

Year 2, semester commencing July

SCB123  Physical Science Applications
SCB131  Experimental Chemistry
Plus either
MAB101  Statistical Data Analysis 1
Or
Elective

Chemistry Part-time Course Structure

Students interested in undertaking this major part-time should consult the discipline coordinator.

UNIT SYNOPSES
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.
Antirequisites: BSB123, EFB101, MAB141, MAN101, MAB233
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

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. This unit is incompatible with a grade of High Achievement in Senior Mathematics B. The aim of this unit is 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.
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

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

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

PQB312 ANALYTICAL CHEMISTRY FOR SCIENTISTS AND TECHNOLOGISTS
This unit addresses three vital theoretical and practical elements of analytical chemistry: quality assurance in a chemical laboratory; principles of chemical sampling; common instrumental techniques. It is a generic unit designed to address the needs and skills of students enrolled in the Chemistry major as well as other majors such as Forensic Science and double degrees in with the Chemistry major. The unit builds on the analytical chemistry concepts introduced in SCB131 Experimental Chemistry. The aim of this unit is to provide students with principles of analytical chemistry, including some common instrumental techniques, which are firmly linked to the theory and practice of the discipline in a modern, working laboratory.
Prerequisites: SCB131
Equivalents: PCB414
Credit points: 12
Contact hours: 4.5 per week
Campus: Gardens Point
Teaching period: 2011 SEM-1 and 2011 SEM-2

PQB331 STRUCTURE AND BONDING
This unit provides detailed coverage of the theories of bonding in organic, inorganic and coordination compounds including orbital hybridisation valence bond theory, coordination theory and crystal field theory. The cause and effect relationships between bonding and structure are developed leading to an understanding of structural variability, chirality, and other modes of isomerism for a broad range of chemical compounds. An introduction to molecular symmetry, which is central to the study of molecular geometry and shape, also provides the
background for later studies in spectroscopy. Lectures are complemented by 7 laboratory experiments and 4 hands-on style workshops.

**Prerequisites:** SCB121 and SCB131  
**Antirequisites:** PCB334, PCB354  
**Credit points:** 12  
**Contact hours:** 4.5 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**PQB401 REACTION KINETICS, THERMODYNAMICS AND MECHANISMS**

Physical Chemistry is a discipline of chemistry in which the influences of physical factors on chemical reactions are described and quantified. The fundamental factors that govern the extents (equilibria) and rates (kinetics) of chemical reactions are usually the realm of Physical Chemistry. This unit illustrates this basic science with applications of these principles to actual reaction types that are expounded as case studies of the principles underlying the Chemistry. In addition, all students of chemistry need an understanding of the concepts of acids and bases in their widest sense. This unit provides the tools that chemists use to understand how and why molecules react. The aim of this unit is to demonstrate how reactions and their equilibria and rates can be described and quantified, and to understand by studying key examples, the fundamental factors that govern the outcomes of chemical reactions.

**Prerequisites:** PQB331  
**Antirequisites:** PCB354, PCB405  
**Credit points:** 12  
**Contact hours:** 4.5 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**PQB442 CHEMICAL SPECTROSCOPY**

Spectroscopic techniques are now widespread in scientific laboratories. An appreciation of both the principles and practice of spectroscopy is essential for those contemplating a career in chemistry. The use of spectroscopic methods to elucidate molecular structure provides an excellent vehicle for training in the scientific method, particularly the logical application of experimental data to deduce the solution to a complex problem. Whilst the fundamental theoretical concepts will be dealt with in the early part of the unit, later emphasis will be on developing practical skills in problem solving, a skill of value to all fields of scientific and technological endeavour.

**Prerequisites:** PQB331  
**Equivalents:** PCB444  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**PQB502 ADVANCED PHYSICAL CHEMISTRY**

A Chemistry graduate in today's highly technological world requires knowledge of the principles that govern the behaviour of solids, liquids, gases, and mixtures thereof. This leads to an appreciation of how fundamental physical chemical principles determine the bulk properties of materials and how the chemical nature of interfaces govern chemical reactions in many important applications. This unit is placed appropriately in fifth semester, following the second year units that provide the basic principles, language and tools of chemistry.

**Prerequisites:** PQB401  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**PQB531 ORGANIC MECHANISMS AND SYNTHESIS**

This unit deals with organic reaction mechanisms and their application in organic synthesis. Topics in mechanisms include: structural and electronic effects that govern reactivity of organic molecules; major classes of mechanisms including elimination reactions, nucleophilic additions to carbonyl compounds, nucleophilic acyl substitution, electrophilic addition to alkenes and electrophilic substitution of aromatics. Topics in synthesis include the principles of organic synthesis design using the retrosynthetic approach; carbon-carbon bond formation to build the major functional group classes; and the use of protecting and activating groups.

**Prerequisites:** PQB401, PQB442  
**Antirequisites:** PCB554  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**PQB631 ADVANCED INORGANIC CHEMISTRY**

Major topics covered are as follows: organometallic chemistry, including metal-carbon bonding, main group and transition metal organometallics and applications of organometallic compounds in synthetic chemistry; bioinorganic chemistry; physical methods of structure determination, such as single crystal X-ray diffraction; chemical applications of group theory.

**Prerequisites:** PQB331  
**Equivalents:** PCB634  
**Credit points:** 12  
**Contact hours:** 4.5 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**PQB642 CHEMICAL RESEARCH**

This unit addresses a selection of topics in advanced chemistry from a range of evolving areas of relevance in modern chemistry and chemical technology such as nanotechnology, drug design, free-radical chemistry and trace metal speciation in environmental and biological systems. It includes the important issue of the societal and ethical implications of the profession of chemistry.

**Prerequisites:** 4 Advanced Level Chemistry units  
**Assumed knowledge:** Completion of any advanced Chemistry units is assumed knowledge  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**SCB110 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  **Teaching period:** 2011 SEM-1 and 2011 SEM-2

**SCB121 CHEMISTRY 2**

Chemistry is the central science. This is a unit of fundamental importance as it covers the background and general principles that underpin understanding in many science and health related disciplines. In this unit you will be introduced to fundamental aspects of chemistry including the nature of matter, atoms, molecules and ions. From this basis you will develop an understanding of the electronic structure of atoms, chemical bonding and molecular structure as well as the fundamentals of organic chemistry (often described as the chemistry of life). The aims of this unit are to generate an understanding of the importance of chemical bonding and molecular structure and how these factors effect the properties of organic and bioinorganic molecules; and to allow recognition of, and provide an understanding of, the nature of organic functional groups and their respective reactivity.

**Prerequisites:** (SCB111 or PCB142). SCB111 can be studied in the same teaching period  **Antirequisites:** PQB105 and SCB113  **Credit points:** 12  **Contact hours:** 4.5 per week  **Campus:** Gardens Point  **Teaching period:** 2011 SEM-1 and 2011 SEM-2

**SCB122 CELL AND MOLECULAR BIOLOGY**

SCB122 Cell and Molecular Biology 1 equips students with a comprehensive understanding the molecular basis of the cell. This unit expands on the basic principles and concepts relating to cell structure, function, perpetuation and specialisation introduced in SCB112 and introduces students to fundamental molecular mechanisms central to the organisation of the cell. Students will be shown how macromolecular interactions are crucial to information flow and heredity. Students are taught the relationships between chromosomes, genes and cellular function and ultimately how these may determine an organism's phenotype. This unit underpins cell biology and molecular biology units that are offered in second year Life Science units. SCB122 is also ideal for interfaculty students (eg Education, Business, Arts) who will undertake no further life science studies.

**Prerequisites:** SCB112. SCB112 can be studied in the same teaching period  **Antirequisites:** LSB238  **Credit points:** 12  **Contact hours:** 4.5 per week  **Campus:** Gardens Point  **Teaching period:** 2011 SEM-2

**SCB123 PHYSICAL SCIENCE APPLICATIONS**

Physics principles underpin all of the sciences and 'new technologies'. This unit adopts an investigative team-based approach to provide students with an appreciation of fundamental concepts in physical science, together with experience in the application of these concepts to a range of 'real world' problems. The unit should be taken in the first year of study as the fundamental principles introduced here will be built upon in later units in the context of each science student's major discipline area. Employers in cutting-edge industries expect science graduates to have effective strategies for problem solving, skills for collaborative work and scientific communication and research skills. This unit aims to develop these skills by applying the fundamental concepts of physical science to problems in a team environment.
Credit points: 12  Contact hours: 4.5 per week  
Campus: Gardens Point  Teaching period: 2011 SEM-2

**SCB131 EXPERIMENTAL CHEMISTRY**

Chemistry is the central science. A detailed study of chemistry and related disciplines requires the development of practical laboratory skills for synthesis and chemical analysis. This unit is designed specifically to develop these aspects of chemistry. This unit is a laboratory-based unit which is designed for students who intend to continue with experimental science units. The lectures complement the weekly practical sessions and teach the theory required to interpret experimental results. The aim of this unit is to develop a broad knowledge of, and the practical skills required for, scientific experiments in chemistry. The skills acquired in this unit are transferable to other practical sciences including medical science, biochemistry, molecular biology and pharmacy.

**Prerequisites:** SCB113 or PQB105 or (SCB111 and SCB121). SCB121 can be concurrently enrolled with SCB131

Credit points: 12  Campus: Gardens Point  Teaching period: 2011 SEM-2

**SCB500 INDUSTRY PROJECT**

In this unit students will apply scientific methods and quantitative techniques to real work issues. Students will develop an appropriate plan for analysing and resolving an industry issue under the guidance of both a QUT supervisor and an associate supervisor from an industry partner. At the end of the unit students will present both an oral seminar and a written report.

Credit points: 12  Contact hours: 52  Campus: Gardens Point  Teaching period: 2011 SEM-1, 2011 SEM-2 and 2011 SUM