Bachelor of Technology Innovation (Chemistry) (ST50)

Year offered: 2010
Admissions: Yes
CRICOS code: 070694G
Course duration (full-time): 4 years
Domestic fees (indicative): 2010: CSP $2,125 (indicative) per semester
International Fees (indicative): 2010: $11,750 (indicative) per semester
Domestic Entry: February
International Entry: February and July
Past rank cut-off: 77
Past OP cut-off: 12
Assumed knowledge: English (4, SA) and Maths B (4, SA)
Preparatory studies: For information on acquiring assumed knowledge visit http://www.studentservices.qut.edu.au/apply/ug/info/knowledge.jsp
Total credit points: 384
Standard credit points per full-time semester: 96
Course coordinator: Associate Professor Chris Collet
Campus: Gardens Point

Overview
Chemistry is the study of the structure, properties, synthesis and reactions of materials. Chemistry is one of the central sciences since its results are used in almost all areas of science including life sciences, the environment, geosciences, biology, and food science.

Career Outcomes
Graduates can build careers in the world of commercialisation and technology transfer of research innovation and complex emerging technologies pertaining to their specific discipline and beyond. Graduates could pursue careers in all aspects of the new product development continuum including business development officers, venture capital associates, investment analysts, commercialisation managers, technology transfer officers, intellectual property analysts, policy development officers and, of course, research scientists.

Chemistry Major Course Structure

Year 1 Semester 1
SCB110 Science Concepts and Global Systems
SCB111 Chemistry 1
SCB112 Cellular Basis of Life
MAB101 Statistical Data Analysis 1
MAB105 Preparatory Mathematics
MAB120 Algebra and Calculus

SCB121 Chemical Analysis 2
SCB123 Physical Science Applications
SCB124 Cell and Molecular Biology

Year 2 Semester 1
PQB312 Analytical Chemistry For Scientists and Technologists
PQB331 Structure and Bonding
PQB333 Advanced Organic Chemistry
PQB334 Spectroscopy
PQB341 Physical Analysis
PQB342 Chemical Spectroscopy
PQB351 Chemistry for Industry
PQB352 NMR Spectroscopy

Year 2 Semester 2
PQB401 Reaction Kinetics, Thermodynamics and Mechanisms
PQB421 Physical Analysis
PQB422 Chemical Spectroscopy

Year 3 Semester 1
MAB121 Calculus and Differential Equations

NOTE: Students with a Sound Achievement in Maths B and NOT wishing to major in Mathematics or Physics should enrol in MAB101

Students without a Sound Achievement (4 semesters) in Maths B should enrol in MAB105

Students with a Sound Achievement in Maths C and wishing to major in Mathematics or Physics should enrol in MAB121

Students without a Sound Achievement in Maths C and wishing to major in Mathematics or Physics should enrol in MAB120

Year 1 Semester 2
SCB121 Chemistry 2
SCB123 Physical Science Applications
SCB124 Cell and Molecular Biology

Year 2 Semester 1
PQB313 Analytical Chemistry For Industry
PQB351 Chemistry for Industry
PQB352 NMR Spectroscopy

Year 2 Semester 2
PQB404 Nanotechnology and Nanoscience
PQB423 Process Principles

Year 3 Semester 1
The unit acknowledges that organisations exist in an increasingly international environment where the emphasis will be on knowledge, the ability to learn, to change and to innovate. Organisations are viewed from individual, group, corporate and external environmental perspectives.

**Antirequisites:** BSB115  **Equivalents:** CTB115  **Credit points:** 12  **Contact hours:** 3 per week  **Campus:** Gardens Point and Caboolture  **Teaching period:** 2010 SEM-1, 2010 SEM-2 and 2010 SUM

**BSB126 MARKETING**

This introductory subject examines the role and importance of marketing to the contemporary organisation. Emphasis is placed on understanding the basic principles and practices of marketing such as the marketing concept, market segmentation, management information systems and consumer behaviour. The unit explores the various elements of the marketing mix, with special reference to product, price, distribution, and promotion, including advertising and public relations. By way of introduction only, key issues relating to services marketing, e-marketing and strategic marketing are also canvassed.

**Antirequisites:** BSB116  **Equivalents:** CTB126  **Credit points:** 12  **Contact hours:** 4 per week  **Campus:** Gardens Point and Caboolture  **Teaching period:** 2010 SEM-1, 2010 SEM-2 and 2010 SUM

**AMBU40 MARKETING PLANNING AND MANAGEMENT**

This unit extends the student’s knowledge of the fundamental marketing concepts and theories introduced in the Faculty Core unit in Marketing, by adding further breadth and depth of knowledge of marketing and developing skills in the application of this knowledge to marketing planning and management within the business environment. Emphasis is on the role of the marketing manager at the product management level in undertaking analysis, planning, implementation and control of marketing activities.

**Prerequisites:** BSB126 or CTB126  **Equivalents:** CTB240  **Credit points:** 12  **Contact hours:** 3 per week  **Campus:** Gardens Point and Caboolture  **Teaching period:** 2010 SEM-1 and 2010 SEM-2

**BSB115 MANAGEMENT**

The unit provides an introduction to the theories and practice of management and organisations. Emphasis is on the conceptual and people skills that are needed in all areas of management and in all areas of organisational life. The

**AMBU40 INNOVATION COMMERCIALISATION STRATEGIES**

Students study strategies and approaches used in industry and government organisations for the research, development and commercialisation of biotechnology innovations. The unit offers the opportunity to read widely as well as in depth about the commercialisation of molecular biology and biotechnology research. Theoretical concepts are integrated with prepared case studies prior to guest speaker seminars.

**Prerequisites:** BSB310 or MGB223  **Credit points:** 12  **Contact hours:** 3 per week  **Campus:** Gardens Point  **Teaching period:** 2010 SEM-2

**LWS007 INTRODUCTION TO INTELLECTUAL PROPERTY LAW**

Intellectual property protection is undoubtedly of paramount importance in the research, development and commercialisation of emerging technologies. Managers and researchers need to be aware of the different types of property that can be protected and how the property needs to be protected. There have also been significant developments in the field of intellectual property law in recent years. The concepts taught in Introduction to Intellectual Property Law are of significant relevance to persons intending to practice in the emerging fields of science.

**Credit points:** 12  **Contact hours:** 3 per week  **Campus:** Gardens Point

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**UNIT SYNOPSISES**

**AMBU40 MARKETING PLANNING AND MANAGEMENT**

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**Prerequisites:** BSB126 or CTB126  **Equivalents:** CTB240  **Credit points:** 12  **Contact hours:** 3 per week  **Campus:** Gardens Point and Caboolture  **Teaching period:** 2010 SEM-1 and 2010 SEM-2

**BSB115 MANAGEMENT**

The unit provides an introduction to the theories and practice of management and organisations. Emphasis is on the conceptual and people skills that are needed in all areas of management and in all areas of organisational life. The
Gardens Point  Teaching period: 2010 SEM-1

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 is assumed knowledge.
Credit points: 12
Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2010 SUM-2, 2010 SEM-1 and 2010 SEM-2

MAB105 PREPARATORY MATHEMATICS
This unit is a substitute for Senior Mathematics B for those students who need the equivalent background for the successful study of units which assume it. It includes: basic number facts, natural numbers, integers, rational numbers, real numbers and their operations; basic algebra; functions and equations, graphs, linear functions, equations and applications; systems of linear equations; quadratic, exponential, logarithmic and trigonometric functions, properties and applications; introduction to calculus; rates of change, derivatives, rules of differentiation, second derivatives, maxima and minima and applications; integration and applications. This unit is incompatible with an exit assessment of High Achievement or better in Senior Mathematics B.

Assumed knowledge: Year 10 Level 6 Mathematics is assumed knowledge
Credit points: 12
Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2010 SEM-1 and 2010 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.

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: 2010 SEM-1, 2010 SEM-2 and 2010 SUM

MAB121 CALCULUS AND DIFFERENTIAL EQUATIONS
This unit extends the areas of function and calculus introduced in MAB120 by introducing series representations for functions and more advanced methods of differentiation and integration for functions of one variable. A strong connection to real world problems is made by introducing the use of differential equations in modelling, and exploring appropriate methods of solution. Practical calculations of volumes and surface areas of solids of revolution extend your interpretations of the definite integral. Taylor and Fourier series are introduced as a means of approximating functions by sums of polynomials and periodic functions. Some more advanced methods for indefinite integrals, such as partial fraction decomposition, are also introduced.

Assumed knowledge: Grade of at least Sound Achievement in Senior Mathematics C (or equivalent) or MAB125 or MAB180 or MAB120 is assumed knowledge
Credit points: 12
Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2010 SUM-2, 2010 SEM-1 and 2010 SUM

MGB223 ENTREPRENEURSHIP AND INNOVATION
This unit introduces students to the nature and characteristics of entrepreneurship and innovation and explores the inter-relationship between the two within contemporary economies from managerial perspective. Learning will be directed towards developing the theoretical and applied knowledge, skills, and attitudes that will support and enhance innovation and enterprise creation activity, through the development of a business plan. The unit is designed for those individuals interested in creating a new venture or working in industries as employees of venture owners or those that serve this sector. Students will have opportunity to build a comprehensive plan of their business concept.

Prerequisites: BSB115 or CTB115  Credit points: 12
Contact hours: 3 per week  Campus: Gardens Point and Caboolture  Teaching period: 2010 SEM-1 and 2010 SEM-2

MGB225 INTERCULTURAL COMMUNICATION AND NEGOTIATION SKILLS
The course develops students' abilities to identify and resolve problems in cross-cultural communication or negotiation situations where cultural differences have created misunderstandings or undesirable or unexpected outcomes. It first explores the concept of 'national culture' by considering the work of major theorists of cultural value dimensions - from Hall to Schwartz. Students are encouraged to analyse communication/negotiation process issues in terms of these value dimensions and to practise...
managing the process of communication/negotiation to improve their outcomes.

**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:** 2010 SEM-1

**PQB312 ANALYTICAL CHEMISTRY FOR SCIENTISTS AND TECHNOLOGISTS**
Reliable chemical analysis and testing is fundamental to the functioning of our society. This generic unit is designed for future scientists and technologists in the fields of chemistry, forensic science and other similar sciences. It introduces students to concepts of quality assurance, good laboratory practice and the vital instrumental areas of analysis – chromatography and spectroscopy. Laboratory work is a key extensive activity in this unit.

**Prerequisites:** SCB131    **Equivalents:** PCB414    **Credit points:** 12    **Contact hours:** 4.5 per week    **Campus:** Gardens Point    **Teaching period:** 2010 SEM-1 and 2010 SEM-2

**PQB313 ANALYTICAL CHEMISTRY FOR INDUSTRY**
A modern chemist working in industry requires a thorough understanding of the fundamentals of analytical chemistry on which applications in sophisticated, state-of-the-art instrumental methods are based. This unit provides students with a grounding in the classical qualitative and quantitative gravimetric and wet analysis, together with common spectrophotometric and electrochemical methods of analysis. Through the practical program in this unit, students will be able to learn the connections between the theoretical aspects of analytical chemistry and the work in the laboratory. The chemistry behind some applications of these methods is also discussed, eg water, fertilisers, foods, minerals, metals, etc.

**Prerequisites:** SCB131    **Equivalents:** PCB314    **Credit points:** 12    **Contact hours:** 4.5 per week    **Campus:** Gardens Point    **Teaching period:** 2010 SEM-1

**PQB404 NANOTECHNOLOGY AND NANOSCIENCE**
Nanotechnology is the science of constructing molecular-scale devices and of their applications. Like biotechnology, it is a growth industry and has the potential to significantly affect our lives and the world in which we live. Nanotechnology is truly interdisciplinary, it draws on the strengths of all the basic sciences. The lecture component of the unit will comprise an introduction to the field of Nanotechnology and Nanoscience, with a bias towards Chemical Technology applications derived from the Physical Sciences. The laboratory component will focus on the techniques currently used to characterise and manipulate nanoscale material and the construction of functional devices from nanoscale, molecule components.

**Prerequisites:** SCB111 and SCB121    **Equivalents:** PCB445    **Credit points:** 12    **Contact hours:** 4 per week    **Campus:** Gardens Point    **Teaching period:** 2010 SEM-2
PQB423 PROCESS PRINCIPLES
This unit will provide students with an understanding of the fundamentals of mass and energy balances around a system whether that system be a piece of laboratory equipment, an individual industrial operation, a combination of industrial operations, or a natural phenomenon. It will also assist students to develop generic skills in reporting and oral presentation through an individual investigation of a global mass or energy balance.

Prerequisites: SCB131  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2010 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: 2010 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.

Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2010 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: 2010 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: 5 per week  Campus: Gardens Point  Teaching period: 2010 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: 2010 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 counterpart, 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: 2010 SEM-1

SCB111 CHEMISTRY 1
This unit covers the fundamentals of general and physical chemistry. Topics include atomic and molecular structure, introduction to chemical bonding, reaction stoichiometry,
thermochemistry, gas phase chemistry, reaction kinetics, equilibrium, acids, bases, buffers, oxidation, reduction and electrochemistry. The practical program involves experiments illustrating a range of chemical reaction types including precipitation reactions, acid-base chemistry and redox chemistry using analytical experimental methods. A comprehensive tutorial program (CHELP) complements the lectures and is designed to assist students to develop the problem solving skills required for further study in chemistry and related sciences.

**Antirequisites:** SCB113  
**Credit points:** 12  
**Contact hours:** 4.5 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1 and 2010 SEM-2

**SCB112 CELLULAR BASIS OF LIFE**

A study of life processes in all five groups of living organisms (bacteria, protists, fungi, plants and animals). Traditional topics in biology are integrated with recent research advances in molecular and cellular biology to provide a comprehensive foundation for later units in the medical, biotechnological and ecological sciences. The unit begins by constructing cells from the four quantitatively important groups of biological molecules (proteins, lipids, carbohydrates and nucleic acids). Molecular and evolutionary aspects of genetics are then introduced, with the great diversity of reproductive strategies found among organisms being emphasised. Finally, bioenergetics (photosynthesis and respiration) and its relevance to environmental issues is outlined.

**Antirequisites:** LSB118  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1 and 2010 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, particularly in regards to the chemistry of life. In this unit students will be introduced to fundamental aspects of chemistry including the electronic structure of atoms, chemical bonding and molecular structure. From this basis students will develop an understanding of the fundamentals of organic chemistry including chirality, functional groups and organic reactions which will lead to important bio-inorganic molecules and coordination complexes.

**Prerequisites:** (SCB111 or PCB142)  
**Antirequisites:** SCB113  
**Credit points:** 12  
**Contact hours:** 4.5 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1 and 2010 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.

**Antirequisites:** LSB238  
**Credit points:** 12  
**Contact hours:** 4.5 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 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:** 2010 SEM-2

**SCB131 EXPERIMENTAL CHEMISTRY**

A study of chemistry and related disciplines such as medical science, biochemistry, molecular biology and pharmacy requires the development of practical laboratory skills used in synthesis and chemical analysis. 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.

**Prerequisites:** SCB111 or SCB113  
**Corequisites:** SCB121 unless SCB113 has been successfully completed  
**Credit points:** 12  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-2