Unit sets: Physical and Chemical Sciences

Year offered: 2010
Admissions: Yes

Unit sets
These unit sets have been designed such that introductory units have no prerequisites. Later units in each set may have earlier units as prerequisites.

Due to timetabling constraints it may not be possible to complete all units in a University Wide Elective Set.

Consult with your course coordinator and relevant discipline coordinators prior to undertaking interfaculty studies.

Please be aware that the units you complete in a University Wide Elective Sets will appear on your academic transcript but the unit set title will not unless the set exists as a minor in your course.

Applied Physics unit set
Select FOUR units from the following:

PCB150 Physics 1H
PQB250 Mechanics and Electromagnetism
PQB251 Waves and Optics
PQB360 Global Energy Balance and Climate Change
PQB404 Nanotechnology and Nanoscience
PQB451 Electronics and Instrumentation
PQB460 Astrophysics 1
PQB661 Lasers and Photonics

Astrophysics unit set

PCB593 Digital Image Processing
Or
PQB360 Global Energy Balance and Climate Change
Plus select THREE units from the following:

NQB201 Planet Earth
PCB150 Physics 1H
PQB250 Mechanics and Electromagnetism
PQB460 Astrophysics 1
SCB222 Exploration of the Universe

Industrial Chemistry unit set

Select FOUR units from the following:

PQB312 Analytical Chemistry For Scientists and Technologists
PQB423 Process Principles
PQB513 Instrumental Analysis
PQB584 Forensic Physical Evidence
SCB111 Chemistry 1
SCB121 Chemistry 2
SCB131 Experimental Chemistry
SCB384 Forensic Sciences - From Crime Scene to Court

Lighting Design unit set

PCB121 Vision, Colour and Photometry
PCB122 Lighting Design
PCB123 Sustainability and Human Factors
PCB124 Lamps and Luminaires

UNIT SYNOPSES

NQB201 PLANET EARTH
Earth Science impacts every aspect of modern life. Hence, the concepts of Earth Science are fundamental not only to the field of Geology, but also to Environmental Science, natural resource management, civil engineering and society at large. Planet Earth provides an introduction to Earth Science, including earth materials, geologic history, geological process at the Earth’s surface, and the complex interplay between the lithosphere, atmosphere, hydrosphere and biosphere through geologic time. Thus, Planet Earth is a foundation unit for further studies in Geology and Environmental Science and also serves as a broad introduction to the world we live on.

Equivalents: NRB230 Credit points: 12 Contact
hours: 4 per week    Campus: Gardens Point    Teaching period: 2010 SEM-2

**PCB121 VISION, COLOUR AND PHOTOMETRY**
This is the first unit in the Minor in Lighting and introduces the student to the nature of light, vision and the scientific interpretation and quantification of colour. Importantly the student learns the terminology used to describe and quantify different lighting situations; the meaning of luminance and illuminance, intensity and luminous flux, and the relationship between these parameters. The unit includes a significant proportion of practical work where students learn how to measure light and the above concepts are reinforced in practical situations.
Credit points: 12    Contact hours: 40    Campus: Gardens Point    Teaching period: 2010 SEM-2

**PCB122 LIGHTING DESIGN**
The third unit in the Minor in Lighting looks at the principles of basic lighting design, determining the choice, number and location of lamps to achieve a particular result, and the factors that are involved in making these choices. Students will be introduced to Australian Standards for lighting in various situations and the need to ensure that these levels are reached. User-friendly lighting design programs will be available for assignments and lighting design will include commercial indoor lighting, public lighting and entertainment lighting.
Credit points: 12    Contact hours: 40    Campus: Gardens Point    Teaching period: 2010 SEM-1

**PCB123 SUSTAINABILITY AND HUMAN FACTORS**
The last unit in the Minor in Lighting looks at the human factors involved in lighting; the factors such as glare and contrast that determine whether or not we like a particular lit environment, what looks good and what doesn’t. This unit also includes the principles and practices of daylighting and lighting controls, and touches on environmental and sustainability issues.
Credit points: 12    Contact hours: 40    Campus: Gardens Point    Teaching period: 2010 SEM-1

**PCB124 LAMPS AND LUMINAIRES**
This unit introduces the student to the vast range of different lamp sources available today, including incandescent, discharge lamps and LEDs, explaining the important characteristics of each and hence providing an understanding of their different applications. The student is introduced to the concept of colour Rendering and Colour temperature of lamps. The unit also includes a look at the design of reflectors and refractors within the luminaire. The lecture material is supported by a number of practical experiments.
Credit points: 12    Contact hours: 40    Campus: Gardens Point    Teaching period: 2010 SEM-2

**PCB150 PHYSICS 1H**
This unit introduces basic physical measurements, mechanics, heat, waves, acoustics and optics, and the instrumentation used to measure physical parameters.
Credit points: 12    Contact hours: 5 per week    Campus: Gardens Point    Teaching period: 2010 SEM-1 and 2010 SEM-2

**PCB593 DIGITAL IMAGE PROCESSING**
This unit provides students with a basic understanding of the computer techniques used in image processing and reconstruction. Specific areas of study include the following: the structure of a digital image; image display techniques; grey scale palettes and look-up tables; Fourier transform theory; convolution theory; image processing hardware; image processing techniques, eg analysis, enhancement and restoration; spatial filtering; Fourier space filtering; methods of image reconstruction; 3D volume and surface rendering; applications of image processing in medicine, astronomy and remote sensing, etc.
Prerequisites: PCB375-2 or PCB496 or PQB250
Credit points: 12    Contact hours: 4 per week    Campus: Gardens Point    Teaching period: 2010 SEM-1

**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: 2010 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: 2010 SEM-2

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

PQB360 GLOBAL ENERGY BALANCE AND CLIMATE CHANGE
Modern societies are becoming increasingly aware of potential environmental problems associated with conventional energy production technologies. Application of alternative technologies is therefore increasing, with ambitious targets and plans to support research and development for reducing energy related environmental consequences. This unit is designed to offer science and engineering students an opportunity to gain awareness about the expanding field of alternative energy technologies and to understand relationships between use of energy and its impact on local and global environment.
Prerequisites: MAB111 or MAB131  Equivalents: PCB563  Credit points: 12  Contact hours: 4 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

PQB451 ELECTRONICS AND INSTRUMENTATION
Instrumentation plays an increasingly important role in the life of a scientist. This unit is designed to give the student a working knowledge in instrumentations and the principles of circuit theory and electronics that underlie instrumentation. It is offered at this stage of the program since it relies on work developed in the earlier advanced-level units and provides a basis for experimental work in later units.
Prerequisites: PCB525 or PCB250  PCB361, PCB460  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2010 SEM-2

PQB460 ASTROPHYSICS 1
This second level unit is one of the key units in the astrophysics co-major and introduces students to most of the main aspects of astrophysics. This unit is essential as it defines the connections between the supporting units of the co-major. Students are required to use the knowledge and skills developed in first level physics, maths and natural resource units.
Prerequisites: PCB136 or PCB250 or SCB123  Equivalents: PCB469  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2010 SEM-2

PQB513 INSTRUMENTAL ANALYSIS
TBA
Prerequisites: PQB312 or PCB414  Equivalents: PQB514  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2010 SEM-1

PQB525 UNIT OPERATIONS
Having gained an understanding of mass and energy balances in PQB423 you will be able to appreciate the principles underlying the design and operation of the many individual processes, or unit operations, that together make up a large part of any full-scale industrial process. It is vital that Chemists involved in Chemical Technology understand how unit operations work so that they can interact effectively with unit operators and process engineers. An additional
role of this unit is to build a knowledge base for the subsequent development of generic skills in Chemical Technology through a problem-solving exercise involving an authentic industrial process in PQB623.

**Prerequisites:** PQB423  
**Equivalents:** PCB524  
**Credit points:** 12  
**Contact hours:** 4.5 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1

**PQB584 FORENSIC PHYSICAL EVIDENCE**

This unit provides a theoretical and practical framework to introduce you to the physical evidence processing techniques of questioned documents and computer forensics and the forensic examination techniques of optical and electron microscopy. The unit will also discuss the physical and chemical structure of some common types of physical evidence (fibres, fabrics & severance, soils and physical fits) and the analytical methods used for their analysis. It is placed appropriately in the fifth semester of the course to coincide with and complement the Instrumental Analysis unit PQB513 which the core knowledge for the instrumental techniques used within the forensic analysis of various types of physical evidence.

**Prerequisites:** PQB312, SCB384  
**Antirequisites:** PCB584  
**Credit points:** 12  
**Contact hours:** 4 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

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

**SCB222 EXPLORATION OF THE UNIVERSE**

This unit provides an introduction to optical observational astronomy; instrumentation; celestial sphere and astronomical coordinates; observations of constellations, stars, planets, clusters and other interesting celestial objects. The theory includes: optics of telescopes; properties of light; determination of physical properties of stars; nebulae; stellar spectra and classification; historical models of the solar system; Kepler’s law, gravitation; physical geology of the planets and formation of the solar system; phenomena of astronomical origin; brief introduction to stars and galaxies. This course includes practical exercises and field trips.

**Credit points:** 12  
**Contact hours:** 5 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-2

**SCB384 FORENSIC SCIENCES - FROM CRIME SCENE TO COURT**

This unit provides an introduction to two fundamental areas in forensic science, crime scenes and justice. Mock crime scenes involving real life scenarios are used to provide hands-on training on crime scene management and examination protocols. The principles for forensic examination of crime scenes involving fire, explosion, murder, etc, are introduced through lectures, workshops and practical exercises. Also an overview of the techniques used in forensic photography, fingerprinting as well as Legal procedures at court is presented. This unit is provided by professional forensic practitioners with practical real life experience being transferred to new generations. This head start provides a unique advantage for a strong career in forensics.

**Credit points:** 12  
**Contact hours:** 4.5 per week