Bachelor of Applied Science/Bachelor of Mathematics (SC20)

Year offered: 2011
Admissions: Yes
CRICOS code: 049434C
Course duration (full-time): 4 years
Domestic Fees (indicative): 2011: CSP $2,178 (indicative) per semester
International Fees (indicative): 2011: $11,875 (indicative) per semester
Domestic Entry: February
International Entry: February and July
QTAC code: 418712
Past rank cut-off: 81
Past OP cut-off: 10
OP Guarantee: Yes
Assumed knowledge: English (4, SA) and Maths B (4, SA)
Preparatory studies: For information on acquiring assumed knowledge visit http://www.qut.edu.au/assumed-knowledge
Total credit points: 384
Standard credit points per full-time semester: 48
Course coordinator: Dr Perry Hartfield (Science Major); Professor Graeme Pettet (Mathematics Major)
Campus: Gardens Point

Course Overview
Studying a double degree in applied science and mathematics will provide you with advanced knowledge and skills that are highly sought after by employers. A stronger training in mathematics and statistics enhances your capabilities in modelling analysis and design.

This four year double degree course integrates studies in one of the science majors with studies in mathematics. The science majors available are biochemistry, biotechnology, chemistry, ecology, environmental science, forensic science, geoscience, microbiology and physics.

The mathematics component offers studies in core mathematics, applied mathematics, computational mathematics, discrete mathematics, financial mathematics, mathematical modelling, operations research, statistics, statistical modelling, scientific computation and data visualisation.

Professional Recognition
Membership of the Australian Mathematical Society, the Statistical Society of Australia and the Australian Society for Operations Research is available. Graduates will satisfy the requirements for membership in the relevant professional body for their chosen science major.

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

Recommended Study
Maths C and knowledge of at least one of the sciences. For the majors in biochemistry, biotechnology, forensic science, and microbiology - Biological Science and Chemistry are recommended.

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

Deferment
Domestic students can defer their offer in this course for one year. In exceptional circumstances up to 12 months of additional deferment may be granted.

Find out more on deferment.

Further Information
For further information about this course please contact:

Science Coordinator
Dr Perry Hartfield
Phone: +61 7 3138 2984
Email: p.hartfield@qut.edu.au
Alternative phone contact: +61 7 3138 2782
Alternative email: enquiry.scitech@qut.edu.au

Mathematics Coordinator
Professor Graeme Pettet
Phone: +61 7 3138 5238
Email: g.pettet@qut.edu.au

Course structure

Students must complete at least (a) 192 credit
points (16 twelve credit point units) of Mathematics units and (b) 192 credit points (16 twelve credit point units) of Science units, according to the requirements as follows:

Level 1 Units:

- Students must complete the following Level 1 Mathematics units:
  - MAB101 Statistical Data Analysis 1
  - MAB120 Algebra and Calculus
  - MAB121 Calculus and Differential Equations
  - MAB122 Algebra and Analytic Geometry
  - MAB210 Statistical Modelling 1
  - MAB220 Computational Mathematics 1

  NOTE: MAB120 is for students who do not have an exit assessment of at least Sound Achievement in four semesters of both Senior Mathematics B and Senior Mathematics C (or equivalent).

  Students with Sound Achievement in both Senior Mathematics B and C take a level 2 Mathematics unit option instead of MAB120.

  Students must complete the following Level 1 Science Foundation units:
  - SCB110 Science Concepts and Global Systems
  - SCB111 Chemistry 1
  - SCB112 Cellular Basis of Life

  In addition, students are required to complete any mandatory units - and should complete all recommended units, specified for the science major selected.

Level 2 and 3 Mathematics Units:

- At least 120 credit points (10 twelve credit point units) must be taken from Level 2 and Level 3 Mathematics units with at least 48 credit points (4 twelve credit point units) from Level 3 Mathematics units:
  - MAB311 Advanced Calculus
  - MAB312 Linear Algebra

Level 2 and 3 Science Units:

- At least 96 credit points (8 twelve-credit point units) must be taken from Level 2 and Level 3 Science units with at least 48 credit points (4 twelve credit point units) from Level 3 Science units. The science units must meet the advanced level requirements of one of the following majors of the SC01 Bachelor of Applied Science course: Biochemistry; Biotechnology; Chemistry; Ecology; Environmental Science; Forensic Science; Geoscience; Microbiology or Physics.

Science Elective Units:

- The Mathematics unit (or units) normally undertaken in the first year of SC01 Bachelor of Applied Science is replaced by a Science elective unit (or units). This Science elective unit can be from any level. The level 2 Mathematics unit in the Physics major is replaced by a level 2 Science elective unit.

Science Units: Biochemistry Major (Mandatory units)

Year 1, Semester 1
- SCB111 Chemistry 1
- SCB112 Cellular Basis of Life
  - TWO Mathematics Units

Year 1, Semester 2 (Life Sciences Pre-Major Strand)
- SCB120 Plant and Animal Physiology
- SCB121 Chemistry 2
  - TWO Mathematics units

Year 2, Semester 1
- SCB110 Science Concepts and Global Systems
  - Science Elective unit
  - TWO Mathematics units

Year 2, Semester 2
- SCB122 Cell and Molecular Biology
- SCB123 Physical Science Applications
  - TWO Mathematics units

Year 3, Semester 1
- LQB381 Biochemistry: Structure and Function
- LQB383 Molecular and Cellular Regulation
  - TWO Mathematics units

Year 3, Semester 2
- LQB481 Biochemical Pathways and Metabolism
- LQB483 Molecular Biology Techniques
TWO Mathematics units

Year 4, Semester 1
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>LQB581</td>
<td>Functional Biochemistry</td>
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<tr>
<td>LQB582</td>
<td>Biomedical Research Technologies</td>
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TWO Mathematics units

Year 4, Semester 2
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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>LQB681</td>
<td>Biochemical Research Skills</td>
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<tr>
<td>LQB682</td>
<td>Protein Biochemistry and Bioengineering</td>
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TWO Mathematics units

Science Units: Biotechnology Major (Mandatory units)

Year 1, Semester 1
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<th>Course Code</th>
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<tbody>
<tr>
<td>SCB111</td>
<td>Chemistry 1</td>
</tr>
<tr>
<td>SCB112</td>
<td>Cellular Basis of Life</td>
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TWO Mathematics units

Year 1, Semester 2 (Life Sciences Pre-Major Strand)
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<th>Course Title</th>
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<tbody>
<tr>
<td>SCB120</td>
<td>Plant and Animal Physiology</td>
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<tr>
<td>SCB121</td>
<td>Chemistry 2</td>
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TWO Mathematics units

Year 2, Semester 1
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<td>SCB110</td>
<td>Science Concepts and Global Systems</td>
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Science Elective unit
TWO Mathematics units

Year 2, Semester 2
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<th>Course Title</th>
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<tbody>
<tr>
<td>SCB122</td>
<td>Cell and Molecular Biology</td>
</tr>
<tr>
<td>SCB123</td>
<td>Physical Science Applications</td>
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</table>

TWO Mathematics units

Year 3, Semester 1
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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>LQB381</td>
<td>Biochemistry: Structure and Function</td>
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<tr>
<td>LQB383</td>
<td>Molecular and Cellular Regulation</td>
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</table>

TWO Mathematics units

Year 3, Semester 2
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>LQB483</td>
<td>Molecular Biology Techniques</td>
</tr>
<tr>
<td>LQB484</td>
<td>Introduction to Genomics and Bioinformatics</td>
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TWO Mathematics units

Year 4, Semester 1
TWO units from:
<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>LQB583</td>
<td>Genetic Research Technology</td>
</tr>
<tr>
<td>LQB584</td>
<td>Medical Cell Biology</td>
</tr>
<tr>
<td>LQB585</td>
<td>Plant Genetic Manipulation</td>
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</tbody>
</table>

TWO Mathematics units

Information for future students
Published on: 13 June 2012
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### Year 4, Semester 1
- **PQB502** Advanced Physical Chemistry
- **PQB531** Organic Mechanisms and Synthesis
- TWO Mathematics units

### Year 4, Semester 2
- **PQB631** Advanced Inorganic Chemistry
- **PQB642** Chemical Research
- TWO Mathematics units

### Science Units: Ecology Major (Mandatory units)

#### Year 1, Semester 1
- **SCB111** Chemistry 1
  - TWO Mathematics units
- **SCB112** Cellular Basis of Life
  - TWO Mathematics units

#### Year 1, Semester 2 (Ecology and Environmental Science Pre-Major Strand)
- **SCB120** Plant and Animal Physiology
- **SCB122** Cell and Molecular Biology
  - TWO Mathematics units

#### Year 2, Semester 1
- **SCB110** Science Concepts and Global Systems
  - Science Elective unit
  - TWO Mathematics units

#### Year 2, Semester 2
- **NQB201** Planet Earth
- **NQB202** History of Life on Earth
  - TWO Mathematics units

#### Year 3, Semester 1
- **NQB302** Earth Surface Systems
- **NQB321** Ecology
  - TWO Mathematics units

#### Year 3, Semester 2
- **NQB421** Experimental Design
- **NQB422** Genetics and Evolution
  - TWO Mathematics units

#### Year 4, Semester 1
- **NQB521** Population Genetics and Molecular Ecology
- **NQB523** Population Management
  - TWO Mathematics units

#### Year 4, Semester 2
- **NQB521** Population Genetics and Molecular Ecology
- **NQB523** Population Management
  - TWO Mathematics units
- **NQB622** Conservation Biology
- **NQB623** Ecological Systems
  - TWO Mathematics units

### Science Units: Environmental Science Major (Mandatory units)

#### Year 1, Semester 1
- **SCB111** Chemistry 1
- **SCB112** Cellular Basis of Life
  - TWO Mathematics units

#### Year 1, Semester 2 (Ecology and Environmental Science Pre-Major Strand)
- **SCB120** Plant and Animal Physiology
- **SCB122** Cell and Molecular Biology
  - TWO Mathematics units

#### Year 2, Semester 1
- **SCB110** Science Concepts and Global Systems
- **SCB123** Physical Science Applications
  - TWO Mathematics units

#### Year 2, Semester 2
- **NQB202** History of Life on Earth
  - Science Elective unit
  - TWO Mathematics units

#### Year 3, Semester 1
- **NQB302** Earth Surface Systems
- **NQB321** Ecology
  - TWO Mathematics units

#### Year 3, Semester 2
- **NQB403** Soils and the Environment
- **NQB421** Experimental Design
  - TWO Mathematics units

#### Year 4, Semester 1
- **NQB501** Environmental Modelling
- **NQB502** Field Methods in Natural Resource Sciences
  - TWO Mathematics units

#### Year 4, Semester 2
### Science Units: Forensic Science Major (Mandatory units)

<table>
<thead>
<tr>
<th>Year 1, Semester 1</th>
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<tbody>
<tr>
<td>SCB111 Chemistry 1</td>
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<tr>
<td>SCB112 Cellular Basis of Life</td>
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<td>TWO Mathematics units</td>
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<table>
<thead>
<tr>
<th>Year 1, Semester 2 (Forensic Science Pre-Major Strand)</th>
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<tbody>
<tr>
<td>SCB121 Chemistry 2</td>
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<tr>
<td>SCB122 Cell and Molecular Biology</td>
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<td>TWO Mathematics units</td>
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<table>
<thead>
<tr>
<th>Year 2, Semester 1</th>
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</thead>
<tbody>
<tr>
<td>SCB110 Science Concepts and Global Systems</td>
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<tr>
<td>Science Elective unit</td>
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<tr>
<td>TWO Mathematics units</td>
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<table>
<thead>
<tr>
<th>Year 2, Semester 2</th>
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</thead>
<tbody>
<tr>
<td>SCB123 Physical Science Applications</td>
</tr>
<tr>
<td>SCB131 Experimental Chemistry</td>
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<td>TWO Mathematics units</td>
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<tr>
<th>Year 3, Semester 1</th>
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<tbody>
<tr>
<td>LQB383 Molecular and Cellular Regulation</td>
</tr>
<tr>
<td>SCB384 Forensic Sciences - From Crime Scene to Court</td>
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<tr>
<td>TWO Mathematics units</td>
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<th>Year 3, Semester 2</th>
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<tbody>
<tr>
<td>JSB979 Forensic Scientific Evidence</td>
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<tr>
<td>PQB312 Analytical Chemistry For Scientists and Technologists</td>
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<td>TWO Mathematics units</td>
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<th>Year 4, Semester 1</th>
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<tbody>
<tr>
<td>PQB513 Instrumental Analysis</td>
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<tr>
<td>PQB584 Forensic Physical Evidence</td>
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<td>TWO Mathematics units</td>
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<th>Year 4, Semester 2</th>
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<tbody>
<tr>
<td>LQB680 Forensic DNA Profiling</td>
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<tr>
<td>PQB684 Forensic Analysis</td>
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### Science Units: Geoscience Major (Mandatory units)

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<th>Year 1, Semester 1</th>
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<tbody>
<tr>
<td>SCB111 Chemistry 1</td>
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<tr>
<td>SCB112 Cellular Basis of Life</td>
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<tr>
<td>TWO Mathematics units</td>
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</table>

<table>
<thead>
<tr>
<th>Year 1, Semester 2 (Geoscience Pre-Major Strand)</th>
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<tbody>
<tr>
<td>NQB201 Planet Earth</td>
</tr>
<tr>
<td>SCB123 Physical Science Applications</td>
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<tr>
<td>TWO Mathematics units</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 2, Semester 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCB110 Science Concepts and Global Systems</td>
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<tr>
<td>Science Elective unit</td>
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<tr>
<td>TWO Mathematics units</td>
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<table>
<thead>
<tr>
<th>Year 2, Semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>NQB202 History of Life on Earth</td>
</tr>
<tr>
<td>SCB222 Exploration of the Universe</td>
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<tr>
<td>TWO Mathematics units</td>
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<tr>
<th>Year 3, Semester 1</th>
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<tbody>
<tr>
<td>NQB311 Mineralogy</td>
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<tr>
<td>NQB314 Sedimentary Geology</td>
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<td>TWO Mathematics units</td>
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<tr>
<th>Year 3, Semester 2</th>
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<tbody>
<tr>
<td>NQB411 Petrology of Igneous and Metamorphic Rocks</td>
</tr>
<tr>
<td>NQB412 Structural Geology and Field Methods</td>
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<td>TWO Mathematics units</td>
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<tr>
<th>Year 4, Semester 1</th>
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<tbody>
<tr>
<td>NQB502 Field Methods in Natural Resource Sciences</td>
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<tr>
<td>NQB513 Geophysics</td>
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<td>TWO Mathematics units</td>
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<tr>
<th>Year 4, Semester 2</th>
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<tbody>
<tr>
<td>NQB615 Geochemistry</td>
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<tr>
<td>NQB612 Basin Analysis and Petroleum Geology</td>
</tr>
<tr>
<td>NQB613 Plate Tectonics</td>
</tr>
<tr>
<td>NQB614 Groundwater Systems</td>
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<tr>
<td>TWO Mathematics units</td>
</tr>
</tbody>
</table>
Science Units: Microbiology Major (Mandatory units)

| Year 1, Semester 1 | SCB110 | Science Concepts and Global Systems |
| SCB111 | Chemistry 1 |
| SCB112 | Cellular Basis of Life |
| | TWO Mathematics units |

| Year 1, Semester 2 (Life Sciences Pre-Major Strand) | SCB120 | Plant and Animal Physiology |
| SCB121 | Chemistry 2 |
| | TWO Mathematics units |

| Year 2, Semester 1 | SCB122 | Cell and Molecular Biology |
| SCB123 | Physical Science Applications |
| | TWO Mathematics units |

| Year 2, Semester 2 | LQB381 | Biochemistry: Structure and Function |
| LQB386 | Microbial Structure and Function |
| | TWO Mathematics units |

| Year 3, Semester 1 | LQB483 | Molecular Biology Techniques |
| LQB486 | Clinical Microbiology 1 |
| | TWO Mathematics units |

| Year 4, Semester 1 | LQB586 | Clinical Microbiology 2 |
| LQB587 | Applied Microbiology 1: Water, Air and Soil |
| | TWO Mathematics units |

| Year 4, Semester 2 | LQB686 | Microbial Technology and Immunology |
| LQB687 | Applied Microbiology 2: Food and Quality Assurance |
| | TWO Mathematics units |

Science Units: Physics Major (Mandatory units)

| Year 1, Semester 1 | MAB101 | Statistical Data Analysis 1 |

| Year 1, Semester 2 (Physics Pre-Major Strand) | PQB250 | Mechanics and Electromagnetism |
| Science Elective unit |
| | TWO Mathematics units |

| Year 2, Semester 1 | SCB112 | Cellular Basis of Life |
| Science Elective unit |
| | TWO Mathematics units |

| Year 2, Semester 2 | PQB251 | Waves and Optics |
| Science Elective unit |
| | TWO Mathematics units |

| Year 3, Semester 1 | PQB350 | Thermodynamics of Solids and Gases |
| Level 2 Science Elective unit |
| | TWO Mathematics units |

| Year 3, Semester 2 | PQB450 | Energy, Fields and Radiation |
| PQB451 | Electronics and Instrumentation |
| | TWO Mathematics units |

| Year 4, Semester 1 | PQB550 | Quantum and Condensed Matter Physics |
| PQB551 | Physical Analytical Techniques |
| | TWO Mathematics units |

| Year 4, Semester 2 | PQB650 | Advanced Theoretical Physics |
| PQB651 | Experimental Physics |
| | TWO Mathematics units |

Mathematics Component (Mandatory units) (WITH Maths C)
<table>
<thead>
<tr>
<th>Year 1, Semester 2</th>
<th>Year 2, Semester 1</th>
<th>Year 2, Semester 2</th>
<th>Year 3, Semester 1</th>
<th>Year 3, Semester 2</th>
<th>Year 4, Semester 1</th>
<th>Year 4, Semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAB121 Calculus and Differential Equations</td>
<td>MAB200 Computational Mathematics 1</td>
<td>Two Mathematics unit</td>
<td>MAB101 Linear Algebra</td>
<td>Two Mathematics units</td>
<td>MAB200 Statistical Modelling 1</td>
<td>Two Level 3 Mathematics units</td>
</tr>
<tr>
<td>Plus TWO units selected according to the Science major requirements</td>
<td>MAB311 Advanced Calculus</td>
<td>Plus TWO units selected according to the Science major requirements</td>
<td>Plus ONE Mathematics unit</td>
<td>Mathematics Component (Mandatory units) (WITHOUT Maths C)</td>
<td>Plus TWO units selected according to the Science major requirements</td>
<td>Mathematics Component (Mandatory units) (WITHOUT Maths C)</td>
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Mathematics Component (Mandatory units) (WITHOUT Maths C)

For Students with Sound Achievement or Better in Senior Mathematics B Only

<table>
<thead>
<tr>
<th>Year 1, Semester 1</th>
<th>Year 2, Semester 1</th>
<th>Year 2, Semester 2</th>
<th>Year 3, Semester 1</th>
<th>Year 3, Semester 2</th>
<th>Year 4, Semester 1</th>
<th>Year 4, Semester 2</th>
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</thead>
<tbody>
<tr>
<td>MAB120 Algebra and Calculus</td>
<td>MAB121 Calculus and Differential Equations</td>
<td>Two Mathematics units</td>
<td>MAB101 Linear Algebra</td>
<td>Mathematics Component (Mandatory units) (WITHOUT Maths C)</td>
<td>Two Level 3 Mathematics units</td>
<td>Mathematics Component (Mandatory units) (WITHOUT Maths C)</td>
</tr>
<tr>
<td>Plus TWO units selected according to the Science major requirements</td>
<td>MAB122 Algebra and Analytic Geometry</td>
<td>Plus TWO units selected according to the Science major requirements</td>
<td>Plus ONE Mathematics unit</td>
<td>Mathematics Component (Mandatory units) (WITHOUT Maths C)</td>
<td>Mathematics Component (Mandatory units) (WITHOUT Maths C)</td>
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Mathematics Component (Mandatory units) (WITHOUT Maths C)
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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>MAB122</td>
<td>Algebra and Analytic Geometry</td>
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<td>MAB210</td>
<td>Statistical Modelling 1</td>
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<tr>
<td>MAB220</td>
<td>Computational Mathematics 1</td>
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<td>Level 2</td>
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<tr>
<td>MAB311</td>
<td>Advanced Calculus</td>
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<td>MAB312</td>
<td>Linear Algebra</td>
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<td>MAB313</td>
<td>Mathematics of Finance</td>
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<tr>
<td>MAB314</td>
<td>Statistical Modelling 2</td>
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<tr>
<td>MAB315</td>
<td>Operations Research 2</td>
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<td>MAB413</td>
<td>Differential Equations</td>
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<td>MAB414</td>
<td>Applied Statistics 2</td>
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<td>MAB420</td>
<td>Computational Mathematics 2</td>
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<td>MAB422</td>
<td>Mathematical Modelling</td>
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<td>MAB461</td>
<td>Discrete Mathematics</td>
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<td>MAB480</td>
<td>Introduction to Scientific Computation</td>
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<tr>
<td>MAB521</td>
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<td>MAB524</td>
<td>Statistical Inference</td>
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<td>MAB525</td>
<td>Operations Research 3A</td>
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<td>MAB533</td>
<td>Statistical Techniques</td>
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<td>MAB536</td>
<td>Time Series Analysis</td>
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<td>MAB613</td>
<td>Partial Differential Equations</td>
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<td>MAB623</td>
<td>Financial Mathematics</td>
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**Level 2 or 3 Elective Unit Suggestions for Physics Major**

- PQB360  Global Energy Balance and Climate Change
- PQB460  Astrophysics 1
- PQB660  Astrophysics 2

**Potential Careers:**


**UNIT SYNOPSES**

**JSB979 FORENSIC SCIENTIFIC EVIDENCE**

The word ‘forensic’ once meant anything relating to a law court. However today the term ‘forensic science’ refers to a whole new subject: it means using science to solve legal issues. As science, and the many sub-disciplines of science, are appearing in court with ever-increasing rapidity, there is a clear need for scientists to understand the foundations to the law, the ways in which law reasons, the adversarial process, and the basics to the key area of evidence law. The aim of this unit is first to provide you with an understanding of evidence law, with a particular emphasis upon the foundations to reception of scientific evidence, and the ways in which expert scientific witnesses are received in our courts. The unit aims to clarify the links between science and law, as well as to articulate the differences between these two increasingly inter-twined disciplines.

**Equivalents:** JSB937, JSB444  
**Credit points:** 12  
**Contact hours:** 3  
**Campus:** Gardens Point and External  
**Teaching period:** 2011 SEM-2

Information on some possible Science elective units.

- NQB201  Planet Earth  
- NQB202  History of Life on Earth
LQB381 BIOCHEMISTRY: STRUCTURE AND FUNCTION
This unit extends basic organic chemistry theory to the level of the biological macromolecules. A clear understanding of the structure and function of these molecules is essential to a student's understanding of the metabolism of living cells. Hence this biomolecular unit is a fundamental prerequisite for all advanced units in the various disciplines in the field of life sciences.
Prerequisites: (SCB121 and SCB122) or (SCB111 and SCB121) or SCB113 Antirequisites: LSB275 and LSB325 and LSB308 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2011 SEM-1

LQB383 MOLECULAR AND CELLULAR REGULATION
Molecular and Cellular Regulation is a second year unit and is a continuation and expansion of topics introduced in SCB112 Cellular Basis of Life and SCB122 Cell & Molecular Biology. Molecular and Cellular Regulation strengthens the focus on the molecular and genetic aspects of cellular processes and the consequences to the organism of failure of these basic processes. Topics taught relate to gene structure and regulation in prokaryotes and eukaryotes and the role of gene expression in the development of complex organisms. Related concepts such as cell signalling, communication, proliferation and survival are further developed in this unit.
Prerequisites: SCB122 or LSB238 Antirequisites: LSB468 and LSB338 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2011 SEM-1

LQB386 MICROBIAL STRUCTURE AND FUNCTION
Aspects of microbiology impinge upon many facets of daily life, for example, human health, genetic engineering, the food industry and the built and natural environment. The unit introduces you to and provides you with a solid foundation in the basic microbiology required for progression to advanced studies in Microbiology. This unit provides knowledge about safe handling and study of micro-organisms that is also very important in many other disciplines, because micro-organisms are used as models and tools in a wide range of study areas.
Prerequisites: SCB112 and (SCB121 or SCB113) Antirequisites: LSB328 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2011 SEM-1

LQB481 BIOCHEMICAL PATHWAYS AND METABOLISM
The study of biochemistry and cell biology, along with molecular biology, provides students with the knowledge required for the proper understanding of the structure and function of living organisms at the molecular level. As such, this unit extends the studies begun in the unit LQB381 Biochemistry into the metabolic processes occurring in living cells, and provides students with a basis for further studies in biochemistry as well as support for other units in the third year of the course.
Prerequisites: LQB381 or LSB308 Corequisites: PUB405 Antirequisites: LSB275, LSB325, LSB408 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2011 SEM-2

LQB483 MOLECULAR BIOLOGY TECHNIQUES
Molecular biology and recombinant DNA technologies have important roles in many areas within the life sciences, including medicine, agriculture, cell biology, environmental science and forensics. Through close alignment of theoretical concepts and practical skills, this lab-based unit expands on molecular themes introduced in earlier cell and molecular biology units to develop expertise in modern recombinant DNA techniques and an understanding of strategies used to identify and manipulate genes. The close relationship between theory and practice in this unit is designed to develop competence, independence and critical thinking that will provide students with a solid foundation for advanced molecular biology studies presented in several third level units.
Prerequisites: LSB238 or SCB122 Antirequisites: LSB468, LSN468, LSN483 Assumed knowledge: LQB383 is recommended prior study Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2011 SEM-2

LQB484 INTRODUCTION TO GENOMICS AND BIOINFORMATICS
The completion of the Human Genome project, along with similar projects on other organisms of a prokaryote and eukaryote nature, marked the beginning of a major revolution in fundamental biology that changed our understanding of the natural world. To understand how information on genome structure-function relationships (ie bioinformatics) is being used in areas such as gene discovery, disease diagnosis and drug development, students need to understand how the information content of DNA and proteins is extracted and analysed. This unit introduces students to the approaches to database mining and genome exploration.
Prerequisites: LQB383 or LSB338 or LSN101 and LSN102 Antirequisites: LSB537, LSB619, LSB469 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2011 SEM-2

LQB486 CLINICAL MICROBIOLOGY 1
Micro-organisms are very important as pathogens of humans and animals, and their accurate clinical diagnosis is essential for appropriate treatment and management of infections. This unit builds upon the foundational topics in microbiology that you learned in LQB386 (Microbial
Structure and Function) and starts preparing you for a career in a microbiology laboratory in clinical practice, industry or research. The unit will advance your knowledge and skills in classical methods of isolation and identification of bacteria in clinical specimens and introduce aspects of microbial pathogenesis and antibiotic sensitivity. The unit will provide you with an understanding of clinically important viruses, and will commence your training in diagnostic parasitology.

**Prerequisites:** LQB386 or LSB328  
**Antirequisites:** LSB435, LSB547  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**LQB581 FUNCTIONAL BIOCHEMISTRY**  
This unit will study advanced biochemical concepts with a focus on metabolism, signalling pathways, systems and networks that coordinate and regulate the functional behaviour of cells and tissues.  

**Prerequisites:** (LQB381 or LSB308) and (LQB383 or LSB338)  
**Antirequisites:** LSB508  
**Credit points:** 12  
**Contact hours:** 5 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**LQB582 BIOMEDICAL RESEARCH TECHNOLOGIES**  
This unit will study the technical principles and practical techniques that are essential for advancing research and development in biochemistry and biotechnology.  

**Prerequisites:** LQB381 or LSB308  
**Antirequisites:** LSB527  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**LQB583 GENETIC RESEARCH TECHNOLOGY**  
The tools available for the discovery and manipulation of new genes are increasing exponentially and, in turn, this is having a significant impact in many areas of the life sciences. The true potential for this ultimately relies on the ability to link genes and their function. There are many strategies, both targeted and global, which facilitate an understanding of gene and genome structure function relationships. These strategies rely on integrated technologies based on molecular genetics, molecular biology and genetic engineering. The identification of function leads then to unlimited potential for detection and manipulation of these genes in human, animal and plant systems.  

**Prerequisites:** LQB483  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**LQB584 MEDICAL CELL BIOLOGY**  
This unit builds and extends the understanding of basic theoretical and practical aspects of molecular cell biology developed in previous cell and molecular biology units. Medical Cell Biology develops and extends the context of the cellular environment and its central role within the organism providing all of the biological functions required by the organism to survive, defend and protect itself from disease and trauma. An understanding of cell biology theory and molecular mechanisms of animal development and disease is essential for introduction to higher level units in medical biotechnology.  

**Prerequisites:** LQB383 or LSB338  
**Antirequisites:** LSB449, LSB503, LSNS84  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**LQB585 PLANT GENETIC MANIPULATION**  
The potential of plant biotechnology can only be recognised as a result of the significant advances being made in technologies enabling the genetic manipulation of plants. Familiarity with the strategies, techniques and breadth of applications is essential as a basis for anyone planning a career in plant biotechnology. The unit is designed with a significant emphasis on achieving technical expertise in plant genetic manipulation and control of gene expression.  

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

**LQB586 CLINICAL MICROBIOLOGY 2**  
Clinical microbiology laboratories throughout the world are recognising the need to maximise their diagnostic capabilities for accurate and early detection and management of medically-important parasitic, fungal and bacterial diseases of humans. This unit emphasises a strong commitment to professional practice by: (i) providing you with a comprehensive, in-depth knowledge and understanding of infectious disease states and their etiology, (ii) developing high level generic and specific laboratory-based skills in diagnostic microbiology and (iii) developing and refining critical thinking skills so that experimental results may be observed and recorded intelligently and reported with a high degree of confidence in their validity and rigor.  

**Prerequisites:** LQB486  
**Antirequisites:** LSB547 and LSB647  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**LQB587 APPLIED MICROBIOLOGY 1: WATER, AIR AND SOIL**  
Issues relating to microbial populations within the environment are of great interest and relevance to the community, and also to scientists. Building on the foundation of basic microbiology, in this advanced level unit you will gain a strong understanding of the nature of microbial populations in water, air and soil, and their importance to the human population. This unit is issues-based, encouraging a problem solving approach as you investigate/study microbial pollution, bioremediation, biogeochemical cycles and a healthy environment. You will
gain knowledge and skills in analysis and interpretation of water, air and soil populations, which will permit you to investigate real-world problems.

**Prerequisites:** LQB386, LSB328, or LSB492

**Antirequisites:** LSB528

**Credit points:** 12

**Contact hours:** 4 per week

**Campus:** Gardens Point

**Teaching period:** 2011 SEM-2

### LQB680 FORENSIC DNA PROFILING

The individuality of human beings is manifested at the molecular level in terms of our DNA, proteins and antigens. Techniques in molecular genetics are most commonly used to detect this individuality in biological samples, such as blood, semen, hair, teeth, bone or saliva. This is one of the final units in the forensic science major, which will draw together knowledge and understanding gained in previous studies. The aim of this unit is to develop your understanding of the application of DNA technologies to human identification for forensic purposes such as crime, parentage testing and the identification of human remains, as well as the issues related to presenting DNA evidence in court.

**Prerequisites:** SCB384

**Credit points:** 12

**Contact hours:** 4 per week

**Campus:** Gardens Point

**Teaching period:** 2011 SEM-2

### LQB681 BIOCHEMICAL RESEARCH SKILLS

In the real world, the design and completion of successful research and/or business projects demand that individuals gather information, solve problems, work effectively as a part of a team and analyse and communicate results in a critical manner. This unit offers opportunities for you to develop these skills that are valued highly by potential employers and research project leaders. The aim of this unit is to assist you to demonstrate and strengthen a number of generic research skills in a mentored problem-based learning environment that mirrors a real-world research team and the challenges that they face.

**Prerequisites:** LQB381 or LSB308. Students with equivalent study can apply for a requisite waiver

**Equivalents:** LSB607

**Credit points:** 12

**Contact hours:** 5 per week

**Campus:** Gardens Point

**Teaching period:** 2011 SEM-2

### LQB682 PROTEIN BIOCHEMISTRY AND BIOENGINEERING

This unit is designed to give you the essential concepts and techniques driving research and industrial biotechnology so that you will be equipped for multiple careers in the biological sciences. The skills you develop will allow you to enter a practical laboratory environment or to apply your knowledge in related areas of evaluations of technologies and intellectual property.

**Prerequisites:** LQB381 or LSB308 or LSB325 or (LSN101 and LSN102)

**Antirequisites:** LSB605, LSB608

**Credit points:** 12

**Contact hours:** 5 per week

**Campus:** Gardens Point

**Teaching period:** 2011 SEM-2

### LQB684 MEDICAL BIOTECHNOLOGY

Medical Biotechnology will provide you with a thorough understanding of diagnostics and therapeutics in the commercial environment of biotechnology. A comprehension of approaches and the applications used as therapeutic interventions in medicine is necessary for this understanding. This unit focuses on current state-of-the-art applications within therapeutic biotechnology as directed to novel drug discovery and drug optimisation and to the development of novel therapeutic strategies, such as gene therapy, transplantation and immunotherapy. It will prepare you for subsequent involvement in medical research and/or employment in medical laboratories.

**Prerequisites:** LQB584 or LSB503 or LSB449

**Antirequisites:** LSN684

**Assumed knowledge:** A background understanding of Cell and Molecular Biology as provided in LQB383. LQB483 and LQB584 is assumed

**Equivalents:** LSB609

**Credit points:** 12

**Contact hours:** 5 per week

**Campus:** Gardens Point

**Teaching period:** 2011 SEM-2

### LQB685 PLANT MICROBE INTERACTIONS

Microorganisms, including viruses, bacteria and fungi, cause many devastating diseases in plants and are responsible for significant losses to crops in Australia and Internationally. Diagnosis and control of these organisms, which vary considerably in their biology and infection strategies, is an ongoing challenge. However, plant genetic engineering approaches are now offering new and novel solutions to these problems. These approaches are of widespread scientific, commercial and humanitarian interest. The application of current technologies and development of new, novel technologies relies on an understanding of the biology of the organism, of the way in which these organisms cause disease in plants and the mechanism by which many plants are resistant.

**Prerequisites:** LQB483 or LSN483

**Antirequisites:** LQB578

**Assumed knowledge:** LSB584 or LSB503 or LSB449

**Recommended**

**Credit points:** 12

**Contact hours:** 4 per week

**Campus:** Gardens Point

**Teaching period:** 2011 SEM-2

### LQB686 MICROBIAL TECHNOLOGY AND IMMUNOLOGY

This capstone unit builds upon your foundation knowledge and understanding of microorganisms and bioinformatics, molecular technology, and immunological skills. You will: (i) study infectious disease states as a major focus, (ii) research the importance of microbial pathogens as aetiological agents of disease, (iii) apply your knowledge of bioinformatics and molecular assays to design polymerase chain reaction (PCR) assays that can be used to selectively detect and amplify a specific bacterial pathogen, (iii) extend...
your knowledge of molecular subtyping methods, genomics, manipulation of bacterial genes, antibiotics, human immunology and vaccines, and (iv) write a research report in the format of a journal article.

**Prerequisites:** LQB386 and LQB483  
**Antirequisites:** LSB648  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**LQB687 APPLIED MICROBIOLOGY 2: FOOD AND QUALITY ASSURANCE**

Food microbiology and quality assurance constitute potential areas of employment for graduates. Many aspects of these disciplines are important in public health and operational management. Understanding fundamental concepts and their correct application are critical for food safety and management of both food- and non-food-based operations. This unit with content in applied food microbiology and quality systems, builds on the introduction to food microbiology provided in earlier units. The aim of this unit is to gain advanced knowledge and expertise in food microbiology and fundamental quality assurance principles suitable for application in food and other (bio)technology-based industries.

**Prerequisites:** LQB386 or LSB328  
**Assumed knowledge:** Completion of 72 credit points of second level science units is assumed knowledge  
**Equivalents:** LSB628  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**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  
**Teaching period:** 2011 SUM-2, 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  
**Teaching period:** 2011 SEM-1, 2011 SEM-2 and 2011 SUM

**MAB121 CALCULUS AND DIFFERENTIAL EQUATIONS**

Building upon the foundations established in MAB120 or Senior Maths C, this unit addresses the significant role of mathematical modelling using differential equations for the description and resolution of simple and complex problems relevant to real world situations. The formulation and solution of such problems is supported by appropriate advanced mathematical concepts used for function approximation, differentiation and integration. Undertaking this unit will allow you to develop your problem solving skills, especially in the context of advanced mathematical techniques applied to ordinary differential equations used to model real world problems. You will also gain a deeper understanding of the concepts of the derivative and the integral, and how these may be used in applied contexts.

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

**MAB122 ALGEBRA AND ANALYTIC GEOMETRY**

Building upon the foundations established in MAB120 or Senior Maths C, this unit addresses the significant role of mathematical modelling using vectors, matrices and multivariable calculus for the description and resolution of simple and complex problems relevant to the real world. The formulation and solution of such problems is supported by appropriate advanced mathematical concepts used for function approximation, differentiation and integration. Undertaking this unit will allow you to develop your problem solving skills, especially in the context of advanced mathematical techniques applied to vectors, matrices and multivariable functions used to model real world problems.

**Assumed knowledge:** Grade of at least Sound Achievement in Senior Mathematics C (or equivalent) or MAB120 or MAB100 or MAB125  
**Equivalents:** MAB112, MAB127, MAB132  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1, 2011 SEM-2 and 2011 SUM
MAB210 STATISTICAL MODELLING 1
This unit is intended for all mathematics degree students, all double degree students with mathematics, secondary education students with mathematics as a teaching area, and quantitatively-oriented students in other courses, particularly in Science, Information Technology, Engineering and areas of Business. The unit will provide you with fundamental skills and operational knowledge for all further study in statistics, and highly relevant foundations for other areas of mathematics such as mathematical modelling and operations research. The unit will also help you develop fundamental problem-solving skills in statistics and mathematics.
Prerequisites: MAB121 or MAB122  Antirequisites: MAN210  Assumed knowledge: Grade of Sound Achievement in Senior Mathematics C (or equivalent) or MAB20 is assumed knowledge. Students are advised to enrol in either MAB121 or MAB122 in the same semester if not previously completed.  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-1 and 2011 SEM-2

MAB220 COMPUTATIONAL MATHEMATICS 1
Many real world problems are not solvable analytically, meaning that it is necessary to develop computational methods that can be used to solve these problems. Additionally, to be able to apply these methods to large problems, they must be implemented as algorithms in a computer language such as MATLAB. This unit addresses both the theoretical development of computational methods and their implementation in MATLAB. The aim of this unit is to provide you with the introductory concepts, computational techniques and programming skills that will allow you to solve many real world problems. It is also designed to prepare you for study in the advanced units in computational mathematics.
Antirequisites: MAN220  Assumed knowledge: Grade of at least Sound Achievement in Senior Mathematics B (or equivalent) or MAB105 and corequisite MAB120 or MAB125 or MAB100 or MAB180 if you don't have Senior Mathematics C is assumed knowledge  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-1 and 2011 SEM-2

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

MAB313 MATHEMATICS OF FINANCE
Finance provides one of the significant areas for the application of mathematics. Understanding the fundamental principles involved will enhance your general preparation for life and provide an essential tool for those of you who intend to pursue further studies or careers in the financial area. The aim of this unit is to provide you with an introduction to the methods used in obtaining relevant solutions to financial and business problems.
Prerequisites: MAB111 or MAB121 (which can be concurrently enrolled)  Antirequisites: MAN313  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-2

MAB314 STATISTICAL MODELLING 2
This unit includes: models for stochastic processes and statistical methods, which have applications in engineering, information technology, finance, and physical and life sciences. Markov chains; random walks; branching processes; queueing processes; long-term behaviour of processes; use of generating functions; bivariate and conditional distributions; transformations of random variables; beta and gamma distributions; mixture distributions; order statistics, minimum and maximum.
Prerequisites: MAB122 (which can be concurrently enrolled)  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-1

MAB315 OPERATIONS RESEARCH 2
This unit introduces the essential features of operations research methods. It develops a number of basic mathematical techniques to solve generic problems and the theoretical foundations of these techniques. Students should develop the ability to apply various operations research methods, algorithms and techniques in the solution of practical problems. Students will also look at the applications of operations research techniques to real-world problems.
Prerequisites: MAB210 and (MAB112 or MAB122)  Antirequisites: MAN315  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-1
MAB413 DIFFERENTIAL EQUATIONS
Differential Equations are among the most important aspects of the theoretical developments of any branch of science. It is often the case that the formulation of mathematical models of real world problems leads to an equation in which a function and its derivatives play a major role. Such equations are examples of differential equations. This unit builds on studies of differential equations in first year and provides a framework for studying partial differential equations and other aspects of applied mathematics in later semesters.
Prerequisites: MAB311 or MAB312  Antirequisites: MAN413  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-2

MAB414 APPLIED STATISTICS 2
This unit includes: Simple linear regression (revision), multiple linear regression, making inferences from regressions, choosing a model, checking model assumptions, general linear models - analysis of covariance, ANOVA revisited, designing experiments, issues in designing experiments, analysing experimental results, further experimental designs, assumptions, and how to cope if they aren't met, simulations.
Prerequisites: MAB101  Assumed knowledge: MAB112 is recommended prior study  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-2

MAB420 COMPUTATIONAL MATHEMATICS 2
This unit provides you with the opportunity to employ a number of the skills that you have developed in the disciplines of computational mathematics and linear algebra, combining them in a coherent manner for resolving topical and relevant real world problems. You will become familiar with the methodologies for developing numerical algorithms that can be employed for either the direct solution or the iterative solution of large, sparse linear systems.
Prerequisites: MAB220 and MAB312  Antirequisites: MAN420  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-2

MAB422 MATHEMATICAL MODELLING
In this unit you will develop skills in the formulation and interpretation of mathematical models of ‘real-world’ problems drawn from the literature, the media and the lecturer's own research areas. You will also develop and extend your skills in the use of mathematical software to investigate solutions of some of these models. By emphasising the need to write clear mathematical arguments and to explain in logical and clear English the conclusions drawn from the mathematical models developed in the unit, you will also develop your written communication skills.
Prerequisites: MAB121  Antirequisites: MAN422  Assumed knowledge: MAB220 is recommended for prior/concurrent study for exposure to MATLAB  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-2

MAB461 DISCRETE MATHEMATICS
Discrete mathematics is playing an ever increasingly important role in society. We live in an electronic age where information security is of paramount importance, and it is discrete mathematics in the main that provides this security. In addition, many real world systems are discrete in nature and therefore lend themselves to a discrete analysis. These methods are therefore vital to the professional mathematician and useful to those with an interest in mathematics. This second level unit will provide you with an introduction to discrete and combinatorial mathematics, and give you a mathematical perspective that is different from the traditional coverage in other mathematics units. It will also provide you with valuable methods to apply in other areas of science and computer science.
Prerequisites: MAB112 or MAB122  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-2

MAB480 INTRODUCTION TO SCIENTIFIC COMPUTATION
This unit teaches students how to implement a mathematical algorithm in a modern scientific computing environment (eg Matlab). A case-study approach is used with an emphasis on writing efficient code. Also an overview of other software packages used in mathematics will be given.
Antirequisites: ITB849  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point

MAB521 APPLIED MATHEMATICS 3
This unit includes: partial differential equations such as the wave, heat and Laplace equations; special functions(gamma, delta, Bessel and error functions, Legendre polynomials); vector analysis and applications (vector algebra, vector calculus, fields, grad, div, curl, line and surface integrals, divergence theorem, Stoke's theorem, applications); functions of a complex variable (analytic functions, contour integrals, Laurent series, residues).
Prerequisites: MAB311  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-1

MAB522 COMPUTATIONAL MATHEMATICS 3
This unit includes: deriving the basic equations that describe fluid motion; the finite volume method for solving PDEs (application to the generalised diffusion equation, cell-
centred and vertex-centred schemes, handling of boundary and initial conditions); solution of systems of nonlinear equations (Newton's method, Inexact Newton methods, Globally convergent methods).

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

**MAB524 STATISTICAL INFERENCE**
This unit includes: maximum likelihood estimation, confidence intervals and hypothesis tests, introduction to Bayesian inference, prior and posterior distributions, Bayesian inference for binomial data, Poisson count data and normal data, simulation techniques for sampling from distributions. Use of software Matlab and R.

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

**MAB525 OPERATIONS RESEARCH 3A**
This unit develops problem-solving skills and sharpens analytical skills. This unit introduces the technical issues involved in applying operations research principles, methods and algorithms in the solution of real-world problems.

**Prerequisites:** MAB315  
**Antirequisites:** MAN525  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**MAB533 STATISTICAL TECHNIQUES**
This unit builds on your knowledge and skills of statistical techniques and aims to provide you with an understanding and a working knowledge of some more specialised statistical techniques and their applications. Topics covered include quality management concepts and tools for statistical process control, modelling and analysis of reliability (for inanimate objects) and survival (for living entities), and multivariate techniques such as principal components analysis, discriminant analysis and cluster analysis.

**Prerequisites:** MAB210 and MAB414  
**Antirequisites:** MAB253  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**MAB536 TIME SERIES ANALYSIS**
Data in business, economics, engineering and the natural sciences often occur in the form of time series. Time Series Analysis provides models and methods for the analysis of such series of correlated observations. The ability to forecast optimally, to understand causal relationships between variables, and to analyse dynamic systems is of great practical importance. For example, optimal sales forecasts are needed for business planning, transfer function models are needed for improving the design and control of a process plant, and vector time series models are used to represent the relationships and interactions of macroeconomic variables in an economy. This unit is concerned with the building of time series models and the use of such models for practical applications such as optimal forecasting, simulation, causality analysis, and analysis of dynamic systems.

**Prerequisites:** MAB314 and MAB414  
**Antirequisites:** MAN536, MAB526  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**MAB613 PARTIAL DIFFERENTIAL EQUATIONS**
Partial differential equations are the classical foundation of mathematical models used to unambiguously describe processes exhibiting spatial and temporal variation. There exist numerous modern important examples of such so called continuum models and so it is essential that any practising mathematician be conversant with both the background, formulation and solution of such equations. This unit aims to develop your understanding of the construction, analysis, solution and interpretation of partial differential equation models of real-world processes.

**Prerequisites:** MAB311 and MAB413  
**Antirequisites:** MAN613  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**MAB623 FINANCIAL MATHEMATICS**
This unit includes the following: quantitative techniques in business, economics and finance; theory and structure of interest rates; general accumulation and discounting functions; force of interest; discounting including Modern Portfolio theory and extension; varying interest; general annuities; varying annuities; continuous varying annuities; mathematical analysis of financial transactions in money and capital markets; life annuities and life assurances; the life table; basic life table functions; life annuities and assurances; policy values; paid up policy values; changes to policies; use of life table; superannuation.

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

**MAB624 APPLIED STATISTICS 3**
Applied statistics provides methods for investigating relationships between variables that arise in data from a variety of areas including science, technology and commerce. The planning of the collection of the data, using ideas of experimental design, and the analysis of the resulting data, using methods based on statistical inference, are fundamental aspects of the statistical process. In addition, communication of results with clear reporting of the conclusions of the analysis is very important. These activities are an important part of decision making processes whatever the context of the application. This unit
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: 2011 SEM-2

NQB202 HISTORY OF LIFE ON EARTH
This unit aims to provide you with an understanding of the processes of evolution and the changing environmental conditions through time that influenced the patterns of the evolution of life on this planet. The unit will provide you with practical experience in fossil plant and animal identification, classification and morphological interpretation. It will also enable you to apply palaeontological information to interpret the evolutionary history of higher taxa and the changing ancient depositional environments through time.
Equivalents: NRB240  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-2

NQB302 EARTH SURFACE SYSTEMS
Understanding long and short term climate and environmental change is now recognised as crucial to the interpretation of our biotic, geomorphic and cultural landscapes. To fully understand environment change it is important to recognise the interconnectedness between the atmosphere, hydrosphere, lithosphere, biosphere and humanity’s place within these spheres over various temporal and spatial scales. Developing knowledge of past and present climate change and landscaping processes helps to predict future process pathways for natural resource management, civil engineering, risk analysis, and impact assessment in the context of both natural and anthropogenic induced change.
Assumed knowledge: NQB201 is assumed knowledge.
Equivalents: NRB301  Credit points: 12  Contact hours: 4 per week  Campus: Gardens Point  Teaching period: 2011 SEM-1

NQB311 MINERALOGY
Minerals are the building blocks of rocks which comprise the solid Earth. The study of minerals is essential for...
understanding the structure and composition of the earth and the detailed processes of the rock cycle. Mineralogy forms the basis for petrology (the study of the genesis of rocks) and geochemistry, and is thus essential for Geoscience. The unit may also be of interest to chemists.  

**Equivalents:** NRB333  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

### NQB314 SEDIMENTARY GEOLOGY

This unit provides students with an introduction to sedimentology; both sediments and sedimentary rocks. The unit focuses on the link between the range of features preserved in sedimentary rocks and what those features tell us about sedimentary processes, depositional environments and the burial history of the rocks. The sedimentological processes and depositional environments observed in the modern world are discussed and used as a foundation for interpreting the evidence preserved in the ancient sedimentary rock record, in turn revealing much about earth processes in geologic history.  

**Assumed knowledge:** NQB201 is assumed knowledge.  
**Equivalents:** NRB331  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

### NQB321 ECOLOGY

Ecology is the study of the factors that influence the distribution and abundance of organisms. Ecology deals with basic properties of individuals and the emergent properties of collections of individuals that form populations and the dynamics of these populations and their interactions with populations of other species. An understanding of basic ecological principles is central to managing species and ecosystems. This unit provides a broad theoretical background in the major concepts of plant and animal ecology. It serves the dual role of providing a thorough grounding in ecology for students from all faculties; and laying the conceptual foundation for later subjects in the ecology and environmental science.  

**Prerequisites:** SCB110 or SCB112  
**Equivalents:** NRB311  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

### NQB403 SOILS AND THE ENVIRONMENT

This unit will provide you with grounding in soil science (pedology) by emphasising pedological principles, their application to environmental soil analysis and management, and knowledge of ecosystem function of soil in a changing environment. This one of the most critical resources to consider within the context of climate change and is an essential component of environmental scientific studies. It also compliments and provides a basis for further biogeoscientific studies in the SC01 degree. Your knowledge of past and present soil processes will help you to predict process pathways and outcomes for the purposes of environmental planning and management, risk analysis, and impact assessment involving soils. It also contributes to your understanding of field survey and interpretation of soil phenomena in ecological, geological and environmental contexts.  

**Prerequisites:** NQB302 or NRB301 or (ENB272 and ENB274)  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

### NQB411 PETROLOGY OF IGNEOUS AND METAMORPHIC ROCKS

Igneous and metamorphic rocks compose the bulk of the Earth. Understanding what these rocks are and how they form is an essential part of the study of geology and is fundamental to a wide range of higher level units. This unit builds upon the knowledge and skills acquired in the prerequisite unit (NQB311 Mineralogy) by focusing on the description, classification and origins of igneous and metamorphic rocks. This unit aims to allow you to develop the theoretical and practical skills necessary to describe, classify and interpret igneous and metamorphic rocks.  

**Prerequisites:** NQB311 or NRB333  
**Equivalents:** NRB436  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

### NQB412 STRUCTURAL GEOLOGY AND FIELD METHODS

Structural geology, the deformation of earth materials, is one of the main elements in the core curriculum in geology. It is also essential to other subdisciplines of geology, such as foundation engineering and petroleum and mineral exploration. Geologists need to be able to describe and map structures, to understand the mechanical principles of rock deformation, and to be able to manipulate and calculate structural data. This unit fosters the skill of critical three- and four-dimensional analysis that usually sets geoscientists apart from other scientists and technologists.  

**Prerequisites:** NQB314 or NRB331  
**Equivalents:** NRB434  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

### NQB421 EXPERIMENTAL DESIGN

This unit deals with the theory and practice of experimental design and the quantitative approaches used for the investigation of ecological and environmental questions discussed in the prerequisite unit Ecology and developed in subsequent units in the ecology and environmental science majors.  

The aims of this unit are to to provide an introduction to the logic of experimentation and experimental design; build a practical extension on the theoretical basis of statistics obtained in other units using experimental situations commonly met in ecology and environmental science; and
apply methods used to quantify the ecological attributes of populations and communities in experimental field situations.

**Prerequisites:** MAB101 or MAB104 or MAB105, and NQB321 or NRB311  
**Equivalents:** NRB412  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**NQB422 GENETICS AND EVOLUTION**

A detailed understanding of the principles of genetics is required to fully comprehend modern developments in ecology and evolutionary theory. These principles will be taken forward to develop a clear understanding of the mechanisms and processes that drive evolution in natural populations. The unit provides the foundation for further studies in population and conservation biology. The aim of the unit is to provide a detailed understanding of the principles of genetics and their application to studies of evolution and ecology.

**Prerequisites:** SCB112  
**Equivalents:** NRB410  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**NQB501 ENVIRONMENTAL MODELLING**

The capacity for management of complex environmental problems such as climate change, now and in the future, will rely on the capacity of environmental managers to create, interpret and critically analyse models of environmental systems. Mathematical model building promotes the capacity to understand the interdependent relationships that characterise environmental systems and also provides a quantitative foundation for informed environmental management.

**Prerequisites:** NQB412 or NQB421  
**Assumed knowledge:** 48 credit points of second level science units is assumed knowledge.  
**Equivalents:** NRB500  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**NQB502 FIELD METHODS IN NATURAL RESOURCE SCIENCES**

Field experience is an essential part of the professional training of geologists, environmental scientists, ecologists, and natural resource specialists in general. The theory and practice of methods to interpret, measure, map, and monitor important natural resource features and characteristics are essential to the study of geological, ecological and environmental systems. Methods of survey, mapping and interpretation are necessary skills for resource assessment, geo-exploration, environmental impact assessment, land evaluation, baseline studies, and ecological investigations. There are varying emphases on these outcomes depending on the type of field survey you undertake in this unit.

**Prerequisites:** (NQB321 or NQB411) and (NQB302 or NQB412)  
**Assumed knowledge:** 36 credit points of second level science units in selected major is assumed knowledge. NQB302 and NQB403 for Env Sc, NQB321 for Ecol, NQB411 and NQB412 for Geosc  
**Equivalents:** NRB601  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**NQB513 GEOPHYSICS**

Geophysics is an integral branch of geology, providing many of the most useful methods of imaging the subsurface of the earth. These methodologies are useful in disciplines as diverse as plate tectonics, oil and mineral exploration, hydrogeology, environmental geology, engineering geology, and seismic hazards. The aim of the unit is to provide you with the core knowledge and skills of geophysical measurements, processing of data, and geological interpretation of geophysical data.

**Prerequisites:** (NQB201 or NRB230) and (NQB412 or NRB434)  
**Equivalents:** NRB534  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**NQB521 POPULATION GENETICS AND MOLECULAR ECOLOGY**

This unit is an extension of NQB422 Genetics and Evolution. Topics include the genetic structure of populations and processes of evolutionary change; natural selection, inbreeding and adaptation, species and speciation theory; ecological genetics; the genetics of behaviour.

**Prerequisites:** NQB422  
**Antirequisites:** NRB510  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**NQB523 POPULATION MANAGEMENT**

This unit develops the theoretical treatment of populations as a unit of study and integrates the content of previous ecology units into approaches for the management of biological populations. The unit focuses on those interactions that are most relevant to pest control, but the unit is also of fundamental importance to harvesting and conservation biology.

**Prerequisites:** NQB321, NQB421  
**Antirequisites:** NRB511  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1

**NQB601 SUSTAINABLE ENVIRONMENTAL MANAGEMENT**

This unit provides background and details on global sustainable management issues and practices with a focus on Australia. It is therefore an important unit of study for any graduate wishing to pursue a career in environmental science who shares an abiding interest in the state and sustainable management of our planet. The unit compliments other advanced units dealing with environmental science and its practice. The aim of this unit
is to gain deeper understanding of a variety of current issues in environmental management; their multi-disciplinary nature, the science behind them, and the ways of achieving sustainable environmental management in scientific and practicable ways.

**Assumed knowledge:** 48 credit points of second level science units is assumed knowledge. **Equivalents:** NRB600  **Credit points:** 12  **Contact hours:** 4 per week  
Campus: Gardens Point  
Teaching period: 2011 SEM-2

**NQB602 ENVIRONMENTAL CHEMISTRY**

Focusing on fundamental environmental principles, this unit provides essential material for students majoring or co-majoring in any of several disciplines: earth science, environmental science, ecology, biodiversity and chemistry. Material covered includes: basic chemical principles underlying global, regional and local environmental processes; behaviour of natural and synthetic chemical species in the environment and biota (basic toxicology); and basic concepts in applied biogeochemistry, bioremediation and bioleaching. The unit also fosters development of practical and theoretical environmental monitoring skills using physicochemical parameters. Such monitoring data is used to promote informed environmental management through facilitation of scientific hypotheses testing about the environment; supply of data for model validation; testing compliance with regulations and guidelines; and providing data for environmental impact and risk assessment.

**Prerequisites:** PCB140 or PCB142 or SCB111 or SCB121  
**Assumed knowledge:** 72 credit points of Science and/or Health units is assumed knowledge  
**Equivalents:** NRB440  
**Credit points:** 12  
**Contact hours:** 4 per week  
Campus: Gardens Point  
Teaching period: 2011 SEM-2

**NQB612 BASIN ANALYSIS AND PETROLEUM GEOLOGY**

The aim of the unit is to provide you with a fundamental working knowledge of sedimentary strata at regional and basin-wide scales, so as to allow you to solve problems in the exploration and modern environmental management sectors. This unit fosters the skill of critical three- and four-dimensional analysis that usually sets geoscientists apart from other scientists and technologists, and develops an understanding of exploration and production aspects of the fossil fuel industries. Undertaking this unit, you will acquire: the conceptual and technical tools to enable you to rationally interpret the distribution of rock units in space and time with emphasis on predicting the occurrences of petroleum resources; an understanding of the genesis and setting of hydrocarbon resources; and an understanding of the techniques of exploration, evaluation and utilisation of petroleum.

**Prerequisites:** (NQB413 or NRB437) and (NQB513 or NRB534). NQB513 can be studied in the same teaching period as NQB612  
**Equivalents:** NRB636  
**Credit points:** 12  
**Contact hours:** 4 per week  
Campus: Gardens Point  
Teaching period: 2011 SEM-2

**NQB613 PLATE TECTONICS**

This unit considers geological observations in the context of a unifying theory. It examines lithospheric plates, plate geometries, Earth morphology, relative and absolute plate movements, stresses of plate interactions, types of plate boundaries, and orogenesis. It also examines the development of the most important geologic theory of the 20th century.

**Prerequisites:** (NQB412 or NRB434) and (NQB314 or NRB331) and (NQB411 or NRB436) and (NQB513 or NRB534). NQB513 can be studied in the same teaching period as NQB613  
**Equivalents:** NRB635  
**Credit points:** 12  
**Contact hours:** 4 per week  
Campus: Gardens Point  
Teaching period: 2011 SEM-2

**NQB614 GROUNDWATER SYSTEMS**

This unit focuses on the origin, occurrence and movement of groundwater; aquifer properties; chemistry and quality of groundwater; exploration methods for groundwater; drilling methods and well testing equipment; assessment of groundwater problems; both supply and quality; and introduction to modelling of groundwater systems. Groundwater resources of Australia are covered and current issues. Lectures are supported by desktop exercises. Students will obtain practical experience with pump tests and computer modelling. There is interaction with government and private sector hydrogeologists, and a field site visit for hands-on well testing.

**Prerequisites:** NQB302 or NRB301 or ENB383  
**Equivalents:** NRB633  
**Credit points:** 12  
**Contact hours:** 4 per week  
Campus: Gardens Point  
Teaching period: 2011 SEM-2

**NQB615 GEOCHEMISTRY**

Through lecture, discussion and problem solving exercises, this unit introduces the application of geochemistry, phase equilibria, and thermodynamics to demonstrate the origin and evolution of igneous and metamorphic rocks. Problem-solving exercises synthesise field, petrographic and geochemical data to develop quantitative petrogenetic models and enhance critical thinking and written communication skills. Field study is an important component of this unit.

**Prerequisites:** NRB536  
**Credit points:** 12  
**Contact hours:** 4 per week  
Campus: Gardens Point  
Teaching period: 2011 SEM-1

**NQB622 CONSERVATION BIOLOGY**

Conservation Biology is the application of ecological theory and principles to the problem of the maintenance of viable populations of rare, threatened or endangered species, or ecological systems. The unit integrates ecological and
genetic material covered in earlier units to provide an understanding of factors that enable the maintenance or enhancement of populations. The unit examines biodiversity and its determinants, the process of extinction, population viability analysis and the diagnosis and treatment of population declines, habitat fragmentation, metapopulation processes and the design of natural reserves, and conservation genetics.

**Prerequisites:** NQB321 or NRB311, and NQB422 or NRB410  
**Equivalents:** NRB611  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**NQB623 ECOLOGICAL SYSTEMS**
The science of ecology examines the distribution and abundance of organisms at a number of organisational levels from individuals to landscapes. At each of these levels there are separate and distinct attributes that require investigation and explanation. One important level of organisation is the ecosystem. An essential component of ecological studies is to examine these ecological systems and how they are shaped by the interaction between their constituent species and the physical environment. This unit builds on aspects animal and plant diversity and ecology covered in previous units to examine how the interrelationships between key physical, ecological, biological and geological processes shape ecological systems. The aim of this unit is to develop an understanding of the structure and function of terrestrial and aquatic ecosystems, and especially the processes that have shaped Australia's major ecological systems.

**Prerequisites:** NQB321 or NRB311  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**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 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**PQB251 WAVES AND OPTICS**
Wave phenomena are used to describe and explain many of the physical processes in the universe. Sound and light are the most commonly experienced of these and have far-reaching human applications, including their use as experimental tools for science. The study of wave phenomena has led to the development of quantum mechanics, a cornerstone of modern scientific thought. This first-level unit lays the foundation for discussion of wave phenomena in higher level studies, but will also be relevant to those not considering progressing to a Physics major but wishing to understand more of the Physical world in which we live.

**Assumed knowledge:** Senior Maths B is assumed knowledge.  
**Credit points:** 12  
**Contact hours:** 4.5 hours per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**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
PQB350 THERMODYNAMICS OF SOLIDS AND GASES
This unit provides students with an overview of the basic thermodynamic principles that describe how heat and other forms of energy are transported through matter in its solid and gaseous states. Through integrated lecture and practical classes, it provides students with a foundation for more advanced studies later in areas such as condensed matter physics and quantum mechanics. The three areas of study in this unit; thermodynamics, solid state physics and statistical physics; are essential core topics if students are considering postgraduate study in the physical sciences or professional employment as a physicist.

Prerequisites: (PQB250 or PCB250), and (MAB111 or MAB120 or MAB121)
Assumed knowledge: Students should enrol in MAB311 in the same semester if not already completed
Equivalents: PCB562
Credit points: 12
Contact hours: 4 per week
Campus: Gardens Point
Teaching period: 2011 SEM-1

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: MAB121 and MAB122
Equivalents: PCB563
Credit points: 12
Contact hours: 4 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: PCB361, PCB460
Credit points: 12
Contact hours: 4 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: POB331
Equivalents: PCB444
Credit points: 12
Contact hours: 4 per week
Campus: Gardens Point
Teaching period: 2011 SEM-2

PQB450 ENERGY, FIELDS AND RADIATION
The common theme of the topics covered in this unit is fields, the energy contained in these fields and the transfer of this energy. This theme is addressed in the specific topics of classical mechanics, electromagnetism and radiation physics. The classical mechanics and electromagnetism components build on material presented in introductory units and apply this to complex real world problems. The unit is designed to prepare students for more advanced studies in these areas but the unit will also provide a useful background for students undertaking a comajor in Physics or preparing for a career in secondary education.

Prerequisites: POB250 or PCB250, and MAB311
Equivalents: PCB362
Credit points: 12
Contact hours: 4 per week
Campus: Gardens Point
Teaching period: 2011 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: POB250 or PCB250
Antirequisites: PCB361, PCB460
Credit points: 12
Contact hours: 4 per week
Campus: Gardens Point
Teaching period: 2011 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.

**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**: PQB502 or PCB250 or PCB150
**Equivalents**: PCB469  
**Credit points**: 12  
**Contact hours**: 4 per week  
**Campus**: Gardens Point  
**Teaching period**: 2011 SEM-2

**PQB513 INSTRUMENTAL ANALYSIS**

TBA

**Prerequisites**: PQB312 or PCB414  
**Equivalents**: PCB514  
**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 substitutions 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**: PQB502, PCB442  
**Antirequisites**: PCB554  
**Credit points**: 12  
**Contact hours**: 4 per week  
**Campus**: Gardens Point  
**Teaching period**: 2011 SEM-1

**PQB550 QUANTUM AND CONDENSED MATTER PHYSICS**

TBA

**Prerequisites**: PQB350 and (MAB134 or MAB311)  
**Equivalents**: PCB561  
**Credit points**: 12  
**Contact hours**: 4 per week  
**Campus**: Gardens Point  
**Teaching period**: 2011 SEM-1

**PQB551 PHYSICAL ANALYTICAL TECHNIQUES**

Modern methods of physical analysis are an important tool for the physical scientist. This unit provides an introduction to the physical principles and applications in three fields of analysis: X-ray diffraction, analytical electron microscopy and physical spectroscopy. Each of these topics encompasses a variety of measurement techniques. The methodologies presented have wide application in a number of areas of science and technology including nanotechnology and materials research and development. Lectures are supplemented by laboratory practicals to enable students to gain familiarity and experience with the instrumentation.

**Prerequisites**: (PQB350 or PCB462) and (MAB112 or MAB122)  
**Equivalents**: PCB562  
**Credit points**: 12  
**Contact hours**: 4 per week  
**Campus**: Gardens Point  
**Teaching period**: 2011 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, PCB384  
**Antirequisites**: PCB584  
**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**: 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  

**PQB650 ADVANCED THEORETICAL PHYSICS**  
Advanced electromagnetism, magnetism of materials and magnetic resonance, and advanced statistical mechanics are the fundamental topics for any advanced-level Physics degree. They provide fundamental background knowledge and problem solving skills that are essential in any area of modern theoretical, experimental, and applied physics. This unit also provides you with an essential platform for further studies and research in physics and applied physics in Honours and at the post-graduate level. The aim of this unit is to provide you with an advanced understanding of fundamental physical phenomena related to electromagnetism and wave propagation, quantum and statistical basis of nuclear magnetism and magnetic resonance, statistical mechanics, quantum statistics, and general statistical thermodynamics.  
**Prerequisites:** (PQB350 or PCB462) and (PQB550 or PCB561)  
**Equivalents:** PCB665  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2  

**PQB651 EXPERIMENTAL PHYSICS**  
This unit represents the culmination of the students experiences in undergraduate experimental work. The unit is offered in the final year of study to take advantage of and integrate the skills acquired in previous units. The student is given the opportunity to select three experiments to be undertaken from a series of extended experiments in the areas of physics research undertaken at QUT.  
**Prerequisites:** PQB451 or PCB460  
**Equivalents:** PCB661  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-1 and 2011 SEM-2  

**PQB660 ASTROPHYSICS 2**  
Theoretical astrophysics and cosmology are at the forefront in developing comprehensive physical understanding of our world, including natural links between macro and micro processes in the Universe. This third level unit is one of the key units in the astrophysics co-major, that presents an advanced undergraduate course in modern theory of gravitation, space-time concept, cosmology, and their relationship with other areas of contemporary physics. You will be required to use the knowledge and skills developed in first and second level physics and maths units. This unit is the 'cap-stone' of the astrophysics co-major. The main aim of this course is to introduce you to one of the most challenging and exciting topics in modern physics - theory of gravitation and relativistic cosmology.  
**Prerequisites:** PQB250 or PCB250 or PCB150  
**Equivalents:** PCB669  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2  

**PQB684 FORENSIC ANALYSIS**  
This unit provides a theoretical and practical framework for forensic analysis and toxicology. It includes topics such as nature and abuse of drugs; introduction to pharmacology and toxicology; illicit drugs and trace evidence; the application of GC, MS and IR in forensic examination; examination of trace evidence. Substantial laboratory and workshop sessions complement the theory.  
**Prerequisites:** PQB513 or PCB514  
**Equivalents:** PCB684  
**Credit points:** 12  
**Contact hours:** 5 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 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:** 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

**SCB120 PLANT AND ANIMAL PHYSIOLOGY**

Regardless of which area of biology you decide to specialise in, you will need to understand the complex interactions between cells, tissues, organs and organ systems that comprise multi-cellular organisms. Although many living processes can be explained at the levels of biochemistry, biophysics and cell biology, a true understanding of complex, multicellular organisms requires integration of knowledge drawn from all of these areas, combined with the more complex physiological and structural levels you will learn about in this unit. The knowledge gained in this and other first level units provides you with the conceptual framework necessary to understand processes occurring from the cellular to the whole organism level and to higher levels of organisation.

**Prerequisites:** SCB112  **Equivalents:** NRB270  **Credit points:** 12  **Contact hours:** 4.5 per week  **Campus:** Gardens Point  **Teaching period:** 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

**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:** 2011 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  

**Campus:** Gardens Point  

**Teaching period:** 2011 SEM-1