Bachelor of Applied Science (Physics) (SC01)

Year offered: 2011
Admissions: Yes
CRICOS code: 003502J
Course duration (full-time): 3 Years
Course duration (part-time): 6 Years
Domestic Fees (indicative): 2011: CSP $2,178 per semester (indicative)
International Fees (indicative): 2011: $12,250 (indicative) per semester
Domestic Entry: February and July
International Entry: February and July* (Conditions apply for July entry)
QTAC code: 418011
Past rank cut-off: 77
Past OP cut-off: 12
OP Guarantee: Yes
Assumed knowledge: English (4, SA) and Maths B (4, SA)
Preparatory studies: For information on acquiring assumed knowledge visit http://www.qut.edu.au/assumed-knowledge
Total credit points: 288
Standard credit points per full-time semester: 48
Standard credit points per part-time semester: 24
Course coordinator: Dr Marion Bateson
Discipline coordinator: Dr Stephen Hughes
Campus: Gardens Point

Career Outcomes
Physicists are an asset to almost any industry. Employment areas of QUT physics graduates are very wide-ranging. These include research and development departments of large manufacturing companies, mining and exploration companies, research institutions such as the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Defence Science and Technology Organisation (DSTO), government bodies such as the Bureau of Meteorology, Environmental Protection Agencies and health departments, schools, universities and hospitals. Broad training in data analysis and problem-solving skills also make physicists well suited to management and consulting roles in a range of technology-based industries.

Professional Recognition
Graduates are eligible for membership of the Australian Institute of Physics (AIP).

Recommended Study
Maths C.

Physics Full-time Course Structure: First Semester Entry

<table>
<thead>
<tr>
<th>Year 1, Semester 1</th>
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<tbody>
<tr>
<td>SCB110 Science Concepts and Global Systems</td>
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<tr>
<td>SCB111 Chemistry 1</td>
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<tr>
<td>SCB112 Cellular Basis of Life</td>
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Plus ONE of:

MAB101 Statistical Data Analysis 1
MAB105 Preparatory Mathematics
MAB120 Algebra and Calculus
MAB121 Calculus and Differential Equations

NOTE:
1. Students with a Sound Achievement (4 semesters) in Maths A should enrol in MAB105
2. Students with a Sound Achievement in Maths B and NOT wishing to major in Physics should enrol in MAB101.
3. Students with a Sound Achievement in Maths C and wishing to major in Physics should enrol in MAB121.
4. Students without a Sound Achievement in Maths C and wishing to major in Physics should enrol in MAB120.

Year 1, Semester 2 (Physics Pre-Major Strand)

MAB122 Algebra and Analytic Geometry
PQB250 Mechanics and Electromagnetism
PQB251 Waves and Optics

Plus either:

MAB121 Calculus and Differential Equations
Or
MAB220 Computational Mathematics 1

Year 2, Semester 1

MAB311 Advanced Calculus
PQB350 Thermodynamics of Solids and Gases

Plus TWO other unit selected according to the second major requirements

Year 2, Semester 2 *

PQB450 Energy, Fields and Radiation
PQB451 Electronics and Instrumentation

Plus TWO other units selected according to the second major requirements
Year 3, Semester 1 *

PQB550  Quantum and Condensed Matter Physics
PQB551  Physical Analytical Techniques
   Plus TWO other units selected according to the second major requirements

Year 3, Semester 2 *

PQB650  Advanced Theoretical Physics
PQB651  Experimental Physics
   Plus TWO other units selected according to the second major requirements

Recommended Second Majors:
   Astrophysics, Mathematics

* Elective Unit for all Majors except Forensic Science:

SCB500  Industry Project

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

Physics Full-time Course Structure: Mid-Year Entry

Mid-Year (July) Entry

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

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

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

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

Year 1, semester commencing July

SCB111  Chemistry 1
SCB112  Cellular Basis of Life
   Plus either
MAB120  Algebra and Calculus
   Or
MAB121  Calculus and Differential Equations

Year 2, semester commencing February

MAB220  Computational Mathematics 1
SCB110  Science Concepts and Global Systems
   Plus either
MAB121  Calculus and Differential Equations
   Or
MAB122  Algebra and Analytic Geometry

Year 2, semester commencing July

PQB250  Mechanics and Electromagnetism
PQB251  Waves and Optics
   Plus either
MAB122  Algebra and Analytic Geometry
   Or
PQB451  Electronics and Instrumentation

Physics Part-time Course Structure

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

UNIT SYNOPSES

MAB101 STATISTICAL DATA ANALYSIS 1
Experiments, observational studies, sampling, and polls; data and variables; framework for describing and manipulating probability; independence; Binomial and Normal distributions; population parameters and sample statistics; concepts of estimation and inference; standard error; confidence intervals for means and proportions; tests of hypotheses on means and proportions (one sample and two independent samples); inference using tables of counts;
modelling relationships using regression analysis; model
diagnosis; use of statistical software.

**Antirequisites:** BSB123, EFB101, MAB141, MAN101,
MAB233  **Assumed knowledge:** Grade of at least Sound
Achievement in Senior Mathematics B (or equivalent) or
MAB105 is assumed knowledge.  **Credit points:** 12

**Contact hours:** 4 per week  **Campus:** Gardens Point

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

### MAB105 PREPARATORY MATHEMATICS

This unit is intended to cater for the needs of students
whose background in mathematics is either weak or does
not reach the equivalent of Senior Mathematics B. It is
intended to provide the concepts and skills needed for
successful study of those units within the university which
assume a background equivalent to Senior Mathematics B.
This unit is incompatible with a grade of High Achievement
in Senior Mathematics B. The aim of this unit is to develop
your mathematical skills in and understanding of algebra,
functions and graphing, differential and integral calculus of
one variable and to interpret and solve simple, real world
problems using these skills.

**Assumed knowledge:** Year 10 Level 6 Mathematics is
assumed knowledge  **Credit points:** 12  **Contact hours:**
4 per week  **Campus:** Gardens Point  **Teaching period:**
2011 SEM-1 and 2011 SEM-2

### MAB120 ALGEBRA AND CALCULUS

This unit introduces and reviews the elementary concepts of
function, calculus, matrices and vectors with special
reference to applications in science, technology and
business where appropriate. Topics covered include the
algebra of complex numbers, elementary functions
(polynomial, trigonometric, exponential and logarithmic) and
their properties, differentiation and integration methods and
principles, geometric and algebraic applications of vectors
and the solution of linear systems using matrices.

**Antirequisites:** MAN120  **Assumed knowledge:** Grade of
at least Sound Achievement in Senior Mathematics B (or equivalent) or
MAB105 is assumed knowledge  **Equivalents:** MAB100, MAB125, MAB180

**Credit points:** 12  **Contact hours:** 4 per week  **Campus:** Gardens Point

**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 SUM-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 in 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 B (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 SUM-2 and 2011 SUM

### 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
MAB311 ADVANCED CALCULUS
This unit includes the following: polar coordinates; parametric equations; conic sections; quadric surfaces; vector-valued functions; Fourier series; functions of several variables; graphs; partial derivatives; total derivatives; extrema; Lagrange multipliers; Taylor series for multivariable functions; double and triple integrals; Green's theorems; line and surface integrals; divergence theorem; Stoke's theorem; applications.
Prerequisites: (MAB111 or MAB121) and (MAB112 or MAB122) Credit points: 12 Contact hours: 4 per week
Campus: Gardens Point Teaching period: 2011 SEM-1

PQB250 MECHANICS AND ELECTROMAGNETISM
The experimental means by which we have arrived at our modern understanding of the universe is central to the scientific philosophy. Students of physics and physics related areas need to possess skills in quantitative handling, processing, communication and evaluation of data. Higher level studies in specialised areas of Physics require a familiarity with a range of fundamental topics in Physics and an ability to apply critical thinking and advanced mathematical techniques to the analysis and solution of Physical problems. This first-level unit lays the foundation for these higher level studies by introducing the fundamental topic areas of mechanics and electromagnetism.
Assumed knowledge: Senior Maths B is assumed knowledge. Credit points: 12 Contact hours: 4.5 hours per week
Campus: Gardens Point Teaching period: 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

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) Corequisites: MAB311 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

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: QB250 or QB250, 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: QB250 or QB250 Antirequisites: PCB361, PCB460 Credit points: 12 Contact hours: 4 per week
Campus: Gardens Point Teaching period: 2011 SEM-2

PQB550 QUANTUM AND CONDENSED MATTER PHYSICS
TBA
Prerequisites: QB350 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

**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 in 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

**SCB110 SCIENCE CONCEPTS AND GLOBAL SYSTEMS**

You will undertake interdisciplinary study of the physical, geological and biological concepts relating to the origins of life; from the creation of matter and planets, to the emergence of life in all its complexity, culminating in evolution of earth ecosystems. Human influences, overlaid upon earth's complex systems, will be examined as to their type, extent, and impact. In counterpoint, you will explore the breadth of philosophical developments underlying our search for knowledge; fundamental thoughts and ideas that span the last 2,500 years of human history. Ultimately, these concepts evolved through the development of a scientific method and we explore its workings in relation to the ongoing enterprise of human understanding.

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

**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

**SCB500 INDUSTRY PROJECT**

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

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