Bachelor of Engineering (Aerospace Avionics) (EN40)

Year offered: 2010
Admissions: Yes
CRICOS code: 056529D
Course duration (full-time): 4 years
Domestic fees (indicative): 2010: CSP $3,800 (indicative) per semester
International Fees (indicative): 2010: $12,000 (indicative) per semester
Domestic Entry: February and July
International Entry: February and July
QTAC code: 412502
Past rank cut-off: 79
Past OP cut-off: 11
OP Guarantee: Yes
Assumed knowledge: English (4, SA) and Maths B (4, SA)
Preparatory studies: For information on acquiring assumed knowledge visit http://www.studentservices.qut.edu.au/apply/ug/info/knowledge.jsp
Total credit points: 384
Standard credit points per full-time semester: 48
Course coordinator: Dr R. Mahalinga-Iyer
Discipline coordinator: Dr Felipe Gonzalez
Campus: Gardens Point

Why choose this course?
The Bachelor of Engineering (Aerospace Avionics) is a unique course in Australia.

Career outcomes
As an Aerospace Avionics graduate you will be involved in leading edge technology in an international industry. There are career opportunities with government bodies, the Defence Forces, aerospace and aeronautical companies.

Practical teaching
You will be involved in real world hands-on activities such as; building a satellite; a flight simulator; a UAV (Unmanned Aerial Vehicle); a guided rocket

Industry links
The course has close links with relevant local and overseas industries. Many of the teaching staff are involved in research with government and industry sectors, ensuring the program is relevant to industry and giving you the opportunity to work on real projects during your studies.

Course structure
You will learn about aerodynamics, aircraft control systems, avionics navigation, satellite technology and communication systems.

Facilities / technology
You will have first-hand experience of the latest technologies used in the industry. Experiential and practical learning opportunities are provided through specially designed learning environments that integrate virtual and web-based material with physical equipment to ensure that you have the opportunity to learn by doing which is an important part of engineering education.

Convenience
You will study at QUT's Gardens Point campus in the centre of Brisbane, within easy walking distance to public transport, including buses, trains and ferries.

Who should do this course?
If you are interested in any of the following, you may enjoy a career in Aerospace Avionics:
- how things work
- space and flight
- technology and electronics

Recommended Study
Chemistry, Math C and Physics.

Career Outcomes
Aerospace Engineers are involved in the design, development, manufacture and maintenance work on aeroplanes, helicopters, spacecraft and satellites. Graduates are employed by the RAAF, RAN and by government bodies such as the Defence Research Centres and the Civil Aviation Authority. There are also career opportunities with aerospace companies, aircraft maintenance and aeronautical consulting services. Opportunities outside aerospace also exist in the areas of electronics, process control, instrument manufacture and automotive equipment.

Overview
Students study aerodynamics, aircraft control systems, avionics navigation and communication. In later years of the degree, specialist study is undertaken in design of aircraft and satellite systems including systems engineering methodology, aircraft and satellite technology and applications. As many of the teaching staff are involved in relevant research with government and industry sectors, students have the opportunity to work on real projects during their studies.
Professional Recognition
Full professional accreditation from Engineers Australia has been given for this course.

Minors
For professional recognition you will undertake an Applications minor which consists of a Work Place Integrated Learning unit, a project unit and two specialised engineering units.

Special Course Requirements
Students must complete 60 days approved industrial experience in an engineering environment, including 10 days specialist experience in the avionics industry as part of the Work Integrated Learning unit.

International Student Entry
International students must maintain an enrolment program that will allow them to complete their course within the specified timeframe of their eCoE (electronic Confirmation of Enrolment).

Deferment
QUT allows current Year 12 school leavers to defer their undergraduate admission offer for one year, or for six months if offered mid-year admission, except in courses using specific admission requirements such as questionnaires, folios, auditions, prior study or work experience.

Non-year 12 students may also request to defer their QTAC offer on the basis of demonstrated special circumstances.

Find out more on deferment.

Further Information
School of Engineering Systems - Phone +61 7 3138 1993, Fax +61 7 3138 1516, email: bee.enquiries@qut.com

Full-time Course structure - Students commencing February 2010 onwards (Years 2 - 4)

Please Note:
For 1st year enrolment program please refer to EN40 Bachelor of Engineering course entry.

Year 2 - Semester 1 (to be introduced in 2011)

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>ENB240</td>
<td>Introduction To Electronics</td>
</tr>
<tr>
<td>ENB246</td>
<td>Engineering Problem Solving</td>
</tr>
<tr>
<td>ENB250</td>
<td>Electrical Circuits</td>
</tr>
<tr>
<td>MAB127</td>
<td>Mathematics for Engineering 2</td>
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Year 2 - Semester 2 (to be introduced in 2011)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>ENB121</td>
<td>Aerodynamics</td>
</tr>
<tr>
<td>ENB242</td>
<td>Introduction To Telecommunications</td>
</tr>
<tr>
<td>ENB243</td>
<td>Linear Circuits and Systems</td>
</tr>
<tr>
<td>ENB244</td>
<td>Microprocessors and Digital Systems</td>
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Year 3 - Semester 1 (to be introduced in 2012)

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<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>ENB241</td>
<td>Software Systems Design</td>
</tr>
<tr>
<td>ENB342</td>
<td>Signals, Systems and Transforms</td>
</tr>
<tr>
<td>ENB348</td>
<td>Aircraft Systems and Flight Control</td>
</tr>
<tr>
<td>ENB354</td>
<td>Introduction To Systems Design</td>
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Year 3 - Semester 2 (to be introduced in 2012)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>ENB343</td>
<td>Fields, Transmission and Propagation</td>
</tr>
<tr>
<td>ENB347</td>
<td>Modern Flight Control Systems</td>
</tr>
<tr>
<td>ENB355</td>
<td>Advanced Systems Design</td>
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<tr>
<td>MAB233</td>
<td>Engineering Mathematics 3</td>
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OR

Year 4 - Semester 1 (to be introduced in 2013)

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<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>BEB801</td>
<td>Project 1</td>
</tr>
<tr>
<td>ENB346</td>
<td>Digital Communications</td>
</tr>
<tr>
<td>ENB440</td>
<td>RF and Applied Electromagnetics</td>
</tr>
<tr>
<td>ENB451</td>
<td>Aerospace Radio and Radar Systems</td>
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Year 4 - Semester 2 (to be introduced in 2013)

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>BEB701</td>
<td>Work Integrated Learning 1</td>
</tr>
<tr>
<td>BEB802</td>
<td>Project 2</td>
</tr>
<tr>
<td>ENB357</td>
<td>Spacecraft Guidance and Control</td>
</tr>
<tr>
<td>ENB447</td>
<td>Navigation Systems For Aircraft</td>
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Aerospace Avionics Selectives

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<tr>
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<tbody>
<tr>
<td>ENB344</td>
<td>Industrial Electronics</td>
</tr>
<tr>
<td>ENB448</td>
<td>Signal Processing and Filtering</td>
</tr>
<tr>
<td>ENB457</td>
<td>Controls, Systems and Applications</td>
</tr>
<tr>
<td>INB270</td>
<td>Programming</td>
</tr>
</tbody>
</table>

Full-time Course structure - Students commencing Mid-Year 2010 (Years 2 - 5)

Please Note:
For 1st year enrolment program please refer to
EN40 Bachelor of Engineering course entry.

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<td>ENB250 Electrical Circuits</td>
</tr>
<tr>
<td>MAB127 Mathematics for Engineering 2</td>
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<td>MAB233 Engineering Mathematics 3</td>
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<tr>
<th>Year 2 - Semester 2 (to be introduced in 2011)</th>
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<tbody>
<tr>
<td>ENB150 Introducing Engineering Design</td>
</tr>
<tr>
<td>ENB200 Introducing Sustainability</td>
</tr>
<tr>
<td>ENB242 Introduction To Telecommunications</td>
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<tr>
<td>ENB243 Linear Circuits and Systems</td>
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<td>ENB355 Advanced Systems Design</td>
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<td>ENB346 Digital Communications</td>
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<tr>
<td>ENB348 Aircraft Systems and Flight Control</td>
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<td>MAB233 Engineering Mathematics 3</td>
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<tr>
<td>OR Selective</td>
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<table>
<thead>
<tr>
<th>Year 4 - Semester 2 (to be introduced in 2013)</th>
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<tbody>
<tr>
<td>BEB801 Project 1</td>
</tr>
<tr>
<td>ENB347 Modern Flight Control Systems</td>
</tr>
<tr>
<td>ENB357 Spacecraft Guidance and Control</td>
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<tr>
<th>Year 5 - Semester 1 (to be introduced in 2014)</th>
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<tbody>
<tr>
<td>BEB701 Work Integrated Learning 1</td>
</tr>
<tr>
<td>BEB802 Project 2</td>
</tr>
<tr>
<td>ENB451 Aerospace Radio and Radar Systems</td>
</tr>
</tbody>
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Aerospace Avionics Selectives
- ENB344 Industrial Electronics
- ENB448 Signal Processing and Filtering
- ENB457 Controls, Systems and Applications
- INB270 Programming

Potential Careers:
- Aerospace Avionics Engineer, Electrical and Computer Engineer, Electrical Engineer, Engineer.

UNIT SYNOPSISES

**BEB701 WORK INTEGRATED LEARNING 1**
This unit aims to provide you with the opportunity to learn in a workplace environment. It will involve attendance, participation, observation, critical reflection, and report writing on workplace activities. The emphasis of your critical reflection and report writing will be on identifying and describing aspects of professional relevance incorporating: collaboration and teamwork; workplace, health and safety; professional conduct; ethical responsibility, and other aspects of your workplace experience.

This unit may form part of your (compulsory) course core (as required by professional accrediting bodies e.g. Engineers Australia, Australian Institute of Building, Royal Institution of Chartered Surveyors), or it may be one of several work integrated learning (WIL) units (selected as part of a Minor).

**Prerequisites:** 192cp of completed studies  
**Credit points:** 12  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1, 2010 SEM-2 and 2010 SUM

**BEB801 PROJECT 1**
This unit is usually taken in the final year of study. Students complete an individual project involving the application of skills and knowledge attained during the earlier years of their degree program. For some students, this unit will be taken one of two ‘project’ units related to the same student project; in such cases this unit may be a pre-requisite or co-requisite to the second unit (or a follow-on from the first unit). The final ‘deliverable’ for this unit may vary for each discipline and details will be provided in lectures/tutorials and on the Blackboard website.

**Equivalents:** CEB411, CEB420, CNB434, EEB781-1, EEB889-1  
**Credit points:** 12  
**Contact hours:** 2 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1 and 2010 SEM-2

**BEB802 PROJECT 2**
This unit is usually taken in the final year of study, and is only taken by students completing a two unit project. Students complete an individual project involving the
application of skills and knowledge attained during the earlier years of their degree program. This unit will be taken as the second of two 'project' units related to the same student project.

**ENB121 AERODYNAMICS**
This unit includes the following: introductory concepts of fluid mechanics and thermodynamics; conservation of mass, energy and momentum, state properties of fluids, the standard atmosphere; dimensional analysis; experimental aerodynamics and aerodynamic coefficients; Reynolds number and Mach number effects; estimation aerodynamic forces and moments; fundamentals of aircraft performance; estimating range and endurance; take off and landing calculations; flight envelopes.

**Assumed knowledge:** MAB126 or MAB180 or MAB131, and ENB101 or ENB110 is assumed knowledge.

**Equivalents:** MMB251  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-2

**ENB150 INTRODUCING ENGINEERING DESIGN**

**Assumed knowledge:** ENB110 is assumed knowledge.

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

**ENB200 INTRODUCING SUSTAINABILITY**

This unit will enable you as a graduating Built Environment and Engineering professional to take active and positive steps to transform professional practice in ways that promote the sustainability of our planet, our economy and our society. As future professionals in the fields of Design, Urban Development and Engineering Systems, you will need to understand and apply the concepts of sustainability in your professional practice if we are to achieve sustainable development in the 21st Century.

**Credit points:** 12  
**Campus:** Gardens Point

**ENB240 INTRODUCTION TO ELECTRONICS**
Module Electronics A provides a basic understanding of the characteristics and operation of discrete semiconductor components. Electronic circuit design is introduced with emphasis on the small signal low and high frequency response of those circuits. Module Digital Electronics gives students a good grounding in the basic principles of digital design, with particular regard to the fundamentals of digital number systems, Boolean algebra, combinational and sequential logic design.

**Prerequisites:** ENB103 or ENB120  
**Equivalents:** EEB312  
**Credit points:** 12  
**Contact hours:** 5 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1

**ENB241 SOFTWARE SYSTEMS DESIGN**
The unit introduces students to Software Engineering by considering a whole Software Lifecycle. Each step of the lifecycle is treated in detail, such as concept phase, requirement definition, software design, human-computer interaction, implementation, audits, and maintenance. Software design principles and techniques are presented as well as real-time system design. CASE development tools are briefly introduced as well as object oriented programming for which a structured Object Oriented Analysis and Design are considered.

**Prerequisites:** ENB246 or INB104  
**Equivalents:** EEB612  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-2

**ENB242 INTRODUCTION TO TELECOMMUNICATIONS**
Telecommunications systems and the principles underlying their operations are introduced starting from mathematical preliminaries such as the Fourier series and the Fourier transform. Analogue modulation techniques (AM and FM), systems and circuits for generation and demodulation, analogue to digital conversion, pulse modulation and baseband digital data communication techniques are studied using time and frequency domain analyses.

**Prerequisites:** (ENB120 or ENB103) and (MAB126 or MAB110 or MAB111)  
**Equivalents:** EEB340  
**Credit points:** 12  
**Contact hours:** 3 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1

**ENB243 LINEAR CIRCUITS AND SYSTEMS**
Network analysis; Laplace transform of signals and transfer functions of systems, time and frequency responses of linear circuits, feedback configurations and transfer functions, analyse and designing analogue systems using transistors and operational amplifiers, designing and synthesising analogue filters, signal conditioning.

**Prerequisites:** ENB120 and MAB126  
**Assumed knowledge:** ENB240 is assumed knowledge.  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-2

**ENB244 MICROPROCESSORS AND DIGITAL SYSTEMS**
This unit covers the basis for electronic circuit design in general but also in connection with microprocessor systems, theory and design of advanced embedded digital systems and practical implementation. The practical application of these circuits including interfacing and environment factors will be considered.

**Prerequisites:** ENB240  
**Assumed knowledge:** ENB246 or INB104 is assumed knowledge.  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-2
ENB246 ENGINEERING PROBLEM SOLVING
This unit introduces students to the use of computers as tools for solving engineering problems. MATLAB is introduced as a numerical computing environment with the capacity to support complex mathematics and to be programmed to solve specific engineering problems. Standalone application development using C++ is introduced as a means of exposing students to the high and low level computer programming concepts that are necessary to the implementation of engineering solutions in hardware specific programming environments.
Assumed knowledge: MAB126 or MAB180 or MAB131, and ENB103 or ENB120 is assumed knowledge. Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2010 SEM-1

ENB250 ELECTRICAL CIRCUITS
This unit introduces you to electrical circuit analysis. It shows how to determine the transient and steady state solution in single and three phase circuits as well as the interaction of fluxes and currents in transformers and electrical machines.
Prerequisites: ENB120 Antirequisites: ENB103 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point

ENB342 SIGNALS, SYSTEMS AND TRANSFORMS
The unit covers the area of Signals in Linear Systems for which a detailed study of Fourier theory applied to both analogue and discrete-time signals and to the analysis of linear systems will be given. Systems will be represented in time as well as in frequency and various characteristics and relationships in the two domains will be discussed. The students will be introduced to the fundamentals of analogue and discrete-time signal processing; analogue and discrete Fourier transform; linear and discrete convolution. Finally, the students will learn the fundamentals of digital filter design and implementation, with examples and applications arising from various disciplines.
Prerequisites: ENB242 Assumed knowledge: ENB243 and ENB246 are assumed knowledge. Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2010 SEM-1

ENB343 FIELDS, TRANSMISSION AND PROPAGATION
Fundamental concepts of static and time varying electromagnetic fields; Maxwell's equations and the characteristics of their solution, such as wave equations, losses in various media and energy flow; numerical methods; transmission line theory, terminated line, Smith Circle Chart usage and lattice diagram; propagation modes in waveguides and optical fibre; free-space propagation, reflection, refraction, diffraction; basic antenna theories and antenna parameters, Frii's transmission equation, half-wave dipole, two-element array.

Prerequisites: ENB103 or ENB250 Assumed knowledge: MAB127 or MAB182 or MAB132 is assumed knowledge. Equivalents: EEB641 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2010 SEM-1

ENB344 INDUSTRIAL ELECTRONICS
The unit gives a basic understanding of linear and switching applications in industrial electronics. Practical knowledge associated with interfacing and design is developed. Students will also study the theory and design of advanced digital embedded systems as well as the practicalities associated with implementation. It also covers power rectification, controlled rectification, inverters, AC and DC drives, uninterruptible power supplies and power switching components.
Prerequisites: ENB240 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2010 SEM-2

ENB346 DIGITAL COMMUNICATIONS
Revolutionary developments in the field of Digital Communication Technology have enabled improvement in the characteristics of communication systems in order to meet the performance requirements for transmission of information for private, business and industrial applications. This unit which covers Elements of a Digital Communication System aims at providing the students with an in-depth understanding of the theory and applications of digital communication systems and technology.
Prerequisites: ENB342 Assumed knowledge: MAB233 is assumed knowledge. Equivalents: EEB560 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2010 SEM-2

ENB347 MODERN FLIGHT CONTROL SYSTEMS
The modules of this unit are Control Systems B and Flight Control Systems. The unit provides students with an understanding of control system design and analysis for discrete time control systems as well as using the state space approach. Furthermore, it introduces students to different aspects of flight control including factors affecting the performance and simulation. Specific topics such as artificial stability and MILSTDs are also covered.
Prerequisites: ENB348 Equivalents: EEB535 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2010 SEM-2

ENB348 AIRCRAFT SYSTEMS AND FLIGHT CONTROL
The modern aircraft is an extremely complex machine comprised of many systems. These systems include propulsion, engine management, flight management, flight control, navigation, and life support and flight data recorders. The safe and reliable operation of all these systems is required to conduct a single flight. The modern
avionics engineer requires an understanding of all these systems and how they operate on modern civil and military aircraft. This unit places emphasis on the flight control systems of modern aircraft which is one of the primary sub-systems. As part of this, methods for modelling the dynamic behaviour of aircraft, missiles and spacecraft are introduced, along with the criteria for stability. 

**Prerequisites:** MAB127 or MAB182 or MAB132 
**Assumed knowledge:** ENB121 and ENB140 are assumed knowledge.  
**Equivalents:** EEB431 
**Credit points:** 12 
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1

### ENB354 INTRODUCTION TO SYSTEMS DESIGN

Introduction systems engineering methodologies and techniques as applied to Aerospace Engineering projects. The students receive formal lectures and apply the knowledge gained to a specific case study or mini project.  
**Equivalents:** EEB585 
**Credit points:** 12 
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1

### ENB355 ADVANCED SYSTEMS DESIGN

Students apply the systems engineering documentation and specifications developed in ENB345 Introduction to Systems Design and complete the project to the final systems engineering review stage.  
**Prerequisites:** ENB354 
**Equivalents:** EEB685 
**Credit points:** 12 
**Contact hours:** 2 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-2

### ENB357 SPACECRAFT GUIDANCE AND CONTROL

**Assumed knowledge:** MAB127 or MAB182 or MAB132 are assumed knowledge.  
**Credit points:** 12 
**Campus:** Gardens Point

### ENB440 RF AND APPLIED ELECTROMAGNETICS

This unit addresses the following: lumped and distributed microwave and RF circuits, including [y], [t] and [s] parameters; impedance matching techniques; passive and active microwave devices; RF circuit design techniques; microwave and RF measurement techniques; linear antennas and microwave antennas; analysis and synthesis of antenna arrays; specialised antennas and antenna measurements; EMC definition, standards and regulations; test plan; measurements; interference coupling; susceptibility; EMC design techniques, component selection, circuit layouts, grounding, shielding, filters, suppressors, isolation and safety; EMC management; propagation of electromagnetic fields in electrical materials; application of numerical methods.  
**Prerequisites:** ENB343 
**Antirequisites:** ENB445 
**Assumed knowledge:** ENB242 and ENB244 are assumed knowledge.  
**Equivalents:** EEB961 
**Credit points:** 12 
**Contact hours:** 5 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1

### ENB447 NAVIGATION SYSTEMS FOR AIRCRAFT

Modern aviation continues to flourish, with millions of passenger miles flown each year throughout the world and in all kinds of weather condition. Safe and reliable navigation is one of the primary functions that enable these flights. In past years pilots navigated visually but this relied on fair weather conditions. Today pilots use navigation aids to allow navigation in all types of weather conditions day or night. This unit presents the principles and practices of modern navigation sensors and systems. To be a competent Avionics Engineer, a detailed knowledge of the principles of navigation is mandatory. Navigation is a fundamental building block for all aspects of aerospace projects.  
**Prerequisites:** MAB127 or MAB182 or MAB132 
**Assumed knowledge:** ENB343 and ENB346 are assumed knowledge.  
**Equivalents:** EEB835 
**Credit points:** 12 
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-2

### ENB448 SIGNAL PROCESSING AND FILTERING

This unit gives a comprehensive introduction to the representation and processing of signals distorted or corrupted by noise, and the systems needed to process them. Techniques for estimating signal parameters for the detection of signals in the presence of noise will be discussed. The methods presented will be tested on real data drawn from different engineering applications, such as wireless communications, biomedical EEG signals and brain models, speech and music synthesis, and radars.  
**Prerequisites:** ENB342 
**Assumed knowledge:** MAB233 is assumed knowledge.  
**Equivalents:** EEB941 
**Credit points:** 12 
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-2

### ENB451 AEROSPACE RADIO AND RADAR SYSTEMS

This unit includes a thorough treatment of the elements of radio and radar systems, ground, air and space based. This is a highly technical unit and an emphasis will be put on the solution of technical problems and the knowledge required to solve these problems. Electromagnetic Compatibility and Electromagnetic Interference principles are covered in detail. Analysis of antennas, modulation techniques, amplifiers and filtering techniques for radio, as well as, types of radar and applications, Mechanisms for Ranging, Doppler Radar and Receiver Processing are some of topics addressed.  
**Prerequisites:** ENB343 
**Equivalents:** EEB760 
**Credit points:** 12 
**Contact hours:** 3 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1

### ENB457 CONTROLS, SYSTEMS AND APPLICATIONS
Control systems are playing an increasingly important role in process control, energy management and utility management. This unit is concerned with the application of advanced control systems with an emphasis on physical architectures and implementations. Topics covered include control system actuators, sensors and controllers, control system architectures, human machine interfacing, adaptive control strategies and intelligent control.

**Prerequisites:** ENB301  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-2

**INB270 PROGRAMMING**

This unit aims to give you a positive introduction to the skills required in solving computational problems and implementing solutions in a programming or scripting language. Although some theoretical aspects of computer programming are introduced briefly, the overall emphasis of the unit is programming practice. The unit emphasises generic programming concepts and related problem-solving strategies. The skills you learn in this unit will be applicable to a wide variety of commonly-used, industrially-significant programming and scripting languages.

**Prerequisites:** INB104 or ENB246  
**Antirequisites:** ITB003, ITB112, ITB411, INN270  
**Credit points:** 12  
**Contact hours:** 3 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-2

**MAB127 MATHEMATICS FOR ENGINEERING 2**

This unit extends the areas of function, calculus, matrices and vectors introduced in MAB125 by introducing functions of more than one variable, partial derivatives and multiple integrals, vector valued functions, and matrix methods for the solution of systems of ordinary differential equations. Each of these topics is realised by contextualised engineering related problems.

**Assumed knowledge:** Grade of at least Sound Achievement in Senior Mathematics C (or equivalent) or MAB125 or MAB120 or MAB131 or MAB182 is assumed knowledge  
**Equivalents:** MAB112, MAB122, MAB132  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1, 2010 SEM-2 and 2010 SUM

**MAB233 ENGINEERING MATHEMATICS 3**

This unit is mostly introductory statistics for engineering but also includes a small component on foundations of computational mathematics. Statistics includes: the planning, execution, analysis and reporting of data investigations; use of a statistical package; modelling data; relationships between variables; estimation; confidence intervals; tolerance limits; hypothesis testing; fitting and investigating relationships; regression; design and analysis of experiments; risk; random variables; special distributions; linear combinations of correlated variables; reliability. The introduction to computational mathematics includes: function approximation; polynomial interpolation; numerical solution of ordinary differential equations.

**Prerequisites:** MAB131 or MAB182 or MAB121 or MAB126 or MAB127  
**Antirequisites:** BSB123  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Gardens Point  
**Teaching period:** 2010 SEM-1