Bachelor of Engineering (Medical) (EN40)

Year offered: 2011
Admissions: Yes
CRICOS code: 056529D
Course duration (full-time): 4 years
Domestic Fees (indicative): 2011: CSP $3,878 (indicative) per semester
International Fees (indicative): 2011: $12,375 (indicative) per semester
Domestic Entry: February and July
International Entry: February and July
QTAC code: 412502
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 R. Mahalinga-Iyer
Discipline coordinator: Dr Gary Chadwick
Campus: Gardens Point

Why choose this course?
The Bachelor of Engineering (Medical) will provide with the skills to design, manufacture, install, monitor and maintain medical and surgical equipment and to provide advice on engineering matters to medical and allied staff.

Career outcomes
As a graduate of this degree you may find employment in a hospital as an advisor to health and medical professionals, in a firm concerned with the design, manufacture, supply and maintenance of medical, health and sporting equipment, an occupational health agency or in a research institution.

Practical teaching
High quality teaching and technical staff will provide you with the skills to design, manufacture, install, monitor and maintain medical and surgical equipment and to provide advice on engineering matters to medical and allied staff.

Industry links
The academic staff collaborate with clinicians and surgeons from local hospital departments. You will be given the opportunity to undertake Hands-on activities such as hospital and industry site visits, industry-based projects and work experience.

Course structure
As part of your studies you will undertake industrial experience in a medical engineering environment.

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 Medical Engineering:

- Design
- Problem solving
- Mathematics and physics

Recommended Study
Chemistry, Maths C and Physics.

Professional Recognition
Full professional accreditation from Engineers Australia has been given for this course.

Special Course Requirements
Students must obtain at least 60 days of industrial employment in an engineering environment as part of the Work Integrated Learning unit. Half of this experience must be in an industry related to Biomedical Engineering.

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

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
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.

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.

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)
- ENB211 Dynamics
- ENB212 Strength of Materials
- LSB131 Anatomy
- MAB127 Mathematics for Engineering 2
  OR
- MAB233 Engineering Mathematics 3

Year 2 - Semester 2 (to be introduced in 2011)
- ENB205 Electrical and Computer Engineering
- ENB215 Fundamentals of Mechanical Design
- ENB221 Fluid Mechanics
- LSB231 Physiology

Year 3 - Semester 1 (to be introduced in 2012)
- ENB222 Thermodynamics 1
- ENB231 Materials and Manufacturing 1
- ENB311 Stress Analysis
- ENB319 Biomechanical Engineering Design

Year 3 - Semester 2 (to be introduced in 2012)
- ENB313 Automatic Control
- ENB318 Biomechanical Engineering Systems
- ENB338 Biomaterials
- ENB322 Biofluids

Year 4 - Semester 1 (to be introduced in 2013)
- BEB801 Project 1
- ENB335 Modelling and Simulation For Medical Engineers
- ENB432 Engineering Asset Management and Maintenance
- MAB233 Engineering Mathematics 3
  OR
  Selective

Year 4 - Semester 2 (to be introduced in 2013)
- BEB701 Work Integrated Learning 1
- BEB802 Project 2
- ENB437 Health Legislation in the Medical Environment
- PCB605 Biomedical Instrumentation

Medical Engineering Selectives
- BSB115 Management
- MAB220 Computational Mathematics 1
- HMB384 Injury Prevention and Rehabilitation
- MAB422 Mathematical Modelling
- PCB593 Digital Image Processing
- PCN112 Medical Imaging Science
- PCN211 Physics of Medical Imaging
- PUB112 Workplace Health and Safety
- PYB100 Foundation Psychology
- SCB384 Forensic Sciences - From Crime Scene to Court

Potential Careers:
Biomechanical Engineer, Biomedical Engineer, Engineer, Mechanical Engineer.

UNIT SYNOPSES

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; work place, health and safety; professional conduct; ethical responsibility, and other aspects of your work place 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).
Assumed knowledge: This unit is not designed for first year students. It is recommended that you check WIL Community Blackboard site for information on enrolment.
pattern. If you are EN40 student you can only enrol after completing a minimum of 192 cp.  

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

BE801 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: 2011 SEM-1 and 2011 SEM-2

BE802 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.  

Equivalents: CEB415, EEB782-2, EEB889-2 Credit points: 12  Contact hours: 2  
Campus: Gardens Point  
Teaching period: 2011 SEM-1 and 2011 SEM-2

BSB115 MANAGEMENT  
The unit provides an introduction to the theories and practice of management and organisations. Emphasis is on the conceptual and people skills that are needed in all areas of management and in all areas of organisational life. The unit acknowledges that organisations exist in an increasingly international environment where the emphasis will be on knowledge, the ability to learn, to change and to innovate. Organisations are viewed from individual, group, corporate and external environmental perspectives.  

Antirequisites: BSD115  
Equivalents: BSX115, CTB115  
Credit points: 12  Contact hours: 3 per week  
Campus: Gardens Point and Caboolture  
Teaching period: 2011 SEM-1, 2011 SEM-2 and 2011 SUM-1

ENB205 ELECTRICAL AND COMPUTER ENGINEERING  
This unit introduces single and three phase power, electrical machines, principles of transformers, electronic circuits and sensors, filters, operational amplifier applications. It also covers computing fundamentals, programming in MATLAB and Excel using applications in electrical and computer engineering.  

Prerequisites: ENB120 or ENB103  
Credit points: 12  
Contact hours: 4 per week  
Campus: Gardens Point  
Teaching period: 2011 SEM-2

ENB211 DYNAMICS  
Fundamental equations of particle kinetics; energy, power, impulse and momentum; kinematics of rigid bodies in plane motion, relative motion and motion relative to rotating axes; kinetics of rigid bodies, Basic machine components, (Gears, clutches, brakes etc.), Single degree of freedom system.  

Prerequisites: (MAB126 or MAB180 or MAB131) and (ENB130 or PCB136 or PCB150)  
Assumed knowledge: ENB110 or ENB101 are assumed knowledge.  
Equivalents: MMB112 Credit points: 12  Contact hours: 4 per week  
Campus: Gardens Point  
Teaching period: 2011 SEM-1

ENB212 STRENGTH OF MATERIALS  
This unit introduces the analysis of stress and strain in simple engineering components and systems such as uniaxial and bending stresses, deflection of beams, torsion, thin walled structures, combined loading, yield criteria, and introduces the finite element method (FEA).  

Prerequisites: ENB110 or ENB101 and ENB104  
Credit points: 12  Contact hours: 5 per week  
Campus: Gardens Point  
Teaching period: 2011 SEM-1

ENB215 FUNDAMENTALS OF MECHANICAL DESIGN  
Basic procedures of design, design for sustainability, universal design, Concept development, creative problem solving, Basic component design, computational scheme in design, manufacture & materials.  

Assumed knowledge: MAB126 or MAB180 or MAB131, and ENB101 or ENB110, and ENB104 or ENB110 are assumed knowledge.  
Equivalents: MMB281  
Credit points: 12  Contact hours: 5 per week  
Campus: Gardens Point  
Teaching period: 2011 SEM-2

ENB221 FLUID MECHANICS  
This unit introduces the basic concepts of fluid mechanics and applies them to some simple engineering problems.  

Assumed knowledge: MAB126 or MAB180 or MAB131, and ENB101 or ENB110 are assumed knowledge.  
Credit points: 12  Contact hours: 4 per week  
Campus: Gardens Point  
Teaching period: 2011 SEM-2

ENB222 THERMODYNAMICS 1  
Thermodynamic behaviour of substances; theory and application of the 1st and 2nd laws of thermodynamics; thermodynamic cycles, including gas cycles, vapour power cycles and refrigeration cycles; gas-vapour mixtures and the principles of air-conditioning; fuels and combustion.  

Assumed knowledge: MAB127 or MAB182 or MAB132, and ENB130 or PCB136 are assumed knowledge.  
Credit points: 12  Contact hours: 4 per week  
Campus:
ENB231 MATERIALS AND MANUFACTURING 1
Materials and their engineering applications, Manufacturing systems and technology, material properties and manufacturing, material selection, failure, graphical communication.
Assumed knowledge: ENB104 or ENB110 is assumed knowledge. Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2011 SEM-1

ENB311 STRESS ANALYSIS
Further analysis of stress and strain; torsion of prismatic sections and thin-walled sections; axisymmetric problems; energy methods; thin plates. Introduction to FEA including the use of a FEA software.
Prerequisites: ENB102 or ENB212 Equivalents: MMB212 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2011 SEM-1

ENB313 AUTOMATIC CONTROL
This unit introduces you to the theory and practice of control systems engineering. The unit introduces system modelling principles for mechanical, electrical and electromechanical systems, using the Laplace transform to build transfer-function models of system components. The unit emphasizes the practical application of control theory to the analysis and design of feedback systems to ensure stability, reduce steady state errors and improve transient response.
Prerequisites: ENB211 Antirequisites: ENB301 Assumed knowledge: ENB312 is assumed knowledge.
Credit points: 12 Contact hours: 5 per week Campus: Gardens Point Teaching period: 2011 SEM-1

ENB318 BIOMECHANICAL ENGINEERING SYSTEMS
Topics covered in this unit include an appreciation of the mechanics of the tissues of the joints (micro mechanics or tissue mechanics) and the function of the body during normal activities (macro-mechanics or biomechanics). This unit is designed to develop an understanding of the complex properties of the individual tissues and practical competencies in the evaluation of human function and performance from a biomechanical perspective. Biomedical engineers require the ability to analyse the mechanics of the human body for applications such as prosthetic design (both artificial limbs and replacement joints), design of assistive devices for people with disabilities, sporting performance, ergonomic tasks, and other health related areas.
Prerequisites: ENB211 Assumed knowledge: LSB131 and LSB451 are assumed knowledge. Equivalents: MMB391 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2011 SEM-2

ENB319 BIOMECHANICAL ENGINEERING DESIGN
This unit is structured to further develop the engineering design skills of students, with particular emphasis on the role of computer-aided design (CAD), materials selection, manufacturing processes, assembly and maintenance in the design and management of bio-engineering devices. A knowledge of manufacturing processes, fundamentals of engineering design, engineering drawing and engineering materials is assumed. Contents include design for manufacture, materials selection, computer-aided design and solid modelling, rapid prototyping techniques, user interface, and case studies of selected medical devices.
Prerequisites: ENB215 Equivalents: MMB392 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2011 SEM-1

ENB322 BIOFLUIDS
The mechanics of fluids in biological and biomedical systems differs from industrial applications as most of the fluids encountered exhibit viscosity that changes in a non-linear manner with shear rate. It is therefore necessary, when designing a second course in the mechanics of fluids for medical engineers, to examine the particular properties of the fluids that might be encountered and to introduce techniques to analyse their behaviour. It is also important to consider how the properties of the fluids relate to their biological function and the relevance of their properties to the design of associated equipment.
Prerequisites: ENB201 or ENB221 Equivalents: MMB362 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2011 SEM-2

ENB335 MODELLING AND SIMULATION FOR MEDICAL ENGINEERS
Traditional experimentation techniques can often not be applied to investigate the mechanics of biological systems. Medical engineers are often then required to use modelling and simulation techniques to understand the behaviour of biomechanical components and/or systems. This unit introduces you to some of the fundamental principles of modelling and simulation techniques and their applications in Biomedical Engineering.
Prerequisites: ENB318 Equivalents: MMB496 Credit points: 12 Contact hours: 4 per week Campus: Gardens Point Teaching period: 2011 SEM-2

ENB338 BIOMATERIALS
Topics covered in this unit include: an understanding of the relationships between the properties, failure mechanisms, processing and microstructures of various materials used for medical applications and their interaction with human tissues; an understanding of the fundamentals of the use of materials in a medical environment and an understanding of the fundamentals of materials properties and processing; consideration of metallic, ceramic, polymeric implant
materials; composites as biomaterials; structure-property relationships of biomaterials; tissue response to implants; soft tissue replacements; hard tissue replacements.

**Assumed knowledge:** LSB131, LSB451 and ENB231 are assumed knowledge.  
**Equivalents:** MMB292  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Kelvin Grove  
**Teaching period:** 2011 SEM-2

### LSB131 ANATOMY

This unit includes basic concepts of anatomy: an overview of the structure of cells, body tissues, and body systems; aspects of surface anatomy which are relevant to human movement; musculoskeletal systems.

**Prerequisites:** LSB145  
**Credit points:** 12  
**Contact hours:** 5 per week  
**Campus:** Kelvin Grove  
**Teaching period:** 2011 SUM

### LSB231 PHYSIOLOGY

This unit covers the general physiological principles such as homeostasis and how all systems in the body contribute to it. Topics include cells, transport processes, cardiovascular system, cardiac electrical activity, cardiac output, regulation of blood pressure, respiratory system, endocrine system, pulmonary ventilation and its function.

**Assumed knowledge:** LSB145  
**Credit points:** 12  
**Contact hours:** 4 per week  
**Campus:** Kelvin Grove  
**Teaching period:** 2011 SEM-2

### MAB127 MATHEMATICS FOR ENGINEERING 2

Building upon the foundations established in MAB125 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 discipline of engineering. The formulation and solution of such problems is supported by appropriate advanced mathematical concepts used for function approximation, differentiation and integration. You will complete this unit in first year or first semester of second year depending on your initial maths background. Undertaking this unit will allow you to develop your problem solving skills, especially in the context of advanced mathematical techniques applied to vectors and matrices used to model engineering relevant 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:** Kelvin Grove  
**Teaching period:** 2011 SUM-1, 2011 SEM-2 and 2011 SUM

### MAB200 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.

**Assumed knowledge:** Grade of at least Sound Achievement in Senior Mathematics B (or equivalent) or MAB105 and corequisite MAB120 or MAB125
Instrumentation plays an increasingly important role in the life of a scientist. This unit is designed to give you 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. This unit aims to introduce you to the role of instrumentation in modern scientific work. It will provide you with experience in the use of standard electronic laboratory instrumentation and with an opportunity to develop skills in constructing and testing circuits. This unit will also show you how to access and interpret information on various electronic components and enhance your group interaction skills.

**Credit points:** 12  
**Contact hours:** 5 per week  
**Campus:** Gardens Point  
**Teaching period:** 2011 SEM-2

**PCN112 MEDICAL IMAGING SCIENCE**

This unit offers an introduction to programming techniques and algorithms and digital image processing; the principles of display, perception and interpretation of medical images; image quality. The second part, nuclear medicine, describes radioactive decay, radionuclide production, imaging systems and internal dosimetry.

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

**PCN211 PHYSICS OF MEDICAL IMAGING**

Most medical imaging modalities now produce images in digital form. These digital images frequently undergo processing such as enhancement, registration, fusion and 3D reconstruction. Digital image processing and 3D image visualisation techniques are also extensively used in nuclear medicine and radiotherapy planning. Consequently, computing, numerical methods and digital image processing are necessary skills of a practising medical physicist. This unit is designed to make the student familiar with image visualisation methods and imaging in nuclear medicine, and to develop skills in digital image processing.

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

**PUB112 WORKPLACE HEALTH AND SAFETY**

Introduces students to the basic concepts and theoretical framework of occupational health and safety such that they can identify health and safety problems in the workplace; be aware of strategies for dealing with such problems; and become familiar with the legislation, government agencies and health personnel associated with the working environment. Topics covered will include the physical, chemical and biological environments, and ergonomics. The students will also develop knowledge and skills associated with the actual measurement of the physical and chemical working environment and evaluation of the data collected.

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

PYB100 FOUNDATION PSYCHOLOGY
This unit provides an introduction to the major content areas of psychology, including an introduction to psychological research and report-writing, for students intending to pursue further studies in psychology.

Psychology is a broad-ranging and multifaceted discipline which encompasses the scientific study of human behaviour, and the systematic application of knowledge gained from psychological research to a broad range of applied issues. The goal of this introductory unit is to introduce you to the major subfields and perspectives in psychology, and to develop your understanding of the research methods and report-writing conventions used in psychological research.

Antirequisites: PYB012    Equivalents: PYB101    Credit points: 12    Contact hours: 3 hours per week    Campus: Kelvin Grove  Teaching period: 2011 SEM-1, 2011 SEM-2 and 2011 SUM-1

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