BMEN30006 Circuits and Systems

Credit Points:	12.5
Level:	3 (Undergraduate)
Dates & Locations:	2016, Parkville This subject commences in the following study period/s: Semester 1, Parkville - Taught on campus.
Time Commitment:	Contact Hours: 3 x 1 hour lectures per week, 1 x 1 hour tutorial per week, and 6 x 2 hour workshops per semester Total Time Commitment: 170 hours
Prerequisites:	The prerequisites for this subject are:

Subject	Study Period Commencement:	Credit Points:
ENGR10003 Engineering Systems Design 2	Summer Term, Semester 2	12.50

OR

Admission into the MC-ENG Master of Engineering (Biomedical) or (Biomedical with Business)

AND one of

Subject	Study Period Commencement:	Credit Points:
BMEN20001 Biomechanical Physics & Computation	Semester 1	12.50

OR

Subject	Study Period Commencement:	Credit Points:
COMP20005 Engineering Computation	Semester 1, Semester 2	12.50

PLUS

Subject	Study Period Commencement:	Credit Points:
MAST20029 Engineering Mathematics	Summer Term, Semester 1, Semester 2	12.50

OR

both of the following subjects

Subject	Study Period Commencement:	Credit Points:
MAST20009 Vector Calculus	Semester 1, Semester 2	12.50
MAST20030 Differential Equations	Semester 2	12.50

NOTE :For students enrolled in **MC-ENG (Biomedical)** or **MC-ENG (Biomedical with Business)** BMEN20001 Biomechanical Physics and Computation and MAST20029 Engineering Mathematics may be taken concurrently

Corequisites:	None

Recommended Background Knowledge:	None
Non Allowed Subjects:	Anti-requisites for this subject are: **Subject** / **Study Period Commencement:** / **Credit Points:** 431-221 Fundamentals of Signals and Systems / Not offered 2010 / ELEN30012 Signals and Systems / Semester 2 / 12.50
Core Participation Requirements:	For the purposes of considering applications for Reasonable Adjustments under the Disability Standards for Education (Cwth 2005) and Students Experiencing Academic Disadvantage Policy, this subject requires all students to actively and safely participate in laboratory activities. Students who feel their disability may impact upon their participation are encouraged to discuss this with the Subject Coordinator and the Disability Liaison Unit. http://www.services.unimelb.edu.au/disability/
Coordinator:	Assoc Prof Leigh Johnston
Contact:	Leigh Johnston Email: **l.johnston@unimelb.edu.au (mailto:l.johnston@unimelb.edu.au)**
Subject Overview:	**AIMS** This subject introduces students to the fundamental principles of circuit and signal measurements and analyses in a biosignals context. In addition to the fundamental concepts, topics to be covered include an introduction to various types of sensors and the basic methods required to analyse measurements, calibrate sensors and evaluate measurement system performance. In the laboratories, students will learn about laboratory safety, team work and measurement safety in an integrated way. This subject is one of the subjects that define the Bioengineering Systems Major in the Bachelor of Science and Bachelor of Biomedicine, and it is a core requirement for the Master of Engineering (Biomedical). It provides a foundation for various subsequent subjects, including BMEN90002 Neural Information Processing and BMEN90021 Medical Imaging. **INDICATIVE CONTENT** Topics include: Basic principles of charge, current, Coulomb's law, electric fields and electrical energy, Kirchhoff's current law, Kirchhoff's voltage law, voltage and current division, node voltage analysis, mesh current analysis, Thévenin and Norton equivalent circuits, transient analysis of RC and RL circuits, steady-state analysis of RLC circuits, phasors and impedance, frequency domain models for signals and frequency response for systems, continuous-time and discrete-time Fourier transforms, frequency response, filtering, transfer functions, Z-transforms, Laplace transforms, poles and zeros, Bode plots, and the relationship to state-space representations. This material is complemented by the use of software tools (e.g. MATLAB) for computation and simulation, and practical experience with circuits and systems in the laboratory.
Learning Outcomes:	**INTENDED LEARNING OUTCOMES (ILO's)** Having completed this unit the student should be able to: 1 Apply physical principles, fundamental abstractions and modelling techniques in the analysis of electrical systems; 2 Develop and demonstrate basic biosignals laboratory skills through implementing, testing and debugging simple circuits on prototyping breadboards; 3 Apply fundamental mathematical analysis and modelling techniques to understand signals and systems in both time-domain and frequency-domain; 4 Demonstrate the ability to analyse continuous-time and discrete-time signals and systems.

Assessment:	Six workshop group reports (students work in group of 2 or 3) not exceeding 30 pages in total each spread from week 2 to week 12, requiring 30-40 hours of work in total per student, worth 30%. ILO's 1-4 are assessed in the submitted workshop reports. One mid-semester test of 50 minutes duration, worth 10%. ILO1 is assessed in the mid-semester test. One examination of two hours duration at the end of the semester, worth 60%. ILO's 1, 3 and 4 are assessed in the final examination. Hurdle requirement: Students must pass the end of semester examination to pass the subject.
Prescribed Texts:	To be advised
Breadth Options:	This subject potentially can be taken as a breadth subject component for the following courses: # **Bachelor of Arts (https://handbook.unimelb.edu.au/view/2016/B-ARTS)** # **Bachelor of Commerce (https://handbook.unimelb.edu.au/view/2016/B-COM)** # **Bachelor of Music (https://handbook.unimelb.edu.au/view/2016/B-MUS)** You should visit **learn more about breadth subjects (http://breadth.unimelb.edu.au/breadth/info/index.html)** and read the breadth requirements for your degree, and should discuss your choice with your student adviser, before deciding on your subjects.
Fees Information:	Subject EFTSL, Level, Discipline & Census Date, http://enrolment.unimelb.edu.au/fees
Generic Skills:	On completion of this subject, students should have developed the following generic skills: # Ability to apply knowledge of science and engineering fundamentals # Ability to undertake problem identification, formulation and solution # Ability to utilise a systems approach to complex problems and to design and operational performance # Proficiency in engineering design # Ability to communicate effectively, with the engineering team and with the community at large # Capacity for creativity and innovation # Ability to function effectively as an individual and in multidisciplinary and multicultural teams, as a team leader or manager as well as an effective team member # Capacity for lifelong learning and professional development.
Notes:	**LEARNING AND TEACHING METHODS** The subject is delivered through lectures, tutorials and workshop classes for hands-on laboratory activities. **INDICATIVE KEY LEARNING RESOURCES** Students are provided with lecture slides, tutorials and worked solutions, a problem set and solutions, problem sets, laboratory sheets, and reference text lists. **CAREERS / INDUSTRY LINKS** Exposure to signal processing in a bioengineering context through research lab visits and/or guest lectures.
Related Majors/Minors/ Specialisations:	Bioengineering Systems Master of Engineering (Biomedical with Business) Master of Engineering (Biomedical) Science-credited subjects - new generation B-SCI and B-ENG. Selective subjects for B-BMED