ELEN90058 Signal Processing

Credit Points:	12.5
Level:	9 (Graduate/Postgraduate)
Dates & Locations:	2016, Parkville This subject commences in the following study period/s: Semester 2, Parkville - Taught on campus.
Time Commitment:	Contact Hours: 36 hours of lectures (3 x one hour lectures per week) and up to 24 hours of workshops Total Time Commitment: 200 hours
Prerequisites:	The prerequisite for this subject is: **Subject** / **Study Period Commencement:** / **Credit Points:** ELEN30012 Signals and Systems / Semester 2 / 12.50 OR **Subject** / **Study Period Commencement:** / **Credit Points:** BMEN30006 Circuits and Systems / Semester 1 / 12.50
Corequisites:	None
Recommended Background Knowledge:	None
Non Allowed Subjects:	Anti-requisite for this subject is: **Subject** / **Study Period Commencement:** / **Credit Points:** ELEN30008 Signal Processing 1 (Fundamentals) / Not offered 2016 / 12.50
Core Participation Requirements:	For the purposes of considering request for Reasonable Adjustments under the Disability Standards for Education (Cwth 2005), and Students Experiencing Academic Disadvantage Policy, academic requirements for this subject are articulated in the Subject Description, Subject Objectives, Generic Skills and Assessment Requirements of this entry. The University is dedicated to provide support to those with special requirements. Further details on the disability support scheme can be found at the Disability Liaison Unit website: http://www.services.unimelb.edu.au/disability/
Coordinator:	Prof Erik Weyer
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Subject Overview:	**AIMS** This subject provides an introduction to the fundamental theory of time domain and frequency domain representation of discrete time signals and linear time invariant dynamical systems, and how this theory is used to analyse and design digital signal processing systems and algorithms. Topics include: # Applications of signal processing techniques # Sampling of analog signals, anti-aliasing filters

	# Frequency-domain analysis of signals and systems, Discrete Time Fourier Transform, Discrete Fourier Transform, Fast Fourier Transform # Digital filters, low-pass, high-pass, band-pass, stop-band and all pass filters. Phase and group delay, FIR and IIR filters # Design of digital FIR and IIR filters # Multi-rate signal processing, with a focus on up-sampling, down-sampling, and sampling rate conversion # Simple non-parametric methods for spectral estimation. This fundamental material will be complemented by exposure to MATLAB tools for signal analysis and a DSP (Digital Signal Processor) based development platform for the implementation of signal processing algorithms in the laboratory. **INDICATIVE CONTENT** Sampling of continuous time signals, Design of anti-aliasing filters, Time and frequency representation of discrete time signals and discrete time linear time invariant systems, Discrete Time Fourier Transform and z-transform and their properties, Low order lowpass, highpass, bandpass, bandstop filters, All-pass filter, Design of IIR filters using the bilinear transformation, Design of FIR filters with linear phase using windowing techniques and the Parks McClelland method, Discrete Time Fourier transform and its properties, Fast Fourier Transform, The use of the DFT in implementation of linear filtering algorithms, Up-sampling and down-sampling, multistage and computationally efficient implementations of up-samplers and down-samplers, Energy and power spectra for deterministic signals.
Learning Outcomes:	**INTENDED LEARNING OUTCOMES (ILO's)** Having completed this unit the student should be able to: 1 Apply fundamental mathematical tools, in particular frequency-domain techniques, in the analysis and design of signal processing systems 2 Design, implement and test simple digital filters according to given specifications 3 Use software such as MATLAB for the analysis and design of signal processing systems 4 Use DSP based prototyping platforms and associated software development tools to implement signal-processing algorithms
Assessment:	One written examination, not exceeding three hours at the end of semester, worth 70% Continuous assessment of submitted workshop reports and Matlab based projects report completed in small groups (2-3 students), not exceeding 25 pages over the semester (approximately 25-30 hours of work per student), worth 20% A one-hour mid-semester test, worth 10%. Hurdle requirement: Students must pass the written exam to pass the subject. Intended Learning Outcomes (ILOs) 1 and 2 are assessed in all components. ILOs 3 and 4 are assessed in the continuous assessment. The examination paper will consist of problems designed to test whether the student has understood the fundamental principles and acquired the ability to apply these principles to the solutions of design and estimation problems. The workshop reports can be produced much more quickly than a crafted essay, and they are expected to have a lighter weighting than an essay of similar length.
Prescribed Texts:	None
Recommended Texts:	TBA
Breadth Options:	This subject is not available as a breadth subject.
Fees Information:	Subject EFTSL, Level, Discipline & Census Date, http://enrolment.unimelb.edu.au/fees
Generic Skills:	On completion of this subject, students will have developed the following skills: # Ability to apply knowledge of basic science and engineering fundamentals # In-depth technical competence in at least one engineering discipline # Ability to undertake problem identification, formulation and solution # Ability to utilise a systems approach to design and operational performance # Capacity for independent critical thought, rational inquiry and self-directed learning # Openness to new ideas and unconventional critiques of received wisdom

	# Ability to function effectively as an individual and in multi-disciplinary and multi-cultural teams, with the capacity to be a leader or manager as well as an effective team member # Ability to communicate effectively, with the engineering team and with the community at large
Notes:	Credit may not be obtained for both ELEN30008(431-335) Signal Processing 1 and ELEN90058 Signal Processing **LEARNING AND TEACHING METHODS** The subject will be delivered through a combination of lectures and workshops. Students will complete three workshops and one Matlab based project with the focus on design and implementation of digital signal processing systems which will reinforce the material covered in the lectures. The students will be given 11 problem sheets with tutorial like questions. **INDICATIVE KEY LEARNING RESOURCES** Students will have access to lecture notes and lecture slides. There is a prescribed text book and two alternative text books which covers the same material. In the lecture notes there are clear section references to all three textbooks. The students will be provided with fully worked solutions to all problem sheets. Matlab demonstration programs used in the lectures are available via LMS. **CAREERS / INDUSTRY LINKS** An industry representative will give a one hour lecture about industrial applications of signal processing.
Related Majors/Minors/ Specialisations:	B-ENG Electrical Engineering stream Master of Engineering (Electrical with Business) Master of Engineering (Electrical) Master of Engineering (Mechatronics)