# ELEN30012 Signals and Systems

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| **Credit Points:** | 12.5 |
| **Level:** | 3 (Undergraduate) |
| **Dates & Locations:** | 2016, Parkville<br>This subject commences in the following study period/s:<br>Semester 2, Parkville - Taught on campus.<br>Winter Term, Parkville - Taught on campus. |
| **Time Commitment:** | Contact Hours: SEMESTER OFFERING: 36 hours of lectures (3 x 1 hr lectures per week) and up to 24 hours of workshops; INTENSIVE OFFERING: 36 hours of lectures (12hrs per week for 3 weeks) and up to 12 hours tutorials and workshops (3hrs per week for 4 weeks). Total Time Commitment: 170 hours |
| **Prerequisites:** | Prerequisites for this subject are |

| Subject | Study Period Commencement: | Credit Points: |
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| ELEN20005 Foundations of Electrical Networks | January, Semester 2 | 12.50 |

PLUS

either of the following subjects

| Subject | Study Period Commencement: | Credit Points: |
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| MAST20026 Real Analysis | Semester 1, Semester 2 | 12.50 |
| MAST20029 Engineering Mathematics | Summer Term, Semester 1, Semester 2 | 12.50 |

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

**OR**

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

**OR**

| Subject | Study Period Commencement: | Credit Points: |
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| COMP20007 Design of Algorithms | Semester 1 | 12.50 |

**Note:**

# BMEN20001 is a suitable alternative to COMP20005 or COMP20007 for students enrolled in the B-SCI or the B-BMED undertaking a major in Bioengineering Systems.
# COMP20005 Engineering Computation may be taken concurrently.

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| **Corequisites:** | None |
| **Recommended Background Knowledge:** | Knowledge of the following subjects is recommended |

| Subject | Study Period Commencement: | Credit Points: |
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| ELEN30009 Electrical Network Analysis and Design | Semester 1 | 12.50 |
| ELEN30010 Digital System Design | Semester 1 | 12.50 |

**Non Allowed Subjects:**

431-221 Fundamentals of Signals and Systems

| Subject | Study Period Commencement: | Credit Points: |
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| BMEN30006 Circuits and Systems | Semester 1 | 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:**

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**Contact:**

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**Subject Overview:**

**AIMS**

The aim of this subject is twofold: firstly, to develop an understanding of the fundamental tools and concepts used in the analysis of signals and the analysis and design of linear time-invariant systems path in continuous–time and discrete- time; secondly, to develop an understanding of their application in a broad range of areas, including electrical networks, telecommunications, signal-processing and automatic control.

The subject formally introduces the fundamental mathematical techniques that underpin the analysis and design of electrical networks, telecommunication systems, signal-processing systems and automatic control systems. Such systems lie at the heart of the electrical engineering technologies that underpin modern society. This subject is one of four that define the Electrical System Major in the Bachelor of Science and it is a core requirement in the Master of Engineering (Electrical). It provides the foundation for various subsequent subjects, including ELEN90057 Communication Systems, ELEN90058 Signal Processing and ELEN90055 Control Systems.

**INDICATIVE CONTENT**

Topics include:

Signals – continuously and discretely indexed signals, important signal types, frequency-domain analysis (Fourier, Laplace and Z transforms), nonlinear transformations and harmonics, sampling;

Systems – viewing differential / difference equations as systems that process signals, the notions of input, output and internal signals, block diagrams (series, parallel and feedback connections), properties of input-output models (causality, delay, stability, gain, shift-invariance, linearity), transient and steady state behaviour;

Linear time-invariant systems – continuous and discrete impulse response; convolution operation, transfer functions and frequency response, time-domain interpretation of stable and unstable poles and zeros, state-space models (construction from high-order ODEs, canonical forms, state transformations and stability), and the discretisation of models for systems of continuously indexed signals.

This material is complemented by exposure to the use of MATLAB for computation and simulation and examples from diverse areas including electrical engineering, biology, population dynamics and economics.

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| **Learning Outcomes:** | **INTENDED LEARNING OUTCOMES (ILO's)**<br>Having completed this subject it is expected that the student be able to:<br>1 Apply fundamental mathematical tools to model, analyse and design signals and systems in both time-domain and frequency-domain<br>2 Recognise the broad applicability of the mathematics of signals and systems theory, particularly within electrical engineering<br>3 Recognize the similarities and differences between the mathematical tools needed for dealing with continuous-time systems/signals versus their discrete-time counterparts<br>4 Use MATLAB to study the behaviour of signals and systems as they arise in a variety of contexts. |
| **Assessment:** | SEMESTER 2 Continuous assessment of 3 assignments (each approximately 1000 words) will not exceed 30 pages in total over the semester, approximately 30-35 hours work per student, ongoing throughout the semester (30%) A mid-semester test (one hour), (10%) A written final exam (three hours), held in the examination period at the end of semester (60%) WINTER TERM Continuous assessment of 3 assignments (each approximately 1000 words) will not exceed 30 pages in total over the semester, approximately 30-35 hours work per student, ongoing throughout the teaching period (30%) A mid-term test (one hour), (10%) A written final exam (three hours), held at the end of the teaching period (60%) Hurdle requirement: Students must pass the written exam to pass the subject. Intended Learning Outcomes (ILO's) 1-3 are assessed in the final written examination, the mid-semester test, assignments and workshop project reports. ILO 4 is assessed as part of the workshop project reports. |
| **Prescribed Texts:** | TBA |
| **Recommended Texts:** | Fundamentals of Systems and Signals using the web and MATLAB, by E. Kamen and B. Heck (3rd Edition) |
| **Breadth Options:** | This subject potentially can be taken as a breadth subject component for the following courses:<br># **Bachelor of Arts (https://handbook.unimelb.edu.au/view/2016/B-ARTS)**<br># **Bachelor of Commerce (https://handbook.unimelb.edu.au/view/2016/B-COM)**<br># **Bachelor of Environments (https://handbook.unimelb.edu.au/view/2016/B-ENVS)**<br># **Bachelor of Music (https://handbook.unimelb.edu.au/view/2016/B-MUS)**<br>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:<br># Ability to apply knowledge of basic science and engineering fundamentals<br># Ability to undertake problem identification, formulation and solution<br># Ability to utilise a systems approach to design and operational performance<br># Ability to communicate effectively, with the engineering team and with the community at large<br># Capacity for independent critical thought, rational inquiry and self-directed learning<br># Expectation of the need to undertake lifelong learning, capacity to do so. |
| **Notes:** | **LEARNING AND TEACHING METHODS**<br>The subject is delivered through lectures and workshop classes that combine both theoretical tutorial and MATLAB programming activities.<br>**INDICATIVE KEY LEARNING RESOURCES**<br>Students are provided with lecture slides, lecture notes, practice worksheets and answers, a workshop manual and reference text lists.<br>**CAREERS / INDUSTRY LINKS** |

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| | Exposure to industry applications via guest lecturers. |
| **Related Majors/Minors/ Specialisations:** | B-ENG Electrical Engineering stream<br>Bioengineering Systems<br>Electrical Systems<br>Master of Engineering (Electrical with Business)<br>Master of Engineering (Electrical)<br>Science-credited subjects - new generation B-SCI and B-ENG.<br>Selective subjects for B-BMED |