

ES3C5-15 Signal Processing

26/27

Department

School of Engineering

Level

Undergraduate Level 3

Module leader

Viji Ahanathapillai

Credit value

15

Module duration

10 weeks

Assessment

30% coursework, 70% exam

Study location

University of Warwick main campus, Coventry

Description

[Module web page](#)

Module aims

The module aims to introduce signal processing to 3rd year students. It aims to develop the student's ability to: Select and apply appropriate mathematical methods for modelling and analysing signals; Understand the scientific principles underlying the generation of signals; Use practical skills in a laboratory session in which the relevant test and measurement equipment is available; Select and apply appropriate computer based methods for modelling signals and communication systems; Design signal processing systems.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Analogue Signals and Systems: Time domain and s-domain representation of continuous-time signals; Linear time-invariant systems; Laplace transform; Analogue system transfer functions; Analogue system stability; Fourier transform and analogue frequency response; Analogue filter design and specification; Fourier series for periodic analogue signals; Computational modelling of analogue signals and systems

Digital Signals and Systems: Time-domain and z-domain representation of discrete-time signals; Signal conversion between analogue and digital representations; Sampling and aliasing; Linear shift-invariant systems; Z-transform; Digital system transfer functions; Digital system stability; Discrete-time Fourier transform and digital frequency response; Finite impulse response and infinite impulse response filters; Digital filter design and specification; Discrete Fourier Transform and evaluation with the Fast Fourier Transform; Computational modelling of digital signals and systems

Random Signal Processing: Random variable properties and variable distributions; Random signals; Signal estimation; Correlation; Power spectral density

Image Processing: Multi-dimensional signals; Representing images as signals; Multi-dimensional convolution; Image filtering

Learning outcomes

By the end of the module, students should be able to:

- 1. Apply mathematics to analyse deterministic and random signals and to analyse processing systems [C1, M1].
- 2. Apply signal processing systems to classify signals and extract information [C1, M1].
- 3. Critique practical issues behind signal processing and information retrieval [C12, M12].
- 4. Design signal processing systems to meet a specification [C1, M1].
- 5. Model signals, filters and processes using computer packages [C3, M3].
- 6. Measure and analyse real-world signals [C12, M12].
- 7. Apply fundamental image processing technique to enhance, analyze, and extract information from images (2D signals) using computational tools [C3, M3]

Indicative reading list

[Reading lists can be found in Talis](#)

Subject specific skills

- Ability to conceive, make and realise a component, product, system or process
- Ability to be pragmatic, taking a systematic approach and the logical and practical steps necessary for, often complex, concepts to become reality

Transferable skills

- Numeracy: apply mathematical and computational methods to communicate parameters, model and optimize solutions
 - Apply problem solving skills, information retrieval, and the effective use of general IT facilities
 - Plan self-learning and improve performance, as the foundation for lifelong learning/CPD
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Study

Study time

Type	Required
Lectures	24 sessions of 1 hour (16%)
Practical classes	4 sessions of 2 hours (5%)
Other activity	4 hours (3%)
Private study	114 hours (76%)
Total	150 hours

Private study description

44 hours Guided independent learning
30 hours coursework submission
40 hours final exam study

Other activity description

2 x 1hr examples class
2 x 1hr revision class

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

Assessment group DF

Assessment component	Weighting	Study time	Eligible for self-certification
Lab Assignment	30%		Yes (extension)
Assignment submission supported by timetabled laboratories. Submission consists of a written			

Weighting

Study time

Eligible for self-certification

report (maximum length of 5 pages) in addition to written code files and code output.

Reassessment component is the same

Assessment component

Centrally-timetabled examination
(On-campus) 70%

No

Written 2 hour exam.

- Engineering Data Book 8th Edition
- Students may use a calculator
- Graph paper
- Answerbook Pink (12 page)

Reassessment component is the same

Feedback on assessment

- Model solutions to past papers.
- Individual and cohort-level feedback on assignments.
- Support through advice and feedback hours.
- Cohort-level feedback on final exam.

[Past exam papers for ES3C5](#)

Availability

Anti-requisite modules

If you take this module, you cannot also take:

- ES2H5-15 Signal Processing
- ES98G-15 Signal Processing

Courses

This module is Core for:

- Year 3 of UESA-H161 BEng Biomedical Systems Engineering
- Year 4 of UESA-H162 BEng Biomedical Systems Engineering with Intercolated Year
- Year 3 of UESA-H63W BEng Electronic Engineering
- Year 4 of UESA-H63V BEng Electronic Engineering with Intercolated Year
- Year 3 of UESA-HH35 BEng Systems Engineering
- Year 4 of UESA-HH34 BEng Systems Engineering with Intercolated Year
- Year 3 of UESA-H163 MEng Biomedical Systems Engineering
- Year 3 of UESA-H63X MEng Electronic Engineering
- UESA-HH31 MEng Systems Engineering
 - Year 3 of HH31 Systems Engineering
 - Year 3 of HH35 Systems Engineering
- Year 3 of UESA-H606 Undergraduate Electrical and Electronic Engineering MEng

This module is Core optional for:

- Year 4 of UESA-H164 MEng Biomedical Systems Engineering with Intercolated Year
- Year 4 of UESA-H63Y MEng Electronic Engineering with Intercolated Year
- Year 4 of UESA-HH32 MEng Systems Engineering with Intercolated Year
- Year 4 of UESA-H607 Undergraduate Electrical and Electronic Engineering with Intercolated Year

This module is Optional for:

- Year 3 of UESA-H113 BEng Engineering
- Year 4 of UESA-H111 BEng Engineering with Intercolated Year
- Year 3 of UESA-H114 MEng Engineering
- UESA-H115 MEng Engineering with Intercolated Year
 - Year 3 of H115 Engineering with Intercolated Year MEng
 - Year 4 of H115 Engineering with Intercolated Year MEng

This module is Core option list B for:

- UCSA-G406 Undergraduate Computer Systems Engineering
 - Year 3 of G406 Computer Systems Engineering
 - Year 3 of G406 Computer Systems Engineering
- Year 3 of UCSA-G408 Undergraduate Computer Systems Engineering
- Year 4 of UCSA-G405 Undergraduate Computer Systems Engineering (with Intercolated Year)
- Year 4 of UCSA-G407 Undergraduate Computer Systems Engineering (with Intercolated Year)