ES3C5-15 Signal Processing

22/23

Department
School of Engineering
Level
Undergraduate Level 3
Module leader
Adam Noel
Credit value
15
Module duration
10 weeks
Assessment
30% coursework, 70% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory 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.

Signals: Time domain and frequency domain representation of continuous and discrete signals; Laplace transform and transfer functions; Z-transform and transfer functions; Relation between time domain and frequency domain; Fourier Transform; Discrete Time Fourier Transform; Practical use of Fast Fourier Transform; Convolution.

Filter Design: Specification in terms of frequency response; time domain and frequency responses; filter design filter design - FIR and IIR; Linear phase filters; Non-recursive designs using windowing; Quantisation and rounding in both recursive and non-recursive designs; Filter applications
Random Signal Analysis: Revision of some fundamental concepts of probability:- probability density, expected values, correlation; Time domain analysis:- correlation functions for continuous and discrete signals, analogue and digital measurement of correlation; Frequency domain analysis:- spectral densities and their relation to correlation functions, analogue and digital measurement; Estimation of noisy signals.

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
- 2. Apply signal processing systems to classify signals and extract information.
- 3. Critique practical issues behind signal processing and information retrieval
- 4. Design signal processing systems
- 5. Model signals, filters and processes using computer packages
- 6. Evaluate signals and systems using laboratory test and measurement equipment

Indicative reading list

“Essentials of Digital Signal Processing”, B.P. Lathi and R.A. Green, Cambridge University Press, 2014
“Essential MATLAB”, B. Hahn and D. Valentine, Academic Press, 6th Edition, 2017
“Discrete-Time Signal Processing”, Oppenheim and Schafer, Pearson, 3rd Edition, 2013

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

Study

Study time

Type	Required
Lectures	24 sessions of 1 hour (16%)
Practical classes	3 sessions of 2 hours (4%)
Other activity	4 hours (3%)
Private study	116 hours (77%)
Total	150 hours

Private study description

46 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 DC

	Weighting	Study time
Lab Assignment	30%	

Assignment submission supported by laboratory activities and using both hardware and software. Submission consists of a written report (maximum length of 5 pages) in addition to written code files and code output.

Online Examination	70%	

QMP Online Examination 2 x 1hr

~Platforms - QMP

- Online examination: No Answerbook required

	Weighting	Study time

- Students may use a calculator
- Engineering Data Book 8th Edition
- Graph paper

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

Post-requisite modules

If you pass this module, you can take:

- ES97H-15 Biomedical Signal Processing
- ES96T-15 Advanced Wireless Systems and Networks

Courses

This module is Core for:

- Year 3 of UESA-H161 BEng Biomedical Systems Engineering
- Year 3 of UESA-H63W BEng Electronic Engineering
- Year 4 of UESA-H63V BEng Electronic Engineering with Intercalated Year
- Year 3 of UESA-HH35 BEng Systems Engineering
- Year 3 of UESA-HH36 BEng Systems Engineering
- Year 4 of UESA-HH34 BEng Systems Engineering with Intercalated Year
- Year 3 of UESA-H163 MEng Biomedical Systems Engineering
- Year 3 of UESA-H63X MEng Electronic Engineering
- UESA-H636 MEng Electronic Engineering with Intercalated Year
  - Year 3 of H636 Electronic Engineering with Intercalated Year
  - Year 4 of H636 Electronic Engineering with Intercalated Year
- UESA-HH31 MEng Systems Engineering
  - Year 3 of HH31 Systems Engineering
  - Year 3 of HH35 Systems Engineering
- Year 4 of UESA-HH32 MEng Systems Engineering with Intercalated Year
- Year 3 of UESA-H605 Undergraduate Electrical and Electronic Engineering
- Year 4 of UESA-H60V Undergraduate Electrical and Electronic Engineering (with

Intercalated Year)
- Year 3 of UESA-H606 Undergraduate Electrical and Electronic Engineering MEng
- Year 4 of UESA-H607 Undergraduate Electrical and Electronic Engineering with Intercalated Year

This module is Core optional for:

- Year 4 of UESA-H164 MEng Biomedical Systems Engineering with Intercalated Year
- UESA-H636 MEng Electronic Engineering with Intercalated Year
    - Year 3 of H636 Electronic Engineering with Intercalated Year
    - Year 4 of H636 Electronic Engineering with Intercalated Year
- Year 4 of UESA-H63Y MEng Electronic Engineering with Intercalated Year
- Year 3 of UESA-H115 MEng Engineering with Intercalated Year
- UESA-H607 Undergraduate Electrical and Electronic Engineering with Intercalated Year
    - Year 3 of H607 Electrical and Electronic Engineering with Intercalated year
    - Year 4 of H607 Electrical and Electronic Engineering with Intercalated year

This module is Optional for:

- Year 3 of UESA-H113 BEng Engineering
- Year 3 of UESA-H114 MEng Engineering
- Year 4 of UESA-H115 MEng Engineering with Intercalated Year
- Year 1 of TESA-H800 Postgraduate Taught Biomedical Engineering
- Year 1 of TESA-H641 Postgraduate Taught Communications and Information Engineering
- UESA-H11L Undergradaute Engineering (with Intercalated Year)
    - Year 3 of H11L Engineering (with Intercalated Year)
    - Year 4 of H11L Engineering (with Intercalated Year)

This module is Option list A for:

- Year 4 of UESA-H111 BEng Engineering with Intercalated Year
- UESA-H112 BSc Engineering
    - Year 3 of H112 Engineering
    - Year 3 of H112 Engineering
- Year 1 of TESA-H643 Postgraduate Taught Electrical Power Engineering
- Year 3 of UCSA-G406 Undergraduate Computer Systems Engineering
- Year 3 of UCSA-G408 Undergraduate Computer Systems Engineering
- Year 4 of UCSA-G407 Undergraduate Computer Systems Engineering (with Intercalated Year)
- Year 4 of UCSA-G409 Undergraduate Computer Systems Engineering (with Intercalated Year)