

ES97H-15 Biomedical Signal Processing

26/27

Department

School of Engineering

Level

Taught Postgraduate Level

Module leader

Nigel Stocks

Credit value

15

Module duration

10 weeks

Assessment

100% coursework

Study location

University of Warwick main campus, Coventry

Description

Introductory description

ES97H Biomedical Signal Processing

[Module web page](#)

Module aims

To introduce students to the principles of signal processing techniques when applied specifically to biomedical signals, including: ECG, MEG, EEG, SPO2, heart rate etc.

The module will provide the student with a firm grounding in methods and tools for extracting information from digitally acquired biomedical signals.

The module will introduce the practical implementation of signal processing techniques to digitally acquired biomedical signals.

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.

- Introduction to Biomedical Signals
 - o The Nature of Biomedical Signals
 - o Examples of Biomedical Signals
 - o Objectives and Difficulties of Biomedical Signal Analysis
- Revision of pre-requisites
 - o Linear Systems Theory (continuous and discrete time)
 - o Spectral methods (FT, DTFT, DFT, PSD)
- Signal Acquisition
 - o Measurement systems
 - o Sampling theorem
 - o Analogue-digital-conversion
 - o windowing
- Filtering
 - o Filter types
 - o Analogue
 - o Digital FIR IIR
- Random Physiological Signals
 - o Signal as a Stochastic Process
 - o Averaging techniques
- Advanced Methods of Biomedical Signal Processing
 - o DSP hardware and implementation
 - o Medical Devices

Learning outcomes

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

- Demonstrate a systematic knowledge of the complex physical and physiological principles that underpin biomedical signals.
- Demonstrate an advanced understanding of the principles of digital signal processing
- Systematically apply methods to extract relevant information from biomedical signal measurements [M1, M2, M3]
- Critically assess the appropriateness of biomedical signal processing techniques for various problems in the field [M1]
- Evaluate the effectiveness of techniques applied to biomedical signals against specific benchmarks [M3]
- Work as a team to solve a complex problem using Biomedical Signal Processing Techniques [M1, M2, M3, M16]

Indicative reading list

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

Research element

Research for Group project

Interdisciplinary

signal processing and biological signals including pathology

Subject specific skills

Matlab programming. Filter design. Noise reduction. data acquisition.

Transferable skills

Team work. presentation and communication skills.

Study

Study time

Type	Required
Lectures	20 sessions of 1 hour (13%)
Practical classes	3 sessions of 3 hours (6%)
Other activity	4 hours (3%)
Private study	117 hours (78%)
Total	150 hours

Private study description

Guided independent learning 117 hours

Other activity description

Revision Classes 2x2 hours

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A2

Weighting Study time Eligible for self-certification

Assessment component

Group presentation	40%	No
Group presentation of main results of the group project		

Reassessment component

individual presentation and oral exam	No
individual presentations to assess competencies, effort and understanding	

Assessment component

In-class test	60%	No
A combination of qualitative and quantitative short answers		

Reassessment component is the same

Feedback on assessment

Model solutions to past papers.
Support through office hours.
Written feedback on assignment.
Cohort-level feedback on in-class test
Face to face feedback in laboratories

Availability

Pre-requisites

To take this module, you must have passed:

- All of
 - [ES3C5-15 Signal Processing](#)

Courses

This module is Core for:

- Year 4 of UESA-H163 MEng Biomedical Systems Engineering
- Year 5 of UESA-H164 MEng Biomedical Systems Engineering with Intercalated Year

This module is Optional for:

- Year 4 of UESA-H116 MEng Engineering with Exchange Year
- Year 5 of UESA-H115 MEng Engineering with Intercalated Year
- Year 1 of TESA-H800 Postgraduate Taught Biomedical Engineering

This module is Option list A for:

- Year 4 of UESA-H114 MEng Engineering

This module is Option list B for:

- Year 4 of UESA-HH31 MEng Systems Engineering
- Year 4 of UESA-HH33 MEng Systems Engineering with Exchange Year
- Year 5 of UESA-HH32 MEng Systems Engineering with Intercalated Year