FACULTY OF ENGINEERING

MODULE DESCRIPTION FORM

EM310 - Signals and Systems

Module Code: EM310	Module Title: Signals and Systems	
Module Registrar: Dr Graeme West		
Other Staff Involved: Dr Andrew Young (Marker), Dr Michael Devereaux (Assistant)	Credit Weighting: 10	Semester: 2
Compulsory/optional/elective class: NE	Academic Level: 3	
Pre-requisites: EE269, MM213		

Module Format and Delivery (hours):

Lectures	Tutorial	Assignments	Laboratories	Private Study	Total
24	12	2	0	62	100

Educational Aim

This Module aims to:

The aim of this course is to introduce students to the fundamentals of continuous and discrete time signals and linear systems. At the end of this course, students should be able to mathematically and pragmatically define, analyse and design these systems.

Learning Outcomes

On Completion of the module, the student is expected to be able to:

LO 1: Show appreciation of continous and discrete time signals in both the time and frequency domains and their application in linear time-invariant systems
LO 2: Analyse and design LTI systems, including undertaking calculations covering concepts such as noise, convolution,FFT, DFT, digital filtering, quantisation and sampling
LO 3: Understand the role of analogue and digital signal processing systems in various real-world electrical and mechanical systems.

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

Syllabus

The module will teach the following:

ANALOGUE SIGNALS: Elementary signals, linear and logarithmic signal representation, linear time invariant (LTI) principles, noise, signal to noise ratio.
ANALYSIS OF ANALOGUE SIGNALS: Harmonic analysis – Fourier series, line spectra, harmonic distortion, nonlinearity. Convolution integral, Fourier transform, Laplace transform.
ANALOGUE SYSTEMS: Time-domain and frequency domain characterization, frequency

response, impulse response, filtering, poles and zeros, stability.
DIGITAL SYSTEMS: Digital signal processing – ADCs DACs, signal conditioning, anti-alias and reconstruction filters Discrete equations and systems, signal flow graphs.
ANALYSIS OF DISCRETE SIGNALS AND SYSTEMS: The z-transform, poles and zeroes. Discrete Fourier transform (DFT) and the fast equivalent (FFT). Digital filter transfer functions. Finite Impulse Response (FIR) filters. Infinite Impulse Response (IIR) filters.
APPLICATIONS REVIEW: Signals and systems in instrumentation and condition monitoring applications.

Assessment of Learning Outcomes - Criteria

LO1
C 1: The student should be able to describe and contrast contuniuos and discrete signals
C 2: The student should be able to transform signals between the time and frequency domains and understand the relative merits of considering the signals in both domains
LO2
C 1: The student should be able to describe the characteristics of various types of noise such as shot, flicker and thermal
C 2: The student should understand the effect of noise and amplification and be able to select and chain together multi-stage amplifiers to minimise the effects of noise
C 3: The student should understand the fundamentals of fourier transforms and use this to perform simple analyisis on waveforms such as pulse trains and saw tooths
C 4: The student should be able to tackle problems with digital signals including recognising issues with filtering and sampling
C 5: The students should understand the fundamentals of convolution and the application to solving LTI systems
LO3
C 1: The students should have an understanding of the application of amplification to sensors, vibration analysis of mechanical devices such as gearboxes and should be able to recognise examples of linear time invariant systems

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment Feedback

Course aims and objectives are clearly explained in the introductory lecture, and on myplace. Students are made aware of what constitutes good performance through advice in class and worked examples of good practice.

After the class test, a feedback session is held where the class test is reviewed, and areas where the students collectively struggled, or there were common mistakes are highlighted. The students are also offered the opportunity of one-to-one feedback on any specific issues they have with exam.

During tutorial sessions peer review learning is encouraged by both staff and TAs. The use of computers allows all the lecture material to be readily accessed and discussed in association with student led problems.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

To Pass the module, students need to gain a summative mark of:	40

Recommended Reading

“Signals and systems”, H. P. Hsu, 2nd ed., Schaum's Outlines, McGraw-Hill (New York), 2010 ISBN: 9780071634724 Many other textbooks and internet resources exist and students are encouraged to cross reference the class materials and notes with other sources.