Module Code | EEU33C01
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Module Name | Signals and Systems
ECTS Weighting | 5 ECTS
Semester taught | Semester 1
Module Coordinator/s | Dr. W. Dowling

Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline

On successful completion of this module, students should be able to:

1. Represent both continuous-time and discrete-time periodic signals as a Fourier series.
2. Use the Fourier transform and the Laplace transform to analyse continuous time signals and systems.
3. Use the discrete-time Fourier transform and the z-transform to analyse discrete-time signals and systems.
4. Determine the impulse response, step response and frequency response of both continuous-time and discrete-time systems and determine the response of the LTI system to any input signal. Determine the stability of a feedback system.

Graduate Attributes: levels of attainment
- To act responsibly - Enhanced
- To think independently - Attained
- To develop continuously - Enhanced
- To communicate effectively - Enhanced

Module Content

Please provide a brief overview of the module of no more than 350 words written so that someone outside of your discipline will understand it.

The module presents the mathematical techniques used for continuous-time signal and system analysis. The analytical framework for discrete-time signals and systems is then developed. The final part of this module is an introduction to control systems.

Continuous-Time Signals and Systems

- Linearity, time-invariance, impulse response of a linear time-invariant (LTI) system; the convolution integral; properties of LTI systems; unit step response.

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1 An Introduction to Module Design from AISHE provides a great deal of information on designing and re-designing modules.
2 TEP Glossary
Laplace Transform; properties of the Laplace transform; transfer function of LTI system; poles, zeros and stability of an LTI system, the Fourier transform and its properties.

Frequency response; steady state response; low-pass and high-pass filtering.

Representation of a continuous-time signal by its samples; the sampling theorem; reconstruction of a continuous-time signal from its samples.

**Discrete-Time Signals and Systems**

The unit-impulse response of an LTI discrete-time system; the convolution sum; properties of discrete-time LTI systems; unit step response.

Fourier series representation of discrete-time periodic signals; properties of discrete-time Fourier series.

The discrete-time Fourier transform (DTFT); properties of the DTFT.

The z-transform; region of convergence for the z-transform; inverse z-transform; properties of the z-transform.

Causality; Stability; LTI systems characterized by linear constant-coefficient difference equations.

FIR and IIR filters. Introduction to Control Systems.

Linear Feedback Systems; closed-loop system function.

**Teaching and Learning Methods**

3 lectures and 1 tutorial per week. One 3-hour Matlab-based laboratory.

**Assessment Details**

Please include the following:

- Assessment Component
- Assessment description
- Learning Outcome(s) addressed
- % of total
- Assessment due date

<table>
<thead>
<tr>
<th>Assessment Component</th>
<th>Assessment Description</th>
<th>LO Addressed</th>
<th>% of total</th>
<th>Week due</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Written Examination</td>
<td>2-hour Written Examination</td>
<td>1,2,3,4</td>
<td>85</td>
<td>Exam week</td>
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<tr>
<td>In class test</td>
<td>In class test</td>
<td>1,2</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Matlab-based laboratory</td>
<td>Laboratory Report</td>
<td>1,2</td>
<td>5</td>
<td>Report due 2 weeks after lab</td>
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</tbody>
</table>

3 TEP Guidelines on Workload and Assessment
<table>
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<tr>
<th>Reassessment Requirements</th>
<th>The overall module mark at the Supplemental examinations will be determined solely on the basis of the written examination.</th>
</tr>
</thead>
</table>
| Contact Hours and Indicative Student Workload | **Contact hours:** 44  
Independent Study (preparation for course and review of materials): 60  
Independent Study (preparation for assessment, incl. completion of assessment): 21 |
| Module Pre-requisite | 2E1 Engineering Mathematics III  
2E2 Engineering Mathematics IV |
| Module Co-requisite | |
| Module Website | |
| Are other Schools/Departments involved in the delivery of this module? If yes, please provide details. | No |
| Module Approval Date | 23 August 2019 |
| Approved by | W. Dowling |
| Academic Start Year | |
| Academic Year of Date | |