ENGINEERING MATHEMATICS III - 2024/5

Module code: EEE2035

Module Overview

Expected prior learning: Mathematical experience equivalent to Year 1 of EE programmes or equivalent.

Module purpose: This module builds on the fundamental tools and concepts introduced in the mathematics modules in Year 1 (EEE1031 and EEE1032) and applies them to further engineering examples. A broad range of mathematics topics is covered, and their applications are always borne in mind.

Module provider

Computer Science and Electronic Eng

Module Leader

TORRIELLI Alessandro (Maths & Phys)

Number of Credits: 15

ECTS Credits: 7.5

Framework: FHEQ Level 5

Module cap (Maximum number of students): N/A

Overall student workload

Independent Learning Hours: 90

Lecture Hours: 33

Tutorial Hours: 11

Guided Learning: 5

Captured Content: 11

Module Availability

Semester 1

Prerequisites / Co-requisites

None

Module content

Indicative content includes the following:

Fourier Series and Fourier Transforms. Comparison of time and frequency domain. Fourier transforms and inverse transforms. Convolution. Application to signal processing. Quick method for calculating Fourier transforms.

Probability. Meaning of probability. Dependent, independent and mutually exclusive events.

Statistics. Definition of terms. The probability density function. Normalisation. Normal, Binomial and Poisson probability density functions. Applications to errors, noise, and least squares fitting of straight lines and other curves to data.

Method of least squares. Applications to treatment of experimental results.

Matrices. Determinants. Matrix algebra. Transpose and inverse. Solution of linear simultaneous equations. Eigenvalues and eigenvectors. Two-port parameters.

The wave equation. Derivation and d'Alembert solution.

Laplace transforms. Complex frequency. Partial fractions and the solution of differential equations by Laplace transform. Mechanical examples as well as electronic ones.

Z-transforms. Definition, properties, inversion. Applications and worked examples.

Cross- and Autocorrelation. Definition, examples, applications.

Assessment pattern

Assessment type	Unit of assessment	Weighting
Coursework	PROBLEM SHEET 1	10
Coursework	PROBLEM SHEET 2	10
Examination	2HR invigilated exam	80

Alternative Assessment

N/A

Assessment Strategy

The assessment strategy for this module is designed to provide students with the opportunity to demonstrate the learning outcomes. The written examination will assess the knowledge and assimilation of mathematical terminology, notation, concepts and techniques, as well as the ability to work out solutions to previously unseen problems under time-constrained conditions. The assignments give the students a chance to practise the required techniques shortly after they have been taught and in problems of a similar level to those that they will meet in the exam.

Thus, the summative assessment for this module consists of the following.

- Two take-home problem sheets, submitted as coursework.
- Closed-book written examination.

Formative assessment and feedback

For the module, students will receive formative assessment/feedback in the following ways.

· During lectures, by question and answer sessions

· During office hour meetings with students

· By means of unassessed tutorial problems in the notes (with answers/model solutions)

· Via assessed coursework

Any deadlines given here are indicative. For confirmation of exact dates and times, please check the assessment calendar issued to you.

Module aims

- Students will be able to demonstrate the application of relevant advanced mathematics underpinning telecommunications, linear systems, digital signal processing, control theory, networks and laboratories, as well as substantial parts of many third and fourth year (if a MEng student) modules.
- The module also aims to provide opportunities for students to learn about the Surrey Pillars listed below.

Learning outcomes

		Attributes Developed	
Ref			
001	Apply mathematics and mathematical techniques to a range of engineering problems.	KC	C1, C2

Ref		Attributes Developed	
002	Select the appropriate mathematical techniques for a range of problems, for example in continuous and digital control theory (Laplace & z-transforms), DSP (z-transforms), communications (Fourier transforms), circuit theory (matrices, ODEs) and electromagnetism (wave equation); always bearing in mind the limitations of these techniques.	KCT	C3, C6
003	Demonstrate ability to present solutions in a clear and structured way.	CT	C17

Attributes Developed

C - Cognitive/analytical

K - Subject knowledge

T - Transferable skills

P - Professional/Practical skills

Methods of Teaching / Learning

The learning and teaching strategy is designed to achieve the following aims:

- Student familiarity with the basic concepts, notations and techniques used in mathematics as it is applied to engineering, as taught in Year 1 modules EEE1031 and EEE1032
- Student familiarity with the fundamental tools of applied mathematics that will support many other courses in the current and next Level of Electronic Engineering degree programmes.

Learning and teaching methods include the following:

- Lectures
- Class discussion in lectures.
- One-to-one sessions with lecturer during office hours by arrangement.
- One 1-hour pre-recorded tutorial per week.

Indicated Lecture Hours (which may also include seminars, tutorials, workshops and other contact time) are approximate and may include in-class tests where one or more of these are an assessment on the module. In-class tests are scheduled/organised separately to taught content and will be published on to student personal timetables, where they apply to taken modules, as soon as they are finalised by central administration. This will usually be after the initial publication of the teaching timetable for the relevant semester.

Reading list

https://readinglists.surrey.ac.uk
Upon accessing the reading list, please search for the module using the module code: EEE2035

Other information

Engineering Mathematics III addresses the following Surrey Pillars

- Sustainability – by discussing energy (e.g. via Parseval's Theorem), computation of mean power, the difference between energy and power signals; and by laying the groundwork for continuous and discrete control theory in the Laplace and z-transform sections of the course.
- Global and Cultural Intelligence – by discussing the fact that mathematics is a universal language for describing the real world.
- Digital Capabilities - by encouraging the use of computer software to, for example, carry out a least squares computation when the number of unknown parameters is large (e.g. in the Lab experiment, 'The measurement of pi and e', that accompanies this course).
- Employability – by discussing the general applicability of mathematics to all fields of science; by encouraging students to hone their problem solving skills, e.g. via the problem sets at the end of each chapter of the notes, and by the two assignments.
- Resourcefulness and Resilience – by constant probing questions in lectures; by encouraging students to seek help in one-to-one sessions with me outside the lectures; by reinstating the 2 hour, closed book written exam at the end of the course.

Programmes this module appears in

Programme	Semester	Classification	Qualifying conditions
Computer and Internet Engineering BEng (Hons)	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Computer and Internet Engineering MEng	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Electrical and Electronic Engineering BEng (Hons)	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Electrical and Electronic Engineering MEng	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Electronic Engineering BEng (Hons)	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Electronic Engineering MEng	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Electronic Engineering with Computer Systems BEng (Hons)	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Electronic Engineering with Computer Systems MEng	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module

Programme	Semester	Classification	Qualifying conditions
Electronic Engineering with Nanotechnology BEng (Hons)	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Electronic Engineering with Nanotechnology MEng	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Electronic Engineering with Space Systems BEng (Hons)	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Electronic Engineering with Space Systems MEng	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module