# MATHEMATICS I: PURE MATHEMATICS - 2024/5

## Module code: EEE1031

## Module Overview

Expected prior learning: Mathematical knowledge at the level of entry requirements for a degree programme in Engineering.

Module purpose: Mathematics is the best tool we have for quantitative understanding of engineering systems. This course in pure mathematics is specifically designed for Electronic Engineering students and covers the fundamental techniques for many future engineering courses taught here.

### Module provider

Computer Science and Electronic Eng

### Module Leader

PRINSLOO Andrea (Maths & Phys)

### Number of Credits: 15

### ECTS Credits: 7.5

### Framework: FHEQ Level 4

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

## Overall student workload

Independent Learning Hours: 70

Lecture Hours: 26

Tutorial Hours: 5

Laboratory Hours: 12

Guided Learning: 15

Captured Content: 22

## Module Availability

Semester 1

## Prerequisites / Co-requisites

None.

## Module content

The following topics will be taught:

Algebra: Basic algebra (factorisation, partial fractions, roots of quadratics and other simple equations, linear simultaneous equations), geometry, trigonometry. Trigonometric identities and solutions of trigonometric equations.

Properties of Functions: Exponential and logarithmic functions and their properties. Odd, even and periodic functions. Concept of a function and inverse functions, trigonometric and inverse trigonometric functions, solution of trigonometric equations.

Complex numbers: real and imaginary parts, polar and exponential form, Argand diagram, exp(jx) = cos x + j sin x, relationships between trigonometric functions, De Moivre's theorem and applications.

Vectors: Magnitude, dot and cross product. Meaning of the dot and cross product.

Differentiation: Concept of derivative and rules of differentiation for a function of one variable. Differentiation of trigonometric, exponential and logarithmic functions. Applications to gradients, tangents and normals, extreme points and curve sketching. Functions of several variables. The idea that the graph of z=f(x,y) is a surface. First and second order partial derivatives and their meanings as slopes in particular directions. The total differential and applications to errors and rates of change.

Sequences and Series: Arithmetic and geometric sequences and series. Binomial expansion. Maclaurin and Taylor series expansions. Calculation of approximations and limits using power series. Evaluation of limits, including L'Hôpital's Rule.

Integration: Concept of indefinite integration as the inverse of differentiation and standard methods for integration such as substitution, integration by parts and integration of rational functions. Definite integration, areas under curves. Mean and rms values. Integrals requiring trigonometric substitutions. Calculation of areas under curves given implicitly.

Further Integration: Evaluation of multiple integrals with both constant and non-constant limits. Interpretation of the region of integration of a multiple integral and evaluation of multiple integrals by changing the order of integration.

Numerical methods: Newton-Raphson method; numerical integration using power series.

## Assessment pattern

| Assessment type | Unit of assessment | Weighting |
|---|---|---|
| School-timetabled exam/test | 1-HOUR IN-SEMESTER TEST | 20 |
| Examination | 2-HOUR CLOSED-BOOK WRITTEN 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. The in-semester tests give the students a chance to practice the required techniques shortly after they have been taught.

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

- In-semester test
- 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)
- By means of feedback on an unassessed coursework

## Module aims

- This module aims to provide students with some of the basic understanding and skills in mathematics needed to follow a degree programme in electrical, electronic and computer engineering.
- The module also aims to provide opportunities for students to learn about the Surrey Pillars listed below.

## Learning outcomes

| Ref | | Attributes Developed | |
|---|---|---|---|
| 001 | Demonstrate knowledge of the concepts, notation and terminology introduced in the module | KCT | C1 |
| 002 | Perform basic calculations accurately | CPT | C1 |
| 003 | Solve problems in the key mathematical areas | KCT | C2 |
| 004 | Present solutions in a clear, structured way, with accuracy and logical consistency | KPT | C2 |

## 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.
- Student familiarity with the underlying mathematical tools that will support many other courses in the Electronic Engineering degree programmes.
- All students should be at a sufficient level of ability in Mathematics by the end of semester 1 that they can benefit from the course EEE1032 Mathematics II: Engineering Mathematics

Learning and teaching methods include the following.

- Lectures
- Class discussion in lectures
- One-to-one sessions with lecturers during office hours.

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: EEE1031

## Other information

Digital Capabilities – by understanding series approximations of functions and approximations of roots of functions (via the Newton-Raphson method) which are implemented by computer software to produce approximations to a given number of significant figures.

Employability – by learning widely applicable Mathematical skills; and by honing problem-solving and critical thinking skills, e.g. via problems in the module notes, tutorials and unassessed coursework.

Global and Cultural Capabilities – by becoming fluent in Mathematics which is a globally universal language for describing the world.

Resourcefulness and Resilience – by encouraging students to answer questions in lectures and tutorials, and to seek help in one-to-one office hours; and by enabling students to apply their Mathematical knowledge to answer unseen questions in closed book, written assessments.

Sustainability – by learning the foundational Mathematics which underpins a wide range of Engineering and Physical Sciences which have extensive applications to Sustainability.

## Programmes this module appears in

| Programme | Semester | Classification | Qualifying conditions |
|---|---|---|---|
| Astronautics and Space Engineering BEng (Hons) | 1 | Compulsory | A weighted aggregate mark of 40% is required to pass the module |
| Astronautics and Space Engineering MEng | 1 | Compulsory | A weighted aggregate mark of 40% is required to pass the module |
| 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 |