MATHEMATICS FOR ENGINEERS - 2024/5

Module code: ENG1103

Module Overview

A first level engineering mathematics module designed to briefly revise and then extend A-Level maths material and introduce students to more mathematical techniques to support engineering science modules.

Module provider

Mechanical Engineering Sciences

Module Leader

ROBERTS James (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: 62

Lecture Hours: 33

Tutorial Hours: 11

Guided Learning: 11

Captured Content: 33

Module Availability

Semester 1

Prerequisites / Co-requisites

n/a

Module content

Indicative content includes:
Functions: Concept of a function; domain, range. Odd, even and periodic functions. Inverse functions.
Exponential and logarithmic functions and their properties, inverse trigonometric functions, hyperbolic functions and their inverses, solution of trigonometric and hyperbolic equations.
Differentiation: Concept of derivative and rules of differentiation for a function of one variable. Applications to gradients, tangents and normals, extreme points and curve sketching.
Series and Limits: Arithmetic and geometric progressions, Maclaurin and Taylor series, use of series in approximations, Newton Raphson method, various techniques for the evaluation of limits.
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, area under curves, use of recurrence relationships. Applications of integration to curve lengths, surfaces and volumes of revolution, first moments and centroids, second moments and radii of gyration.
Vectors: Vectors as quantities with magnitude and direction, graphical representation, addition and subtraction. Unit vectors; algebraic representation of vectors; addition subtraction, multiplication by constant; scalar (dot) product, projection, resolution into components; cross (vector) product. Vector functions of one variable, differentiation, applications.
Complex numbers: Real and imaginary parts, polar form, Argand diagram, exp(jx), De Moivre¿s theorem and applications.
Fourier Series: Periodic functions of period 2L.

Assessment pattern

Assessment type	Unit of assessment	Weighting
School-timetabled exam/test	Test (1 hr duration)	20
Examination	Exam (2 hrs duration)	80

Alternative Assessment

N/a

Assessment Strategy

The assessment strategy is designed to provide students with the opportunity to demonstrate their knowledge of mathematical concepts and rules, and to show their skills in solving mathematical and engineering problems using appropriately selected techniques.

Formative assessment and feedback
Formative ¿assessment¿ is a regular ongoing process all semester through work on the tutorial questions. Formative feedback is provided orally on a one-to-one basis and to the whole group in tutorial/problems classes, and through the issuing of fully worked solutions to tutorial problems.

Summative assessment
The summative assessment consists of:
Class test (Learning outcomes: 1-5)
Exam (Learning Outcomes 1-7)

Module aims

- Consolidate and extend students' knowledge of basic mathematical concepts and techniques relevant to the solution of engineering problems.
- Equip students to apply their mathematical knowledge and skills to engineering problems.

- Enable students to select appropriate methods of solution.

Learning outcomes

		Attributes Developed
001	Use vector algebra and applications of this, to mechanics	CK
002	Demonstrate the ability to manipulate standard functions	CK
003	Use complex numbers	CK
004	Apply techniques of differential and integral calculus for functions of one variable	CK
005	Demonstrate techniques of differentiation and integration to determine physical engineering properties (e.g. in mechanics)	CK
006	Manipulate simple series and their use in e.g. approximations	CK
007	Represent simple periodic functions in terms of trigonometric (Fourier) series.	CK

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 familiarise students with mathematical concepts and techniques, supported by extensive use of examples and applications; students themselves are engaged in the solution of problems and application of techniques in tutorials/problems classes.
The learning and teaching methods include:
Lectures to revise underpinning prior learning and bring students from varying background to a common level of knowledge, and to introduce new concepts and techniques and provide illustrative examples and
applications.
Recommended wider reading of matching sections of relevant recommended texts.
Problem sheets of examples for technique selection and skill development.
Tutorials/problems classes for the development of skills in technique application and also in selection of
appropriate techniques, using the above problems sheets; assistance is given both at individual level, and for the group on common areas of difficulty

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: ENG1103

Other information

The School of Mechanical Engineering Sciences is committed to developing graduates with strengths in Employability, Digital Capabilities, Global and Cultural Capabilities, Sustainability, and Resourcefulness and Resilience. This module is designed to allow students to develop knowledge, skills, and capabilities in the following areas: Digital Capabilities: Students will use digital technology as part of summative assessment. Students will acquire skills in presenting mathematical solutions using digital technology.

Programmes this module appears in

Programme	Semester	Classification	Qualifying conditions
Aerospace Engineering BEng (Hons)	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Aerospace Engineering MEng	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Biomedical Engineering BEng (Hons)	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Biomedical Engineering MEng	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Mechanical Engineering BEng (Hons)	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Mechanical Engineering MEng	1	Compulsory	A weighted aggregate mark of 40% is required to pass the module