UNIVERSITY of BRADFORD

Module Descriptor

Module Details	
Module Title	Mathematical Methods and Applications
Module Code	ENM4004-B
Academic Year	2023/4
Credits	20
School	Engineering and Informatics (Faculty-wide)
FHEQ Level	FHEQ Level 4

Contact Hours	
Type	Hours
Lectures	48
Tutorials	24
Directed Study	128

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Academic Year

Module Aims

This module develops a comprehensive foundation in mathematics that is required for a describing, modelling, and evaluating science and engineering systems. It reinforces elements of previous mathematical knowledge and develops new mathematical techniques and theory that have applicability to other science and engineering modules, reinforcing the interdisciplinary nature of mathematics underpinning engineering. Students will gain an understanding of a range of mathematical techniques and will develop confidence in applying these to solve various problems.

Outline Syllabus

SEMESTER 1

01 Algebra: manipulation, linear and quadratic equations; powers and roots; exponential and logarithmic forms.
02 Co-ordinate geometry: 2D Cartesian and polar coordinates, familiar geometric shapes and equations (line, circle, ellipse, hyperbola). Parametric curves. 3D Cartesian and spherical coordinates.
03 Functions: concepts and notation, graphs of specific functions (polynomial, trigonometric, exponential, logarithm), transformations, composition, inverses, hyperbolic functions.
04 Differentiation: limits, definitions, tables, rules (sum, product, quotient, chain), techniques (implicit, parametric, logarithmic), application to engineering (related rates, maxima and minima).
05 Integration: definitions, tables, rules, techniques (substitution, by parts), application to engineering (area, surface and volume of rotation, arc length, centroid, mean value).
06 Complex numbers: properties, algebra, polar and exponential forms, roots, loci, application to engineering.

SEMESTER 2

07 Vector algebra: properties, unit vector, (i,j,k), lines and planes, scalar and vector products, application to engineering (forces, work done, moments).
08 Matrix algebra: definitions, basic algebra, linear transformations, linear systems.
09 Ordinary Differential Equations: 1st-order ODEs (direct, separable, linear & integrating factor), specific nonlinear ODEs, constant-coefficient 2nd-order ODEs (complementary function, particular integral), application to
engineering.
10 Numerical methods: errors, power series, solution to equations f(x) = 0, linear systems, numerical integration.

Learning Outcomes

Outcome Number	Description
01	Understand and explain mathematical concepts and techniques underpinning aspects of their course of study.
02	Apply a range of mathematical principles and techniques to describe, model, analyse and evaluate engineering problems related to your engineering discipline.
03	Carry out systematic problem solving

Learning, Teaching and Assessment Strategy

Theory, calculation methodologies and applications are delivered in online lectures with worked examples. Discipline-based tutorial groups are used to reinforce knowledge and skills using a range of exercises. Take-home time-limited formative assessments will support timely and constructive interim feedback. Online seminar sessions for the entire class will be used to provide live worked solutions to the formative assessments that allow students to self-mark and identify gaps in knowledge that can support additional self-directed study. Discipline skills are assessed in formative assessments and summative time-limited coursework assessments.

The VLE will be used to provide access to online resources, lecture notes and external links to websites of interest and use. ESD learning opportunities will be provided via discipline-based examples and exercises, emphasising where modelling and analysis can support achievement of low-impact high-performance engineering solutions.

This module satisfies the below Learning Outcomes as specified by the Accreditation of Higher Education Programmes: Fourth Edition (AHEP4) as published by the Engineering Council in-line with the UK Standard for Professional Engineering Competence (UK-SPEC). These outcomes specify five key areas of learning which partially (C) or fully (M) meet the academic requirement for CEng registration: Science and Mathematics (1), Engineering Analysis (2-4), Design and Innovation (5-6), The Engineer and Society (7-11), and Engineering Practice (12-18). Further details of these learning outcomes can be found at https://www.engc.org.uk/ahep/

M1, C1, C2,

Mode of Assessment

Type	Method	Description	Weighting
Summative	Examination - Closed Book	Answer 6 from 8 questions covering syllabus topics 01-06 (90 minute closed book examination)	50%
Summative	Examination - Closed Book	Answer 5 from 7 questions covering syllabus topics 07-10 (120 minute closed book examination)	50%
Formative	Computerised examination	Multiple activities to cover module topics with live solutions for self marking and reflection with sample solutions uploaded later.	N/A

Reading List

To access the reading list for this module, please visit https://bradford.rl.talis.com/index.html

Please note:
This module descriptor has been published in advance of the academic year to which it applies. Every effort has been made to ensure that the information is accurate at the time of publication, but minor changes may occur given the interval between publishing and commencement of teaching. Upon commencement of the module, students will receive a handbook with further detail about the module and any changes will be discussed and/or communicated at this point.
