UNIVERSITY of BRADFORD

Module Descriptor

Module Details	
Module Title:	Mathematical Methods and Applications
Module Code:	ENM4004-B
Academic Year:	2019-20
Credit Rating:	20
School:	Department of Mechanical and Energy Systems Engineering
Subject Area:	Engineering Mathematics
FHEQ Level:	FHEQ Level 4
Pre-requisites:	
Co-requisites:	

Contact Hours	
Type	**Hours**
Lectures	48
Tutorials	24
Directed Study	128

Availability	
Occurrence	**Location / Period**
BDA	University of Bradford / Academic Year (Sept - May)

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

Algebra: manipulation, linear and quadratic equations; powers and roots; exponential and logarithmic forms.
Co-ordinate geometry: 2D Cartesian and polar coordinates, familiar geometric shapes and equations (line, circle, ellipse, hyperbola). Parametric curves. 3D Cartesian and spherical coordinates.
Functions: concepts and notation, graphs of specific functions (polynomial, trigonometric, exponential, logarithm), transformations, composition, inverses, hyperbolic functions.
Limits:
Differentiation: definitions, tables, rules (sum, product, quotient, chain), techniques (implicit, parametric, logarithmic), application to engineering (e.g. related rates, maxima and minima).
WEEK 7 FORMATIVE TEST (2ND HOUR)
Integration: definitions, tables, rules, techniques (substitution, by parts), application to engineering (e.g. area, surface and volume of rotation, arc length, centroid, mean value).
Complex numbers: properties, algebra, polar and exponential forms, roots, loci, application to engineering.
WEEK 11 (SKILLS FOR ENGINEERS LABS)
Vector algebra: properties, unit vector, lines and planes, i,j,k, scalar product, vector product, applications to engineering (e.g. forces, work done, moments).
Matrix algebra: definitions, basic algebra, linear transformations, linear systems.
SEMESTER 2
WEEK 1 FORMATIVE (1ST & 2ND HOUR)
Matrix algebra: eigenvalues and eigenvectors, applications to engineering (e.g. material deformation).
WEEK 4 REVISION
Ordinary Differential Equations: 1st-order ODEs (direct, separable, linear and integrating factor), specific non-linear ODEs, constant-coefficient 2nd-order ODEs (complementary function, particular integral), application to engineering.
Sequences: sequences, series and power series.
Numerical methods: errors, solution to equations, numerical integration.
WEEKS 8 AND 9 REVISION
WEEK 10 FORMATIVE (1ST & 2ND HOUR)
WEEKS 11 AND 12 REVISION

Learning Outcomes

1	Understand and explain mathematical concepts and techniques underpinning aspects of their course of study.
2	Apply a range of mathematical principles and techniques to describe, model, analyse and evaluate engineering problems related to your engineering discipline.
3	Carry out systematic problem solving

Learning, Teaching and Assessment Strategy

Theory, calculation methodologies and applications are delivered in lectures with worked examples.
Exercise classes and discipline tutorial groups are used to reinforce knowledge and skills using a range of pre-set tutorial exercises.
Structured formative assessments will support timely and constructive interim feedback, providing student with the opportunity for self-gap-analysis.
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.

Discipline skills are assessed in formative and summative classroom tests to facilitate written feedback.
The wider learning outcomes of the module area assessed in the final closed-book examination.

This module satisfies the below Learning Outcomes as specified by the Accreditation of Higher Education Programmes: Third Edition (AHEP3) as published by The Engineering Council in-line with the UK Standard for Professional Engineering Competence (UK-SPEC). These outcomes specify six key areas of learning: Science and Mathematics (SM), Engineering Analysis (EA), Design (D), Economic, Legal, Social, Ethical and Environmental Context (EL), Engineering Practice (P) and Additional General Skills (G).
SM1b, SM2b, SM3b, EA1b, EA3b, SM1m, SM2m, SM3m, SM5m, SM6m.
Further details of these learning outcomes can be found at https://www.engc.org.uk/.

Mode of Assessment

Type	Method	Description	Length	Weighting
Summative	Examination - closed book	Answer selection of questions covering full syllabus. 6 from 9 questions	2 hours	60%
Formative	Classroom test	All questions test on Sem 1 material with live worked solutions in the 2nd lecture hour	60 minutes	%
Formative	Classroom test	All questions test on calculus and Sem 2 material with live worked solutions in the 2nd lecture hour	60 minutes	%
Summative	Classroom test	Answer all questions test covering Sem 1 material	90 minutes	30%
Summative	Classroom test	12 question class test reinforcing formative plus new material	60 minutes	10%
Formative	Classroom test	All questions test with immediate live worked solutions for self-marking and gap analysis	30 minutes	%

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.