UNIVERSITY of BRADFORD

Module Descriptor

Module Details	
Module Title	Advanced Mathematical and Analytical Skills
Module Code	BIC6008-A
Academic Year	2022/3
Credits	10
School	UoB International College
FHEQ Level	FHEQ Level 6

Contact Hours	
Type	Hours
Lectures	50
Directed Study	50

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Non-Standard Academic Year
BDA	University of Bradford / Semester 1
BDA	University of Bradford / Semester 3

Module Aims

This module aims to strengthen and extend students' mathematical skills, to enable students to appreciate the use of mathematics as an engineering tool and to build up a student's level of competence in applying mathematical methods to solve engineering problems.

Outline Syllabus

* Revision of basic mathematical manipulation, including functions and graphs relevant to engineering, complex numbers, review of differentiation and differential equations
* Vector Calculus: addition, subtraction, multiplication, dot product, cross product, divergence of vectors, vector projection on a plane, vector equations of lines and planes, algebra of complex numbers, Loci problem, (properties, De Moivre's theorem, vectors amplitude and phase)
* Matrix algebra: addition, subtraction, multiplication, trace, determinant, linear equations, linear transformations, decompositions, eigenvalues and eigenvectors, the polynomial method, the power method and inverse power method, application to vibration problems, introduction to tensors (with applications to stress and strain tensors)
* Laplace transform: definition, examples, transfer functions, stability of systems, application to solution of ODEs and PDEs
* Fourier transform: Fourier series (discrete domain), definition, examples, link to Laplace transform, frequency domain, applications to SDOF
* Computer Modelling Techniques: Application of MATLAB for engineers and scientific problems.
* Finite Element Analysis (FEA), Revision on matrix manipulation, flexibility method, stiffness method, interpolation functions, the shape function, element selection, discretisation of a domain, analysis type selection, building an FEA model, one-dimensional FEA.
* Introduction to Computational Fluid Dynamic (CFD), flow models, forms of flow governing equations, integral approach, differential approach, conservation and non-conservation forms of the transport equations, discretisation methods

Learning Outcomes

Outcome Number	Description
LO1	Evaluate relevant mathematical concepts and their use.
LO2	Make calculations by hand and with the use of software tools.
LO3	Evaluate the use of mathematical tools and numerical techniques to the solution of engineering problems.
LO4	Formulate a problem ready for computer simulation and drive commonly used industrial software.

Learning, Teaching and Assessment Strategy

Working in groups of up to 18, students learn via tutor-led seminars and practical sessions. The teaching approach places considerable emphasis on interactivity between teacher and students, and between individual students within the group. This will be facilitated by the range of activities introduced into classes, the use of group and pair work, particularly in practical work. Within the practical element of the course, students will learn about the industry-standard software and its uses in resolving engineering problems. A regular review of the student portfolio by their tutor provides opportunities for detailed and helpful formative feedback.

Student progress will be closely monitored by both subject staff and each student's Personal Tutor. Personal Tutors will facilitate one-to-one sessions with students during which they are encouraged to reflect on their progress in meeting their objectives. This monitoring will provide tailored learner support in specific, identified areas for development.

The summative assessment consists of two parts. Part 1 will be a portfolio compiled by the student throughout the module evidencing the use of calculations and evaluation of the use of mathematical tools and numerical techniques to the solution of engineering problems. It will be submitted for grading at the end of the module. Part 2 of the summative assessment consists of an unseen examination covering mathematical concepts and the formulation of a problem ready for computer simulation and drive commonly used industrial software.

Mode of Assessment			
Type	Method	Description	Weighting
Summative	Coursework - Written	Portfolio of written evidence of exercises set during the module (1500 words)	50%
Summative	Examination - Closed Book	Unseen examination, covering all aspects taught during the module (2 Hrs)	50%

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.

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