Module Specification

Fundamentals of Engineering Mathematics and Modelling

Version: 2023-24, v1.0, 14 Jun 2023

Contents

Part 1: Information

Module title: Fundamentals of Engineering Mathematics and Modelling

Module code: UFME3L-30-1

Level: Level 4

For implementation from: 2023-24

UWE credit rating: 30

ECTS credit rating: 15

Faculty: Faculty of Environment & Technology

Department: FET Dept of Engineering Design & Mathematics

Partner institutions: University Centre Weston

Field: Engineering, Design and Mathematics

Module type: Module

Pre-requisites: None

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: This module will provide students with the requisite mathematical knowledge used to synthesise, analyse and evaluate different engineering situations, but also the skills used to model and simulate a variety of engineering problems.

Features: Not applicable

Educational aims: This module provides the initial underpinning for mathematical skills and

analysis of engineering problems, studied across the Electromechanical programme. The module will integrate study of mathematics with engineering subjects studied in other level 4 modules, but also provide the basic mathematical tools which are required and developed in later modules.

Outline syllabus: Algebra and Functions: Contextualisation of standard engineering functions such as polynomials, rational functions, partial fractions, exponential, logarithmic and trigonometric and piecewise functions.

Complex Numbers: Roots of polynomial equations, basic algebraic operations, rectangular, polar and exponential forms.

Matrix and Vector Algebra: Properties of matrices and determinants, the inverse matrix, Gaussian elimination, applications to systems of linear equations. Vector and scalar quantities, resolution of forces, properties of vector quantities, vector addition, unit vectors, position vectors, dot and cross products.

Calculus: Contextualisation of standard derivatives, linear properties, product rule, quotient rule and chain rule. Higher order derivatives, turning points. Contextualisation of standard integrals, indefinite and definite integration, integration by parts, integration applications such as average value of a function, root mean square calculations, centre of mass and moments of inertia.

Linear constant coefficient differential equations: Modelling of simple systems, solution of first and second order linear constant co-efficient ordinary differential equations, natural and forced response.

Matlab Programming: Arithmetic, variables, vectors, matrices, linear systems of equations, data visualisation, conditional statements, functions, programming procedures (for, while), numerical methods for time-step approach to dynamics problems.

Engineering applications: modelling, implementation and verification through Matlab to applications such as: displacement, velocity and acceleration extended to non-

uniform acceleration incorporating numerical methods, projectile motion, tanks, missiles, Newton's laws, work and energy, momentum and force impulse, torque, cooling problems, mechanical and electrical dynamical systems.

Part 3: Teaching and learning methods

Teaching and learning methods: Learning material will be delivered through a set of lectures used to deliver new material and to consolidate previous material, and tutorial workshops in a computer simulation lab where students will work on mathematical and engineering, modelling and simulation problems.

Module Learning outcomes: On successful completion of this module students will achieve the following learning outcomes.

MO1 Demonstrate the ability to use a range of fundamental engineering mathematical techniques.

MO2 Apply mathematical methods and engineering principles to formulate, implement and validate an appropriately constructed mathematical model of an engineering problem.

MO3 Use programming software to model, simulate and implement appropriate mathematical solutions to engineering problems.

Hours to be allocated: 300

Contact hours:

Independent study/self-guided study = 228 hours

Face-to-face learning = 24 hours

Total = 300

Reading list: The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://uwe.rl.talis.com/modules/ufmfms-30-1.html

Part 4: Assessment

Assessment strategy: The assessment is designed to allow students to build confidence in their mathematical abilities over time and to be able to demonstrate the use of computer-based methods for implementing mathematical solutions to engineering problems.

Throughout the first term, students will take 3 summative e-assessments which will be used to provide regular feedback. Students will need to pass all 3 assessments, and will have up to 3 attempt per e-assessment.

The final assessment will be a computer-based timed online examination where students demonstrate their ability to create computer-based solutions to engineering problems that require a mathematical approach (24 hour).

The resit assessment will follow the same format as the first sit assessment profile.

Assessment tasks:

Examination (Online) (First Sit)
Description: Online 24-hour examination.
Weighting: 100 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO2, MO3

Online Assignment (First Sit)
Description: E-Assessment portfolio (pass/fail)
Weighting:
Final assessment: No
Group work: No
Learning outcomes tested: MO1

Examination (Online) (Resit)
Description: Online 24-hour examination.

Weighting: 100 %

Final assessment: Yes

Group work: No

Learning outcomes tested: MO2, MO3

Online Assignment (Resit)

Description: E-Assessment portfolio (pass/fail)

Weighting:

Final assessment: No

Group work: No

Learning outcomes tested: MO1

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Electro-mechanical Engineering {Apprenticeship-UCW}[UCW] BEng (Hons) 2023-24