Module Specification

Calculus and Numerical Analysis

Version: 2025-26, v4.0, Approved

Contents

Part 1: Information

Module title: Calculus and Numerical Analysis

Module code: UFMFNV-30-2

Level: Level 5

For implementation from: 2025-26

UWE credit rating: 30

ECTS credit rating: 15

College: College of Arts, Technology and Environment

School: CATE School of Computing and Creative Technologies

Partner institutions: None

Field: Computer Science and Creative Technologies

Module type: Module

Pre-requisites: Calculus and Numerical Techniques 2024-25

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: This module covers advanced calculus and numerical analysis concepts and techniques.

The concepts of calculus, differential equations, numerical methods and Fourier series will be developed into more advanced mathematical methods and analysis of these methods.
Students will take a mathematical approach to solving problems, analysing methods,

interpretation of results, investigation of strengths and limitations of methods and comparison of methods.

As part of the module, students will use mathematical software and programming to develop methods and to construct and interpret solutions to the mathematical problems investigated in this module.

The material has wide application in science, technology, engineering and finance.

Features: Not applicable

Educational aims: The aim of this module is to ensure that students have a broad knowledge and understanding of advanced concepts and techniques in calculus and numerical methods.

Outline syllabus: PDEs: introduction, classification, direct integration, physical examples (1D wave, 1D heat, 2D Laplace equation), separation of variables, initial and boundary value problems, solution using Fourier series

Analysis of Numerical Techniques

Root Finding Methods: fixed point iteration, Newton's method, secant method, error and convergence analysis

Numerical Integration: trapezoidal rule, Simpson's rule, Gaussian quadrature, error analysis

Interpolation: Newton interpolation, cubic splines

Numerical Solution of ODEs: initial value problems, numerical methods, analysis and comparison of methods

Integral Transforms and their applications: Fourier Transform

Part 3: Teaching and learning methods

Teaching and learning methods: The module is delivered by means of lectures and tutorials. To prepare for assessment, students will be expected to undertake self-directed learning in addition to the directed learning which supports taught classes.

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

MO1 Identify, apply and evaluate techniques for solving problems in calculus, differential equations, and integral transforms.

MO2 Identify, implement and evaluate numerical algorithms.

MO3 Evaluate, improve, and extend the solution to mathematical problems using mathematical software and programming.

MO4 Communicate and interpret results, strengths and limitations of mathematical methods.

Hours to be allocated: 300

Contact hours:

Independent study/self-guided study = 228 hours

Face-to-face learning = 72 hours

Reading list: The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://rl.talis.com/3/uwe/lists/0F8FCCBE-7A64-2EE6-C711-06CBEAC20ED9.html?lang=en-GB&login=1

Part 4: Assessment

Assessment strategy: The assessment strategy is designed to assess achievement of the learning outcomes, to support the development of skills and to provide individual feedback such that students are aware of their progress and level of achievement during the year.

The blend of different types of assessments takes into account different learning styles. The distribution of assessments encourages uniform engagement throughout the year with assessments placed at end of units of module content.

The portfolio assessment not only enables students to engage with a practical element of the module, the use of mathematical software, but also to manage team work. The output from the exercise will be a 10 minute group video with supporting technical material and an individual programming exercise. A peer review exercise will take place to moderate the group presentation.

To written assignment will assess understanding and assimilation of fundamental concepts, theories and techniques and to ability to utilise them in some domain of application (which may include other branches of mathematics).
Students will be able to work on the assignment over several weeks as the relevant material is developed.

The resit assessments will match the main sit.

Assessment tasks:

Written Assignment (First Sit)
Description: Written assignment (approx. 6-12 pages)
Weighting: 50 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO4

Portfolio (First Sit)
Description: Group Presentation and individual programming assignment
Weighting: 50 %
Final assessment: No
Group work: Yes
Learning outcomes tested: MO2, MO3, MO4

Written Assignment (Resit)
Description: Written assignment (approx. 6-12 pages)
Weighting: 50 %

Final assessment: Yes

Group work: No

Learning outcomes tested: MO1, MO4

Portfolio (Resit)

Description: Group Presentation and individual programming assignment

Weighting: 50 %

Final assessment: No

Group work: Yes

Learning outcomes tested: MO2, MO3, MO4

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Mathematics {Foundation} [Frenchay] BSc (Hons) 2023-24

Mathematics [Frenchay] BSc (Hons) 2024-25