Module Specification

Calculus and Numerical Analysis

Version: 2022-23, v3.0, 31 May 2022

Contents

Part 1: Information

Module title: Calculus and Numerical Analysis

Module code: UFMFNV-30-2

Level: Level 5

For implementation from: 2022-23

UWE credit rating: 30

ECTS credit rating: 15

Faculty: Faculty of Environment & Technology

Department: FET Dept of Engineering Design & Mathematics

Partner institutions: None

Delivery locations: Frenchay Campus

Field:

Module type: Standard

Pre-requisites: Calculus and Numerical Techniques 2021-22

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, numerical methods, 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

Total = 300

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.

Component B consists of a group work assignment and a controlled conditions coursework. The group work assignment 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 group work assignment will run during the project week in Teaching Block 1. The output from the exercise will be a 10 minute group video with supporting technical material. A peer review exercise will take place to moderate the group mark in accordance with the Department's Group Work Policy.
The controlled conditions coursework will be a one hour end of module assessment, which will assess key mathematical concepts and techniques covered towards the end of the module. It will contain partially seen questions to allow preparatory work.

Component A consists of an individual computer based assessment taken under controlled conditions. The assignment will be run during Teaching Block 2. The students will get a preparatory brief which will require them to run, modify and analyse computer programs. The activity will conclude with a two hour in-class test where students can demonstrate their coding knowledge under controlled conditions.

The resit assessment will involve an individual written report, which will require students to run, modify and analyse computer programs. This will assess the same topics covered by the computer based assessment in the first sit. In addition there will be a 2 hour online examination (24 hours submission) which will assess the topics covered by the group coursework and the controlled conditions coursework in the first sit.

Assessment components:

In-class test - Component A (First Sit)
Description: An individual assignment leading to a computer based assessment taken under controlled conditions.

The individual assignment will assess material covered in Numerical Solutions of ODEs and Analysis of Numerical Techniques, and the controlled conditions part will take place during Teaching Block 2. Students will receive a brief which will require them to run and edit computer programs as preparation for the controlled assessment.
Weighting: 50 %
Final assessment: No
Group work: No
Learning outcomes tested:

Presentation - Component B (First Sit)
Description: 10 minute Group video with supporting technical material
Weighting: 25 %
Final assessment: No
Group work: Yes
Learning outcomes tested:

Examination (Online) - Component B (First Sit)
Description: A short controlled conditions assessment which assesses the final section of the module. The assessment will be part-seen to allow for preparatory work. The submission will be online (24 hour submission window).
Weighting: 25 %
Final assessment: Yes
Group work: No
Learning outcomes tested:

Written Assignment - Component A (Resit)
Description: Written assignment which requires students to run, modify and analyse computer programs.
Weighting: 50 %
Final assessment: Yes
Group work: No
Learning outcomes tested:

Examination (Online) - Component B (Resit)
Description: A short controlled conditions assessment which assesses the final section of the module. The assessment will be part-seen to allow for preparatory work. The submission will be online (24 hour submission window).
Weighting: 50 %
Final assessment: No
Group work: No
Learning outcomes tested:

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Mathematics with Qualified Teacher Status [Sep][FT][Frenchay][3yrs] BSc (Hons) 2021-22

Mathematics [Sep][FT][Frenchay][3yrs] BSc (Hons) 2021-22

Mathematics [Sep][SW][Frenchay][4yrs] BSc (Hons) 2021-22

Mathematics {Foundation}[Sep][FT][Frenchay][4yrs] BSc (Hons) 2020-21

Mathematics {Foundation}[Sep][SW][Frenchay][5yrs] BSc (Hons) 2020-21

Mathematics with Qualified Teacher Status {Foundation} [Sep][FT][Frenchay][3yrs] - Not Running BSc (Hons) 2020-21