MODULE SPECIFICATION

Part 1: Information			
Module Title	Numerical Analysis		
Module Code	UFMFX9-30-3	Level	Level 6
For implementation from	2019-20		
UWE Credit Rating	30	ECTS Credit Rating	15
Faculty	Faculty of Environment & Technology	Field	Engineering, Design and Mathematics
Department	FET Dept of Engin Design & Mathematics		
Module type:	Standard		
Pre-requisites	Mathematical Methods 2019-20		
Excluded Combinations	None		
Co- requisites	None		
Module Entry requirements	None		

Part 2: Description

Educational Aims: "Numerical Analysis is the study of algorithms for the problems of continuous mathematics" – L.N.Trefethen.

This module will introduce a number of numerical methods for the solution of a range of mathematical problems. Numerical methods are methods in mathematics that solve problems for which there is, typically, no analytical method of solution. The subsequent analysis of the numerical methods considers:

Stability analysis – will the method actually supply useful results at the end,

Efficiency – how much time and space does the method need,

Consistency – will the method actually solve what we think it is solving,

Error analysis – how accurate will the end results be.

Real world problems are often too complicated to be solved analytically. Hence, numerical methods, and their subsequent analysis, are widely used in industry.

Outline Syllabus: It is assumed in the delivery of this module that the following methods have been covered at level 2:

Newton method for one variable.
Lagrange interpolation.
Trapezium rule.
Euler's method.

The syllabus content for the module will cover numerical methods in the following fields and in each case will include an introduction, derivation and analysis of these methods. As appropriate, the analysis will include the topics of accuracy, efficiency, convergence and stability.

Solving Equations:
Bisection method.
Fixed point iteration.
Secant method.

Solving Systems of Equations:
Direct methods.
Iterative methods.
Newton's method.

Numerical Differentiation and Integration:
Finite difference method
Newton-Cotes formulae
Gaussian quadrature

Ordinary Differential Equations:
Initial value problems.
RK-type and multi-step schemes
Improvements to schemes – e.g. adaptive time-steps.
Boundary value problems.

Partial Differential Equations:
Finite difference scheme applied to elliptic, parabolic and hyperbolic problems.
Explicit and implicit schemes.
Regular and irregular grids.
Implementation of Neumann and Robin boundary conditions.

Teaching and Learning Methods: The module is delivered by means of lectures, tutorials and computing laboratory sessions. Attendance at all classes will be strongly encouraged, both in terms of learning and also as part of assessment preparation. To prepare for assessment, students are expected to undertake self-directed learning in addition to the directed learning which supports taught classes.

Typically the scheduled teaching hours take the form of:
(i) Whole group lectures, used to deliver new material and to consolidate previous material, and
(ii) (ii) Small-group classroom tutorials with activities designed to reinforce and enhance students' understanding of the lecture material.
(iii) (iii) Small-group computing laboratory sessions designed to develop the students' ability to generate and utilise software and to analyse software output.

Contact time 72 hours
Assimilation and development of knowledge 150 hours
Coursework preparation 22 hours
Examination preparation 56 hours
TOTAL 300 HOURS

Part 3: Assessment			
The assessment strategy for this module comprises a written examination (Component A) and a Numerical Analysis Assignment (Component B). The end-of-module examination is summative and tests students' ability to bring together concepts and techniques from the whole module and select appropriate solution techniques to the solution of mathematical problems that arise in numerical analysis problems with interpretation of the results. The numerical analysis assignment will involve working with software. Students will build on and adapt template code used in class to address a more challenging problem. This will involve computer programming, interpreting computer outputs and/or performing a critical review of the methods used.			
First Sit Components	**Final Assessment**	**Element weighting**	**Description**
Set Exercise - Component B		25 %	Numerical analysis assignment
Examination - Component A	✓	75 %	Written examination (3 hours)
Resit Components	**Final Assessment**	**Element weighting**	**Description**
Set Exercise - Component B		25 %	Numerical analysis assignment
Examination - Component A	✓	75 %	Written examination (3 hours)

Part 4: Teaching and Learning Methods

Learning Outcomes

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

Module Learning Outcomes	Reference
Read and understand a description of a numerical method and be able to implement the method, both by hand and by software development	MO1
Derive and analyse a numerical method	MO2
Interpret the results of a numerical method, including a critical evaluation of the method's performance	MO3
Identify suitable types of numerical methods for the solution of particular mathematical problems.	MO4

Contact Hours

Independent Study Hours:	
Independent study/self-guided study	228
Total Independent Study Hours:	228
Scheduled Learning and Teaching Hours:	
Face-to-face learning	72

	Total Scheduled Learning and Teaching Hours:	72
	Hours to be allocated	300
	Allocated Hours	300
Reading List	*The reading list for this module can be accessed via the following link:* https://uwe.rl.talis.com/modules/ufmfx9-30-3.html	

Part 5: Contributes Towards
This module contributes towards the following programmes of study: