Title of Module: Numerical Analysis			
Code: MATH08009	**SCQF Level: 8** (Scottish Credit and Qualifications Framework)	**Credit Points: 20**	**ECTS: 10** (European Credit Transfer Scheme)
School:	School of Computing, Engineering and Physical Sciences		
Module Co-ordinator:	Wan R Mekwi		

Summary of Module
This module is intended to serve as a first course in numerical analysis. It will cover computer arithmetic, the fundamental areas of error analysis, numerical methods for the solution of equations in one variable (root-finding algorithms), interpolation and polynomial approximation, and numerical integration. Error analysis will consider round-off errors and computer arithmetic, along with algorithms and convergence. Iterative root-finding algorithms will be explored including fixed-point, bisection, secant and Newton's method for functions of a single-variable. Methods for functions of multiple variables will be briefly introduced Polynomial interpolation will be considered and interpolation error will also be discussed. Approximation using polynomials will also be explored. Quadrature rules including Newton-Cotes and Gaussian quadrature will be designed and analysed together with error estimates. The Graduate Attributes relevant to this module are given below: - Academic: Critical thinker; Analytical; Inquiring; Knowledgeable; Problem-solver; Digitally literate; Autonomous.   - Personal: Motivated; Resilient.   - Professional: Ambitious; Driven.

Module Delivery Method					
Face-To-Face	**Blended**	**Fully Online**	**HybridC**	**HybridO**	**Work-based Learning**
	✓				

Face-To-Face
Term used to describe the traditional classroom environment where the students and the lecturer meet synchronously in the same room for the whole provision.
Blended
A mode of delivery of a module or a programme that involves online and face-to-face delivery of learning, teaching and assessment activities, student support and feedback. A programme may be considered "blended" if it includes a combination of face-to-face, online and blended modules. If an online programme has any compulsory face-to-face and campus elements it must be described as blended with clearly articulated delivery information to manage student expectations
Fully Online
Instruction that is solely delivered by web-based or internet-based technologies. This term is used to describe the previously used terms distance learning and e learning.
HybridC
Online with mandatory face-to-face learning on Campus
HybridO
Online with optional face-to-face learning on Campus
Work-based Learning
Learning activities where the main location for the learning experience is in the workplace.

Campus(es) for Module Delivery

The module will **normally** be offered on the following campuses / or by Distance/Online Learning: (Provided viable student numbers permit)						
Paisley:	Ayr:	Dumfries:	Lanarkshire:	London:	Distance/Online Learning:	Other:
✓						

Term(s) for Module Delivery
(Provided viable student numbers permit).

Term 1		Term 2	✓	Term 3	

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Learning Outcomes: (maximum of 5 statements)
On successful completion of this module the student will be able to: L1. Use root-finding techniques successfully and perform associated error analysis. L2. Implement and apply polynomial interpolation and approximation techniques. L3. Apply quadrature rules to approximate integrals. L4. Solve standard problems in computer arithmetic.

Employability Skills and Personal Development Planning (PDP) Skills	
SCQF Headings	During completion of this module, there will be an opportunity to achieve core skills in:
Knowledge and Understanding (K and U)	SCQF Level 8. Demonstrating a knowledge and understanding of important techniques in the numerical solution of equations in one variable, interpolation, numerical differentiation and integration.
Practice: Applied Knowledge and Understanding	SCQF Level 8. Using a range of standard techniques to solve problems at an advanced level, sometimes in non-routine contexts. Carrying out defined investigative problems within a mathematically based subject.
Generic Cognitive skills	SCQF Level 8. Conceptualising and analysing problems informed by professional and research issues.
Communication, ICT and Numeracy Skills	SCQF Level 8. Implementing and interpreting suitable mathematical software. Making formal written presentation(s) based on the output from an investigative problem.
Autonomy, Accountability and Working with others	SCQF Level 8. Exercising independence and initiative in carrying out a range of activities. Identifying learning needs through reflection based on self, tutor and peer evaluation of work.
Pre-requisites:	Before undertaking this module the student should have undertaken the

	following:	
	Module Code: MATH07009	**Module Title:** Mathematics of Space & Change 2
	Other:	or equivalent
Co-requisites	**Module Code:**	**Module Title:**

* Indicates that module descriptor is not published.

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Learning and Teaching	
Learning Activities During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below:	**Student Learning Hours** (Normally totalling 200 hours): (Note: Learning hours include both contact hours and hours spent on other learning activities)
Lecture/Core Content Delivery	24
Tutorial/Synchronous Support Activity	12
Laboratory/Practical Demonstration/Workshop	12
Independent Study	146
Personal Development Plan	6
	200 Hours Total

**Indicative Resources: (eg. Core text, journals, internet access)
The following materials form essential underpinning for the module content and ultimately for the learning outcomes: "Numerical Analysis" class notes as published on the University VLE. "Numerical Analysis", RL Burden and JD Faires "Elementary Numerical Analysis", K Atkinson Suitable mathematical software, such as Octave.
(**N.B. Although reading lists should include current publications, students are advised (particularly for material marked with an asterisk*) to wait until the start of session for confirmation of the most up-to-date material)
Engagement Requirements
In line with the Academic Engagement Procedure, Students are defined as academically engaged if they are regularly engaged with timetabled teaching sessions, course-related learning resources including those in the Library and on the relevant learning platform, and complete assessments and submit these on time. Please refer to the Academic Engagement Procedure at

the following link: Academic engagement procedure

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Supplemental Information

Programme Board	Physical Sciences
Assessment Results (Pass/Fail)	No
Subject Panel	Physical Sciences
Moderator	Dr Alan J Walker
External Examiner	P Wilson
Accreditation Details	
Version Number	1.05

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Assessment: (also refer to Assessment Outcomes Grids below)
Assignment: Series of coursework assignments, 50% of final mark.
Examination: a final, closed book assessment, 50% of the final mark.
(N.B. (i) **Assessment Outcomes Grids** for the module (one for each component) can be found below which clearly demonstrate how the learning outcomes of the module will be assessed. (ii) An **indicative schedule** listing approximate times within the academic calendar when assessment is likely to feature will be provided within the Student Handbook.)

Assessment Outcome Grids (Footnote A.)

Component 1

Assessment Type (Footnote B.)	Learning Outcome (1)	Learning Outcome (2)	Learning Outcome (3)	Learning Outcome (4)	Weighting (%) of Assessment Element	Timetabled Contact Hours	
Unseen closed book (standard)	✓	✓	✓	✓	50	2	

Component 2

Assessment Type (Footnote B.)	Learning Outcome (1)	Learning Outcome (2)	Learning Outcome (3)	Learning Outcome (4)	Weighting (%) of Assessment Element	Timetabled Contact Hours	
Class test (practical)	✓	✓	✓		50	6	
Combined Total For All Components					100%	8 hours	

Footnotes

A. Referred to within Assessment Section above

B. Identified in the Learning Outcome Section above

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Note(s):
1. More than one assessment method can be used to assess individual learning outcomes.
2. Schools are responsible for determining student contact hours. Please refer to University Policy on contact hours (extract contained within section 10 of the Module Descriptor guidance note). This will normally be variable across Schools, dependent on Programmes &/or Professional requirements.

Equality and Diversity
The module is suitable for any student satisfying the pre-requisites. UWS Equality and Diversity Policy
(N.B. Every effort will be made by the University to accommodate any equality and diversity issues brought to the attention of the School)