

## University of the West of Scotland

## Module Descriptor

Session: 2024/25

<b>Title of Module: Numerical Analysis</b>			
<b>Code: MATH09014</b>	<b>SCQF Level: 9 (Scottish Credit and Qualifications Framework)</b>	<b>Credit Points: 20</b>	<b>ECTS: 10 (European Credit Transfer Scheme)</b>
<b>School:</b>	School of Computing Engineering and Physical Sciences		
<b>Module Co-ordinator:</b>	Dr Wan R. Mekwi		
<b>Summary of Module</b>			
<p>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.</p> <p>Error analysis will consider round-off errors and computer arithmetic, along with algorithms and convergence.</p> <p>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.</p> <p>Polynomial interpolation will be considered and interpolation error will also be discussed. Approximation using polynomials will also be explored.</p> <p>Quadrature rules including Newton-Cotes and Gaussian quadrature will be designed and analysed together with error estimates.</p> <p>The Graduate Attributes relevant to this module are given below:</p> <ul style="list-style-type: none"> <li>• Academic: Critical thinker; Analytical; Inquiring; Knowledgeable; Problem-solver; Digitally literate; Autonomous.</li> <li>• Personal: Motivated; Resilient.</li> <li>• Professional: Ambitious; Driven.</li> </ul>			

<b>Module Delivery Method</b>					
<b>Face-To-Face</b>	<b>Blended</b>	<b>Fully Online</b>	<b>HybridC</b>	<b>Hybrid 0</b>	<b>Work-Based Learning</b>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>See Guidance Note for details.</b>					

Campus(es) for Module Delivery						
The module will <b>normally</b> be offered on the following campuses / or by Distance/Online Learning: (Provided viable student numbers permit) (tick as appropriate)						
Paisley:	Ayr:	Dumfries:	Lanarkshire:	London:	Distance/Online Learning:	Other:
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Add name

Term(s) for Module Delivery					
(Provided viable student numbers permit).					
Term 1	<input checked="" type="checkbox"/>	Term 2	<input type="checkbox"/>	Term 3	<input type="checkbox"/>

Learning Outcomes: (maximum of 5 statements) These should take cognisance of the SCQF level descriptors and be at the appropriate level for the module. At the end 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	
<b>SCQF Headings</b>	During completion of this module, there will be an opportunity to achieve core skills in:
Knowledge and Understanding (K and U)	<b>SCQF Level 9</b> Demonstrating a knowledge and understanding of important techniques in the numerical solution of equations in one variable, interpolation, numerical integration.
Practice: Applied Knowledge and Understanding	<b>SCQF Level 9</b> 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	<b>SCQF Level 9</b> Conceptualising and analysing problems informed by professional and research issues.

Communication, ICT and Numeracy Skills	<b>SCQF Level 9</b> Implementing mathematical concepts and interpreting outputs using suitable mathematical software.  Making formal written presentation(s) based on the output from an investigative problem.	
Autonomy, Accountability and Working with others	<b>SCQF Level 9</b> 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.	
<b>Pre-requisites:</b>	Before undertaking this module the student should have undertaken the following:	
	<b>Module Code:</b> MATH08007 MATH07009	<b>Module Title:</b> Linear Algebra Calculus B
	<b>Other:</b>	Or equivalent
<b>Co-requisites</b>	<b>Module Code:</b>	<b>Module Title:</b>

\*Indicates that module descriptor is not published.

<b>Learning and Teaching</b>	
<b>In line with current learning and teaching principles, a 20-credit module includes 200 learning hours, normally including a minimum of 36 contact hours and maximum of 48 contact hours.</b>	
<b>Learning Activities</b> During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below:	<b>Student Learning Hours</b> (Normally totalling 200 hours): (Note: Learning hours include both contact hours and hours spent on other learning activities)
Lecture/Core Content Delivery	36
Laboratory/Practical Demonstration/Workshop	12
Independent Study	152
	200 Hours Total
<b>**Indicative Resources: (eg. Core text, journals, internet access)</b>	

The following materials form essential underpinning for the module content and ultimately for the learning outcomes:

R L. Burden and J D Faires, *Numerical Analysis*, 9<sup>th</sup> ed., 2011

T. Sauer, *Numerical analysis*, Addison-Wesley Publishing Company, 2011.

D. R. Kincaid and E. W. Cheney, *Numerical analysis: mathematics of scientific computing*, vol. 2, American Mathematical Soc., 2009.

Suitable mathematical software such as MATLAB or Python

(\*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)

### Attendance and Engagement Requirements

In line with the [Student Attendance and Engagement Procedure](#): Students are academically engaged if they are regularly attending and participating in timetabled on-campus and online teaching sessions, asynchronous online learning activities, course-related learning resources, and complete assessments and submit these on time.

### Equality and Diversity

The University's Equality, Diversity and Human Rights Procedure can be accessed at the following link: [UWS Equality, Diversity and Human Rights Code](#).

(N.B. Every effort will be made by the University to accommodate any equality and diversity issues brought to the attention of the School)

### Supplemental Information

<b>Divisional Programme Board</b>	Engineering and Physical Sciences
<b>Assessment Results (Pass/Fail)</b>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<b>School Assessment Board</b>	Computing, Engineering and Physical Sciences
<b>Moderator</b>	Dr Alan J. Walker
<b>External Examiner</b>	P. Wilson
<b>Accreditation Details</b>	

<b>Changes/Version Number</b>	Indicative Resources updated. Module Moderator updated. Updated assessment description and proportions.
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<b>Assessment: (also refer to Assessment Outcomes Grids below)</b>
Assessment 1 – A portfolio of written and computer work (40%)
Assessment 2 – Class test: formal unseen assessment (60%)
(N.B. (i) <b>Assessment Outcomes Grids</b> 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 <b>indicative schedule</b> listing approximate times within the academic calendar when assessment is likely to feature will be provided within the Student Module Handbook.)

### Assessment Outcome Grids (See Guidance Note)

<b>Component 1</b>							
<b>Assessment Type (Footnote B.)</b>	<b>Learning Outcome (1)</b>	<b>Learning Outcome (2)</b>	<b>Learning Outcome (3)</b>	<b>Learning Outcome (4)</b>	<b>Learning Outcome (5)</b>	<b>Weighting (%) of Assessment Element</b>	<b>Timetabled Contact Hours</b>
Portfolio of written and computer work	✓	✓	✓	✓		40	

<b>Component 2</b>							
<b>Assessment Type (Footnote B.)</b>	<b>Learning Outcome (1)</b>	<b>Learning Outcome (2)</b>	<b>Learning Outcome (3)</b>	<b>Learning Outcome (4)</b>	<b>Learning Outcome (5)</b>	<b>Weighting (%) of Assessment Element</b>	<b>Timetabled Contact Hours</b>
Class test	✓	✓	✓	✓		60	2

<b>Combined Total for All Components</b>						100%	2 hours
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