

**University of the West of Scotland  
Module Descriptor**

**Session: 2023/24**

Last modified: 12/02/2024 16:31:00

Status: Proposal

<b>Title of Module: Multivariable Calculus</b>			
<b>Code: MATH08008</b>	<b>SCQF Level: 8</b> (Scottish Credit and Qualifications Framework)	<b>Credit Points: 20</b>	<b>ECTS: 10</b> (European Credit Transfer Scheme)
<b>School:</b>	School of Computing, Engineering and Physical Sciences		
<b>Module Co-ordinator:</b>	Kenneth C. Nisbet		
<b>Summary of Module</b>			
<p>This module extends the ideas in basic differentiation and integration of functions of one variable to the calculus of more than one variable. The idea of partial differentiation will be introduced, both at first and higher order, as well as the more general idea of a directional derivative. These concepts will be used in a number of settings, including the location and classification of critical points in routine contexts and also applications in optimisation problems, e.g. using Lagrange multipliers. Vector calculus will be explored, including a treatment of such notions as the gradient of a scalar field, and the divergence and curl of a vector field, both in routine and applied settings. The concept of basic integration will be extended to a range of problems involving double and triple integrals, e.g. repeated integrals, change of order, use of substitution, such as the use of polar coordinates. Line integrals, including their application to problems involving conservative vector fields, and surface integrals of both scalar and vector fields will be discussed. 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; 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>HybridO</b>	<b>Work-based Learning</b>
✓					
<p><b>Face-To-Face</b> Term used to describe the traditional classroom environment where the students and the lecturer meet synchronously in the same room for the whole provision.</p> <p><b>Blended</b> 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</p> <p><b>Fully Online</b> 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.</p> <p><b>HybridC</b> Online with mandatory face-to-face learning on Campus</p> <p><b>HybridO</b> Online with optional face-to-face learning on Campus</p> <p><b>Work-based Learning</b> Learning activities where the main location for the learning experience is in the workplace.</p>					

<b>Campus(es) for Module Delivery</b>						
The module will <b>normally</b> 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:
✓						

<b>Term(s) for Module Delivery</b>					
(Provided viable student numbers permit).					
Term 1	✓	Term 2	✓	Term 3	

<b>Learning Outcomes: (maximum of 5 statements)</b>	
On successful completion of this module the student will be able to: L1. Apply analytically a range of techniques in partial differentiation. L2. Solve multiple and line integration problems analytically using standard techniques. L3. Implement a range of analytic techniques in vector calculus.	
<b>Employability Skills and Personal Development Planning (PDP) Skills</b>	
<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)	SCQF Level 8. Demonstrating a knowledge and understanding of important techniques in the calculus of more than one variable.  Demonstrating critical awareness of established techniques of enquiry in common applications of multivariable calculus.
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. 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.	
<b>Pre-requisites:</b>	Before undertaking this module the student should have undertaken the following:	
	<b>Module Code:</b> MATH07009	<b>Module Title:</b> 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>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	24
Tutorial/Synchronous Support Activity	12
Independent Study	164
	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: "Multivariable Calculus" class notes as published on the University VLE.  "Calculus: One and Several Variables", SL Salas, GJ Etgen and E Hille.  "Calculus II", TM Apostol	
(**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)	
<b>Engagement Requirements</b>	
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: <a href="#">Academic engagement procedure</a>	

## Supplemental Information

<b>Programme Board</b>	Physical Sciences
<b>Assessment Results (Pass/Fail)</b>	No
<b>Subject Panel</b>	Physical Sciences
<b>Moderator</b>	Wan R Mekwi
<b>External Examiner</b>	C Guiver
<b>Accreditation Details</b>	
<b>Changes/Version Number</b>	1.07 Changes to module delivery Changed module to "long-thin" over T1 and T2 Changed delivery mode to "face-to-face" for new AY

<b>Assessment: (also refer to Assessment Outcomes Grids below)</b>
A series of coursework assignments (50%)
Adapted Assessment (Online open book) (50%)
(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 Handbook.)

### Assessment Outcome Grids (Footnote A.)

<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>Weighting (%) of Assessment Element</b>	<b>Timetabled Contact Hours</b>
Unseen open book (standard)	✓	✓	✓	50	2
<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>Weighting (%) of Assessment Element</b>	<b>Timetabled Contact Hours</b>
Class test (practical)	✓	✓	✓	50	5
<b>Combined Total For All Components</b>				100%	7 hours

#### Footnotes

A. Referred to within Assessment Section above

B. Identified in the Learning Outcome Section above

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)