University of the West of Scotland
Module Descriptor

Session: 2023/24
Last modified: 12/02/2024 16:38:00
Status: Proposal

Title of Module: Mathematical Methods 1			
Code:	**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:	Ryan P. Meeten		

Summary of Module

This two term module will cover the critical elements of applied mathematics needed for scientists and engineers.
The module will cover key topics in differential equations, including separating variables and the method of integrating factors for first order equations. We will investigate second order linear differential equations with constant coefficients and learn about the concepts of general solutions versus particular solutions. We will study the methods of reduction of order, variation of parameters, power series methods and Laplace transforms.
We will next introduce the essential ideas of multivariable calculus for applications beginning with a discussion of functions of several variables. We will treat partial derivatives, gradient, double and triple integrals in various coordinate systems and line integrals. The essential vector calculus notions of vector fields, and their divergence and curl will be introduced.
The module will also feature an overview of matrix methods for scientists and engineers. We will discuss eigenvalues and eigenvectors and then explore matrix factorisations, including LU, QR, diagonalisation, and singular value decomposition (SVD).
The basic aspects of probability theory will be discussed, including random variables, probability distributions and moments. Students who successfully complete this module will have a good grounding in the fundamentals of applied mathematics.
We have defined a set of Graduate Attributes that are the skills, personal qualities and understanding to be developed through your university experience that will prepare for life and work in the 21st century (https://www.uws.ac.uk/current-students/your-graduate-attributes/). The Graduate Attributes relevant to this module are listed below.

- Graduate Attributes - Academic: critical thinker; analytical; inquiring; knowledgeable; digitally literate; problem solver; autonomous; incisive; innovative
- Graduate Attributes - Personal: effective communicator; influential; motivated
- Graduate Attributes - Professional: collaborative; research-minded; enterprising; 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	

Learning Outcomes: (maximum of 5 statements)
On successful completion of this module the student will be able to: L1. Be able to classify and solve standard ordinary differential equations of first and second order. L2. Demonstrate an understanding of key multivariable differential and integral calculus. L3. Show facility with matrix manipulations and apply matrices to problem solving. L4. Understand the core ideas of probability theory. L5. Use computer algebra software to solve problems and enhance understanding of the mathematical concepts.

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. Students will gain critical knowledge of the mathematical techniques employed by scientists and engineers, as well as complementary computational skills.
Practice: Applied Knowledge and Understanding	SCQF Level 8. The ideas discussed in this module will be underpinned by practical problem solving sessions, where students are encouraged to work together collaboratively to tackle difficult problems. The techniques taught here have useful, real world applications in STEM fields and beyond.

Generic Cognitive skills	SCQF Level 8. This is a challenging module and will develop and enhance the numeracy, problem solving and logical ability of the students. Students will have to learn to think abstractly to understand the mathematical concepts presented. They will learn how to analyse problems, formulate a strategy, and then apply mathematical methods to solve the problem.	
Communication, ICT and Numeracy Skills	SCQF Level 8. Students will significantly improve their numeracy skills by engaging with the challenging mathematical ideas in this module. They will be required to explore the concepts in depth using computer algebra and numerical computation in Maxima and Python, thus developing computing skills. Students will also have the opportunity to work together to tackle formative practice problems and in doing so will develop their communication and collaboration skills.	
Autonomy, Accountability and Working with others	SCQF Level 8. Students will be given the opportunity work collaboratively in whiteboard wall learning studios. They will be required to manage their time effectively to prepare and submit high quality coursework assignments and study independently. They will be expected to behave with academic integrity, upholding academic rigour and intellectual honesty.	
Pre-requisites:	Before undertaking this module the student should have undertaken the following:	
	Module Code: MATH07003	**Module Title:** Calculus A
	Other:	
Co-requisites	**Module Code:**	**Module Title:**

* Indicates that module descriptor is not published.

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	36
Tutorial/Synchronous Support Activity	24
Independent Study	140
	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: Riley, Hobson and Bence - Mathematical Methods for Physics and Engineering: A Comprehensive Guide (Third Edition) Arfken, Weber and Harris - Mathematical Methods for Physicists: A Comprehensive Guide (Seventh Edition)
(**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

Supplemental Information

Programme Board	Physical Sciences
Assessment Results (Pass/Fail)	No
Subject Panel	Physical Sciences
Moderator	Gregory V. Morozov
External Examiner	D Faux
Accreditation Details	IoP and will apply for IMA accreditation
Changes/Version Number	1 This is a new long-and-thin module set to replace Mathematics for Physicists 1 and part of Mathematics for Physicists 2 in order to accommodate ASPIRE. The module is MATH coded, reflecting the fact that it may be of interest to engineers and other scientists, as well as physicists.

Assessment: (also refer to Assessment Outcomes Grids below)
Adapted Assessment (Online open book class test) (60%)
4 Coursework assignments (40%)
(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)	Learning Outcome (5)	Weighting (%) of Assessment Element	Timetabled Contact Hours
Unseen open book (standard)	✓	✓	✓	✓		60	2

Component 2

Assessment Type (Footnote B.)	Learning Outcome (1)	Learning Outcome (2)	Learning Outcome (3)	Learning Outcome (4)	Learning Outcome (5)	Weighting (%) of Assessment Element	Timetabled Contact Hours
Portfolio of written work	✓	✓	✓	✓	✓	40	0
					Combined Total For All Components	100%	2 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
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)