University of the West of Scotland

Module Descriptor

Session: 2024/25

Title of Module: Mathematics for Physics 1			
Code: PHYS08006	**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 module is a core module at Level 8 on Institute of Physics (IoP) accredited Physics programmes.

This module is an essential module for all students of physics. It covers the key mathematical techniques and ideas required for underpinning the mathematical content of other physics modules. Physicists need to be equipped with the mathematical tools for understanding and solving differential equations, manipulating and utilising matrices and applying key ideas of multivariable calculus.

The module will cover first order differential equations, including separating variables and integrating factors. It will also cover second order linear differential equations, including a discussion of homogeneous and inhomogeneous cases with constant and variable coefficients. A brief survey of named differential equations such as the Bernoulli and Riccati equations will be undertaken. Power series and Laplace transform methods will be introduced as alternative approaches.

Key concepts in linear algebra related to the solution of systems of linear equations, matrix operations and eigenvalues and eigenvectors of matrices will be described. We will discuss orthonormal bases and the Gram-Schmidt Process. The ideas of the basis independent quantities of trace and determinant will be explored.

We will explore functions of several variables, including the notion of partial derivatives and total derivatives. We will meet the gradient of a scalar field and describe its geometrical properties. Double integration will be covered in both Cartesian and polar coordinate systems. A treatment of line integrals in the plane and the connection to double integrals via Green's Theorem will follow.

The module will end with a brief overview of the key essentials of probability theory, including moments.

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**	**Hybrid 0**	**Work-Based Learning**
☒	☐	☐	☐	☐	☐
See Guidance Note for details.					

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) (tick as appropriate)						
Paisley:	Ayr:	Dumfries:	Lanarkshire:	London:	Distance/Online Learning:	Other:
☒	☐	☐	☐	☐	☐	Add name

Term(s) for Module Delivery					
(Provided viable student numbers permit).					
Term 1	☒	Term 2	☐	Term 3	☐

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	Classify and solve differential equations using a range of techniques
L2	Manipulate matrices and work with eigenvalues and eigenvectors
L3	Understand and apply concepts from differential and integral multivariable calculus
L4	Apply the essentials of probability theory

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** Mathematical techniques that are essential for physics, including differential equations, linear algebra and multivariable calculus.	
Practice: Applied Knowledge and Understanding	SCQF Level **8** Routine mathematical skills and methods tom model and solve physics problems.	
Generic Cognitive skills	SCQF Level **8** • Performing calculations efficiently and accurately at a level suitable for SCQF Level 8 • Presenting clear and logical arguments	
Communication, ICT and Numeracy Skills	SCQF Level **8** • Presenting mathematical arguments in a clear and coherent manner. • A range of numerical and graphical approaches to the solution of differential equations	
Autonomy, Accountability and Working with others	SCQF Level **8** • Group working will encourage collaboration and the demonstration of academic integrity. • Exercising initiative and independence in carrying out defined activities • Taking account of own and others' roles and responsibilities in carrying out and evaluating tasks.	
Pre-requisites:	Before undertaking this module, the student should have undertaken the following:	
	Module Code: PHYS07006 PHYS07007 MATH07003 MATH07009	**Module Title:** Introductory Physics A Introductory Physics B Applied Mathematics Mathematical Analysis
	Other:	or equivalent
Co-requisites	**Module Code:**	**Module Title:**

*Indicates that module descriptor is not published.

Learning and Teaching

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.

The module will be delivered using a modernised “chalk and talk” style so that the mathematical ideas presented are shown at a pace that can be maximally absorbed and understood. The theory sessions will be augmented with some pre-recorded enrichment material for those who are interested in delving in more depth into the topics presented.

The tutorial sessions will be conducted in a white-wall learning studio, allowing the students to experience working in groups in an authentic problem solving setting. Problem solving is a practical task, where clear communication and teamwork is often required to assess, deconstruct, analyse, synthesise and critique a solution.

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
Practice Based Learning	12
Independent Study	152
	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)

(**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. Please ensure any specific requirements are detailed in this section. Module Co-ordinators should consider the accessibility of their module for groups with protected characteristics.
(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

Divisional Programme Board	Engineering and Physical Sciences
Assessment Results (Pass/Fail)	Yes ☐No ☒
School Assessment Board	Physical Sciences
Moderator	Gregory V Morozov
External Examiner	D Faux
Accreditation Details	Institute of Physics (IoP)
Changes/Version Number	**3.0** Module descriptor amended to conform to the new template format and to reflect outcomes from ILR 2023. The module has been updated to mitigate the loss of core material displaced by ASPIRE 2.

Assessment: (also refer to Assessment Outcomes Grids below)
Assessment 1 – Class Test (60%)
Assessment 2 – Written Coursework (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 Module Handbook.)

Assessment Outcome Grids (**See Guidance Note)**

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**
Class Test	✔	✔	✔		60	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**
Portfolio of Written Work	✔	✔	✔	✔	40	0
Combined Total for All Components					100	2