University of the West of Scotland
Module Descriptor

Session: 2022/23

Title of Module: Mathematics for Physicists 2			
Code: PHYS08008	**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 Meeten		

Summary of Module

This is the second half of a two-module sequence of Mathematics for Physicists modules and will be the final essential mathematics module in the physics programmes.
The module will continue to develop on the vector calculus introduced in Mathematics for Physicists 1, which will be essential for electromagnetism and field theory. Some of the key elements of analytic geometry will be treated, inlcuding planes and conic sections. The key ideas of Fourier analysis and integral transforms will be covered. We will then turn our attention to Linear Algebra and consider some of the most important applications of this fundamental topic to solving systems of differential equations and use this as an introduction to the language of quantum mechanics.
At this point all fundamental mathematical topics required to study physics will have been encountered, leaving more specialised subjects to optional modules later in the course.
Students will be introduced to the computer algebra system Maxima to gain an appreciation for what to do when analytic methods are inapplicable. Proficiency in Maxima will translate directly to commercial software packages such as Maple and Mathematica.

- 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. Classify and solve the most fundamental types of differential equations which will be encountered by the working physicist. L2. Demonstrate fluency with ideas from vector calculus. L3. Apply the central results of linear algebra to systems of differential equations. L4. Understand and use integral transforms, appreciate where they come from, and know how they apply to differential equations. L5. Use the computer algebra system effectively, which will translate directly to commercially important software such as Mathematica.

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. *) Core knowledge of ordinary differential equations. *) Core knowledge of linear algebra. *) Core knowledge of integral transforms. *) Demonstrate a critical approach towards problem solving
Practice: Applied Knowledge and Understanding	SCQF Level 8. *) Use many important techniques from applied mathematics. *) Practice computational literacy skills, and some elementary programming in the computer algebra system. *) Practice communicating ideas clearly and logically.

Generic Cognitive skills	SCQF Level 8. Appreciation of deep mathematical concepts imperative for any physicist. Problem solving, computational skills, and communication skills will all be enhanced by studying this module.	
Communication, ICT and Numeracy Skills	SCQF Level 8. *) Use of calculators and computers. *) There will be the opportunity for students to work in groups to solve complicated problems. This will aid communication and group working skills.	
Autonomy, Accountability and Working with others	SCQF Level 8. *) Individual studying and small project management. *) Working towards deadlines and avoiding unnecessary penalties. *) Team-working will be encouraged for certain difficult problems, as well as a computing coursework.	
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 Mathematics of Space & Change Mathematics of Space & Change 2
	Other:	
Co-requisites	**Module Code:**	**Module Title:**

* Indicates that module descriptor is not published.

Learning and Teaching
This module will be delivered mainly in the form of traditional whiteboard “chalk and talk” style lectures. This is crucial for the elucidation of mathematical ideas, as mathematics is a linear subject, and the concepts need to be developed ab initio. There will be tutorial classes which will emphasise problem solving and developing skills. Students will be given the opportunity to work collaboratively at points in the module. The teaching resource for the module will be self-contained, and readily accessible in both printed and pdf form. Students will be given the opportunity to learn the computer algebra system “Maxima” which is the open source software most similar to Maple and Mathematica. Solving problems numerically is a reality for modern working physicists.

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
Laboratory/Practical Demonstration/Workshop	24
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: Brian R. Martin, Graham Shaw, Mathematics for Physicists (Manchester Physics Series), 2015 Mary L Boas, Mathematical Methods in the Physical Sciences Edition: Third, 2007 George B. Arfken, Hans J. Weber, Frank E. Harris, Mathematical Methods for Physicists: A Comprehensive Guide, 2012
(**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
Students are academically engaged if they are regularly engaged with timetabled on-campus and online teaching sessions, asynchronous online learning activities, course-related learning resources, and complete assessments and submit these on time. Please refer to the Academic Engagement and Attendance Procedure at the following link: Academic Engagement and Attendance 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	
Changes/Version Number	1.06 V2 Module contents were clarified. Module coordinator and moderator were changed. Exam changed for final class test for consistency with Mathematics for Physicists 1.

Assessment: (also refer to Assessment Outcomes Grids below)
60% Assessment Category 1: Final Class Test
40% Assessment Category 2: Coursework Assignments
(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
Class test (written)	✓	✓	✓	✓	✓	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
The work for this module will be carried out in learning studios. Arrangements for students with additional support requirements will be made where possible. 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)