University of the West of Scotland

Module Descriptor

Session: 2024/25

Title of Module: Mathematics for Physics 2			
Code: PHYS09012	**SCQF Level: 9 (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 9 on Institute of Physics (IoP) accredited Physics programmes.

This module is an essential module for all students of physics.

The module will begin with a practical treatment of complex variable theory with particular emphasis on the application of the Calculus of Residues for evaluating definite real integrals.

We will then discuss Fourier Analysis, beginning with Fourier series in both trigonometric and exponential forms. The Fourier transform (and its inverse) will be presented. A brief discussion on the Inverse Laplace transform via the Bromwich integral will be considered. The concept of convolution and the convolution theorem will be presented.

The module will also cover the fundamentals of vector calculus required for the study of electromagnetism and field theory. In particular, the concepts of gradient, divergence and curl, including coordinate free definitions of divergence and curl will be discussed. We will also explore vector calculus versions of the Fundamental Theorem of Calculus i.e. Gradient theorem, Divergence theorem and the Circulation theorem. vector calculus will be presented in the standard coordinate systems (Cartesian, cylindrical and spherical).

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**	**Hybrid0**	**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	Appreciate and apply the central results of complex variable theory
L2	Understand and calculate Fourier series and transforms
L3	Manipulate vector calculus operators and understand the physical significance of vector fields
L4	Fluently use alternative coordinate systems to solve problems

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 **9** Mathematical techniques that are essential for physics, including contour integration, Fourier series and transforms and vector calculus.

Practice: Applied Knowledge and Understanding	SCQF Level **9** Routine mathematical skills and methods to model and solve physics problems.	
Generic Cognitive skills	SCQF Level **9** • Performing calculations efficiently and accurately at a level suitable for SCQF Level 9 • Presenting clear and logical arguments • Demonstrating appropriate mathematical maturity	
Communication, ICT and Numeracy Skills	SCQF Level **9** • Presenting mathematical arguments in a clear and coherent manner. • Effective use of a computer algebra system.	
Autonomy, Accountability and Working with others	SCQF Level **9** 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: PHYS08002 PHYS08004 PHYS08006 PHYS08007 PHYS08009	**Module Title:** Optics & Electronics Properties of Matter Mathematics for Physics 1 Classical Mechanics Modern Physics
	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	24
Practice Based Learning	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:

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	Maximilien Barbier
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