University of the West of Scotland
Module Descriptor

Session: 2023/24

Title of Module: Modern Physics			
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 Meeten		

Summary of Module

This module is designed to provide an introduction to special relativity and quantum physics. The syllabus of the module is as follows.

Special Relativity

Definition of inertial reference frames and invariance of the speed of light. The Lorentz transformations and the concepts of time dilation and Lorentz contraction. Twins paradox. Relativistic kinematics and the relativistic Doppler effect. Introduction to Minkowski spacetime and 4-vectors. Momentum and relation to mass and energy as a relativistic property.

Quantum Physics

Blackbody radiation, photoelectric effect, Einstein's photon theory, Rutherford scattering, Compton effect,
Bohr-Sommerfeld quantization condition, Correspondence Principle.
Review of wave theory: wave motion, differential equations describing wave motion, amplitude, phase, plane waves, harmonic (monochromatic) waves, phase and group velocities.
De Broglie relations between waves and particles, Uncertainty Principle, introduction to the Schrodinger equation, meaning of the wavefunction, probability interpretation.
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. Appreciate the need for the ideas of modern physics which supersede classical physics. L2. Develop familiarisation with the ideas of special relativity, including 4-vectors. L3. Demonstrate knowledge and understanding of wave phenomena. L4. Understand the key ideas of quantum physics, such as energy quantisation and wave-particle duality.

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. This module will introduce students to key ideas in modern physics. Students will be exposed to the counterintuitive concepts of quantum physics and relativity. These ideas will be crucial building blocks for future study of core physics.
Practice: Applied Knowledge and Understanding	SCQF Level 8. Students who achieve the learning outcomes in this module will have demonstrated that they can work at a high level mathematically, and this is an invaluable skill for theoreticians and experimentalists alike.
Generic Cognitive skills	SCQF Level 8. This module will give students practice in dealing with abstract and challenging mathematical and physical concepts. The mastery of these concepts will develop cognitive abilities expected of physics

	graduates, such as the ability to be analytical, adaptable, logical and focused.	
Communication, ICT and Numeracy Skills	SCQF Level 8. The significant numerate content of this module will give students a lot of practice in numeracy skills. The communication skills developed while group working in tutorials will also be invaluable.	
Autonomy, Accountability and Working with others	SCQF Level 8. This module involves using a learning studio with surrounding whiteboard walls to encourage students to work in groups on the challenging tutorial problems. In this way the learning happens best when the students communicate and peer teach. Group working skills will therefore be developed naturally as a consequence of how these tutorials operate. Autonomy and academic integrity will be reinforced by lone working assessed assignments.	
Pre-requisites:	Before undertaking this module the student should have undertaken the following:	
	Module Code: PHYS07006 PHYS07007 MATH07003 MATH07009 PHYS07005	**Module Title:** Introductory Physics A Introductory Physics B Calculus A Calculus B Skills for Physics
	Other:	
Co-requisites	**Module Code:**	**Module Title:**

* Indicates that module descriptor is not published.

Learning and Teaching	
The lectures for the module will be delivered using the indispensable "chalk and talk" approach. This is the only approach with the fluidity to accommodate the teaching and learning of mathematical ideas which necessarily follow derivations of ideas from first principles. The ability to add notes and clarify points on the fly is crucial to this kind of subject. The tutorial classes will be based on small group working in rooms with whiteboard walls.	
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
Tutorial/Synchronous Support Activity	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: Modern Physics by Kenneth S. Krane (Wiley) Modern Physics by Tipler and Llewellyn (Freeman)
(**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	Maximilien Barbier
External Examiner	H Boston
Accreditation Details	Institute of Physics
Changes/Version Number	1 This is a new module to refresh the curriculum. Some of the material displaced from other modules by the inclusion of ASPIRE 2 is included here.

Assessment: (also refer to Assessment Outcomes Grids below)
On campus class test (written)
Coursework (two separate pieces of coursework: one on relativity, one on quantum physics).
(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)	Weighting (%) of	Timetabled Contact Hours

					Assessment Element	
Class test (written)	✓	✓	✓	✓	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 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)