Module Descriptor

Title	Advanced Optics		
Session	2025/26	**Status**	Published
Code	PHYS09001	**SCQF Level**	9
Credit Points	20	**ECTS (European Credit Transfer Scheme)**	10
School	**Computing, Engineering and Physical Sciences**		
Module Co-ordinator	Maximilien Barbier		

Summary of Module

This is an optional SCQF Level 9 module for the Physics programme presented in the second term.

This module will cover:

Wave equation for optical waves, plane waves, monochromatic light, intensity of light, light polarization (linear, circular, elliptical), polarizers and Jones algebra.

Fresnel formulas for oblique incidence of optical waves incident on dielectric interfaces, including the cases of TE and TM polarizations, Brewster angle.

Reflection and transmission of light through several layers of different media, transfer matrix method, reflectance and transmittance.

Anisotropic media, birefringence, elements of crystal optics, awareness of Kerr, Pockels and Faraday effects.

Review of interference, coherence, scalar diffraction theory, Fresnel and Fraunhofer approximations, elements of Fourier optics.

Diffraction gratings, spectrometers, Gaussian beam, photoelectric and Compton effects.

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	On-Campus[1] ☒	Hybrid[2] ☐	Online[3] ☐	Work -Based Learning[4] ☐
Campuses for Module Delivery	☐ Ayr ☐ Dumfries	☐ Lanarkshire ☐ London ☒ Paisley	☐ Online / Distance Learning ☐ Other (specify)	

Terms for Module Delivery	Term 1 ☐	Term 2 ☒	Term 3 ☐		
Long-thin Delivery over more than one Term	Term 1 – Term 2 ☐	Term 2 – Term 3 ☐	Term 3 – Term 1 ☐		

Learning Outcomes	
L1	Understand the theory of light propagation through different media
L2	Understand polarization of light, including elliptic polarisation.
L3	Appreciate Fresnel and Fraunhofer diffraction.
L4	Understand the working principles and applications of diffraction.
L5	Perform laboratory experiments appropriate to the content of the topics covered in lectures.

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 9** A broad knowledge of optical theory with a strong underpinning of experimental work.
Practice: Applied Knowledge and Understanding	**SCQF 9** Understanding the working principles and applications of optical instruments.
Generic Cognitive skills	**SCQF 9** Problem-solving skills, mathematical reasoning, practical skills.
Communication, ICT and Numeracy Skills	**SCQF 9** The communication of complex physical ideas, and calculations appropriate to SCQF Level 9.

[1] Where contact hours are synchronous/ live and take place fully on campus. Campus-based learning is focused on providing an interactive learning experience supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus contact hours will be clearly articulated to students.

[2] The module includes a combination of synchronous/ live on-campus and online learning events. These will be supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus and online contact hours will be clearly articulated to students.

[3] Where all learning is solely delivered by web-based or internet-based technologies and the participants can engage in all learning activities through these means. All required contact hours will be clearly articulated to students.

[4] Learning activities where the main location for the learning experience is in the workplace. All required contact hours, whether online or on campus, will be clearly articulated to students

Autonomy, Accountability and Working with Others	**SCQF 9** Academic integrity, working together with laboratory partners, presenting the results of joint experiments as an individual.

Prerequisites	**Module Code**	**Module Title**
	PHYS08002	Optics & Electronics
	PHYS08004	Properties of Matter
	PHYS08006	Mathematics for Physics 1
	PHYS08007	Classical Mechanics
	PHYS08009	Modern Physics
	Other or equivalent	
Co-requisites	**Module Code**	**Module Title**
	PHYS09003	Electromagnetism
	PHYS09012	Mathematics for Physics 2

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.	
Learning Activities During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below:	**Student Learning Hours** (Note: Learning hours include both contact hours and hours spent on other learning activities)
Lecture / Core Content Delivery	24
Tutorial / Synchronous Support Activity	12
Laboratory / Practical Demonstration / Workshop	12
Independent Study	152
Please select	
Please select	
TOTAL	200

Indicative Resources
The following materials form essential underpinning for the module content and ultimately for the learning outcomes: J. Peatross and M. Ware, Physics of Light and Optics, 2015 edition, available at optics.byu.edu F Graham Smith, Terry A King & Dan Wilkins, Optics and Photonics, John Wiley & Sons 2008 Kenyon IR, "The Light Fantastic: A Modern Introduction to Classical and Quantum Optics, Second Edition", Oxford, 2011

(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. **For the purposes of this module, academic engagement equates to the following:** The School of Computing, Engineering and Physical Sciences considers attendance and engagement to mean a commitment to attending, and engaging in, timetabled sessions. You will scan your attendance via the scanners each time you are on-campus and you will login to the VLE several times per week. Where you are unable to attend a timetabled learning session due to illness or other circumstance, you should notify the Programme Leader that you cannot attend. Across the School an 80% attendance threshold is set. If you fall below this, you will be referred to the Student Success Team to see how we can best support your studies.

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. Aligned with the University's commitment to equality and diversity, this module supports equality of opportunity for students from all backgrounds and learning needs. Using the VLE, material will be presented electronically in formats that allow flexible access and manipulation of content. This module complies with University regulations and guidance on inclusive learning and teaching practice. This module has lab-based teaching and as such you are advised to speak to the Module Co-ordinator to ensure that specialist assistive equipment, support provision and adjustment to assessment practice can be put in place, in accordance with the University's policies and regulations.
(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 Physical Sciences**
Overall Assessment Results	☐ **Pass / Fail** ☒ **Graded**
Module Eligible for Compensation	☒ **Yes** ☐ **No** **If this module is eligible for compensation, there may be cases where compensation is not permitted due to programme accreditation requirements. Please check the associated programme specification for details.**
School Assessment Board	Mathematics and Physics
Moderator	S. Song
External Examiner	M. Gorman
Accreditation Details	Institute of Physics (IoP)
Module Appears in CPD catalogue	☐ **Yes** ☒ **No**

Changes / Version Number	3.0 Module descriptor amended to conform to the new template format

Assessment (also refer to Assessment Outcomes Grids below)
Assessment 1
Class Test (60%)
Assessment 2
Coursework: Problem Sets and Laboratory Work (40%)
Assessment 3
(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.)

Component 1							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Class Test	☒	☒	☒	☒	☐	60	2

Component 2							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Coursework	☒	☒	☒	☒	☒	40	12

Component 3							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
	☐	☐	☐	☐	☐		
Combined total for all components						100%	14 hours

Change Control

What	**When**	**Who**
Moved to new template	20/03/2025	M. Barbier