University of the West of Scotland

Module Descriptor

Session: 2024/25

Title of Module: Optics & Electronics			
Code: PHYS08002	**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:	Nara Singh Bondili		

Summary of Module

This is a core module for physics programmes at SCQF Level 8. It would also be suitable for someone with a background in Physics at Level 6 (SQA Higher) wishing to extend their knowledge of optics and electronics. The teaching consists of a mix of lectures, tutorials where students can develop their problem-solving abilities and practical classes where the theory taught in lectures will be brought to life in a variety of hands-on experiments. A formal lab report for one experiment is to be submitted to demonstrate technical writing skills. Topics covered will include:

Wave nature of light, interference of light

Rayleigh resolution criterion.

Malus's law, Brewster's law

Electromagnetic nature of light, polarization,

Optical cavities and laser action.

Optical instruments; Dispersion and Snell's law; Lenses and mirrors – f number and field depth. Ray trace, focal length equation, formation of images. Seidel and chromatic aberrations. Apertures and stops.

Analogue electronics - resistor networks, transistor and operational amplifier circuits.

Digital electronics – binary arithmetic/codes. Component circuits; Boolean algebra and truth tables; Combination logic circuits; Sequential logic circuits.

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)						
+						
☒	☐	☐	☐	☐	☐	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	Demonstrate a critical understanding of the physical principles of equipment and techniques used in hospital nuclear medicine and medical imaging departments.
L2	Demonstrate knowledge of analogue circuits using transistors and operational amplifiers, execute operations in Boolean algebra derived from truth tables and implement using digital circuit components.
L3	Demonstrate practical and analytical skills by building and debugging electronic circuits.
L4	Demonstrate practical ability in performing, recording and analysing the results of laboratory experiments.

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** Knowledge and understanding of the wave nature of light and the evidence for this, including related lab experiments. Also a basic knowledge of analogue and digital circuits.	
Practice: Applied Knowledge and Understanding	SCQF Level **8** Building electronic circuits and de-bugging them, conducting lab experiments in various areas of simple optics.	
Generic Cognitive skills	SCQF Level **8** Interpreting results and drawing conclusions.	
Communication, ICT and Numeracy Skills	SCQF Level **8** Problem solving; communicating ideas in words and in writing; calculations associated with the theory.	
Autonomy, Accountability and Working with others	SCQF Level **8** Working in pairs in the laboratory; contributing in small group tutorials.	
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.

This is a lecture-based course, supplemented with laboratory classes and problem-solving tutorials. The optics lectures will cover the theory of the wave and electromagnetic nature of light. Simple optical systems and instruments will be discussed in the lectures, and this will be backed up by the practical classes where students will learn to take and record measurements, and to assess the uncertainties in these measurements, comparing results, where appropriate, with accepted values (e.g. the measurement of the wavelength of a particular light source). The lectures in electronics will give an introduction to analogue and digital electronics, this will be reinforced by practical work wiring and troubleshooting simple analogue and digital circuits. In doing this, students will also gain skills in written communication by the use of a logbook. A formal lab report is to be submitted for one experiment. The problem-

solving tutorials will allow the student to reflect on the theory and apply it to suitable numerical problems. Students will be encouraged to work in groups as well as on their own. The face-to-face teaching will be supplemented by a Moodle site giving students remote access to the teaching materials and other resources such as homework exercises. In addition to face-to-face contact as outlined above, students will be expected to consolidate their learning by wider reading of the recommended texts, by independent study and by further independent practice at problem solving.

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	12
Laboratory/Practical Demonstration/Workshop	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:

University Physics, Young and Freedman, Addison Wesley 12th Edition (2007)[ISBN: 978-0805321876]

Electronics with Discrete Components, Galvez, John Wiley & Sons (2013), [ISBN: 978-0470889688]

(**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	Marcus Scheck
External Examiner	H Boston
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.

Assessment: (also refer to Assessment Outcomes Grids below)
Assessment 1 – Class Test (60%)
Assessment 2 – Written Coursework and Laboratory Work (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	✓	✓			15	0
Laboratory			✓	✓	25	12
Combined Total for All Components					100	14