University of the West of Scotland

Module Descriptor

Session: 2024/25

Title of Module: Detectors and Nuclear Lab Skills			
Code: PHYS09014	**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:	Nara Singh Bondili		

Summary of Module

This is a core SCQF Level-9 module for Physics with Nuclear Technology and an optional module for Physics.

The module focuses on radiation and detection. The lecture material has a strong connection to laboratory sessions on nuclear laboratory skills. The module is also strongly connected to nuclear applications that impact societal needs, for example, security, energy and health needs.

Detectors and Nuclear Lab Skills will include interaction of charged particles with matter, X-ray, particle detectors, neutrons, gas-filled detectors; scintillation detectors; semiconductor detectors; gamma-ray spectroscopy and trace element analysis.

The module has nuclear measurements which will include laboratory sessions of radiation detection with semiconductor and scintillator particle detectors, and semiconductor and scintillator gamma-ray detectors.

This module would additionally be of interest to students in analytical disciplines in chemistry and biological sciences, as well as physics, providing the student had sufficient understanding of the physical principles involved.

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)						
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	Apply critical understanding to the use of physical techniques in analysis, characterisation, and sensing and detection.
L2	Work with their knowledge of the principal techniques and their application to solve problems in any of the topic areas.
L3	Demonstrate a specialist understanding in at least one area of analysis, characterisation, sensing or detection.
L4	Demonstrate a specialist understanding of how the detection techniques can be applied to nuclear research.

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** The student will demonstrate a critical understanding of the scope and defining features of detectors and nuclear skills, and an integrated knowledge of its main areas and boundaries. The student will demonstrate a critical understanding of the physics and practical knowledge of detection and nuclear techniques, and their applications to energy and health sectors and trace elemental analysis.
Practice: Applied Knowledge and Understanding	SCQF Level **9** The student will apply knowledge, skills and understanding in the following areas. Subject knowledge will be applied during the production of assessed work, and in the laboratory and class discussions. A range of calculation and analysis techniques will be used during the production of assessed work and independent study. Laboratory sessions will include the use of some specialist equipment and advanced techniques. Students will also have to use routine research and enquiry techniques to find information on some topics, and to provide background material for assessed work.
Generic Cognitive skills	SCQF Level **9** Students will undertake critical analysis, evaluation, and synthesis of ideas, concepts and information during independent study and during production of assessed work. In exams, problems sessions, and labs, students will identify and analyse routine problems characteristic of physics at Level 9. Students will show an ability to select appropriate analysis techniques, and ability to select information as appropriate from reference materials and draw on a range of materials in making judgments.
Communication, ICT and Numeracy Skills	SCQF Level **9** The student will use a wide range of routine communication, ICT and numeracy skills such as the production of written work, the use of spreadsheets, and use of computers for data collection. Numerical and graphical data will be produced, interpreted and evaluated in labs and in problem sessions. Advanced specialist skills will be demonstrated in writing a formal report, and using a laboratory notebook to record experimental results and procedures. Presentation of information on mainstream module topics will take the form of PowerPoint slides, formal lab reports, class

	discussions, and in small groups. Audiences may or may not have previous knowledge of the subject.	
Autonomy, Accountability and Working with others	SCQF Level **9** Students will have autonomy in managing their own work during independent study and revision. They will need to exercise some initiative in interpreting the most relevant material to work on. Working in pairs and small group, students will need to use awareness of their own and others' responsibilities. In particular in labs and on any visits students will interact with physics technical staff, researchers, and engineers.	
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. Lectures will cover the theoretical basis for a range of radiation detection techniques, as well as laboratory application of these techniques. Lab-based practical classes will enable the students to gain practical experience of some physical principles and techniques relating to radiation detection. This will also provide the opportunity to develop the ability to maintain a practical logbook which can later be used to produce a formal report. Students are also expected to undertake reading and private study, to supplement their knowledge in the broader field and also in certain main areas as directed. The Aula site will be used to provide learning resources, communicate with students, and enable the use of interactive learning tools.	
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:

G. F. Knoll “Radiation detection and measurement” Third Edition, Wiley (2000)

W. R. Leo “Techniques for Nuclear and Particle Physics Experiments” Springer-Verlag (1994)

L. Lyons “Statistics for Nuclear and Particle Physics” Cambridge University Press (1986)

K.S. Krane, “Introductory Nuclear Physics” JOHN WILEY & SONS (1988)

In addition, it will be necessary for students to consult the internet, “trade magazines” and published literature in order to complete their individual study and assignments. Nuclear Physics research journals such as Nuclear Instruments and Methods, Physical Review C, Physical Review Letters, Nature, and Nuclear Physics A.

(**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	Michael Bowry
External Examiner	H. Boston
Accreditation Details	Institute of Physics (IoP)
Changes/Version Number	**1.0** This is a new module that will run for the first time in 2024-25.

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	✔	✔	✔		20	0
Laboratory	✔	✔	✔	✔	20	12
Combined Total for All Components					100	14