University of the West of Scotland

Module Descriptor

Session: 2024/25

Title of Module: Research Topics in Nuclear Physics			
Code: PHYS10010	**SCQF Level: 10 (Scottish Credit and Qualifications Framework)**	**Credit Points: 20**	**ECTS: (European Credit Transfer Scheme) 10**
School:	School of Computing, Engineering, and Physical Sciences		
Module Co-ordinator:	John F Smith		

Summary of Module

This module is a one of the Level-10 core components of the BSc (Hons) programme Physics with Nuclear Technology. The module covers aspects of radiation detection and measurement and an overview of current research topics in nuclear physics. A pre-requisite for the module is a good understanding of nuclear physics. The content of this module is made up of a section about radiation detectors and their operation and use, followed by discussion of research methods and a discussion of current research topics in nuclear physics. The content is primarily presented in lectures, but with some demonstrations, and some self-study. Assessment is by examination (80%) and coursework (20%). A brief outline of the module content is given below.

Radiation-detection principles
The interaction of charged particles and photons with matter; counting statistics; general properties of radiation detectors; background and detector shielding

Radiation detectors
Ion chambers; proportional counters; scintillation detectors and photomultiplier tubes; semiconductor diode detectors; x-ray detection; gamma-ray detection; detection of light and heavy charged particles; neutron detection

Research methods
Particle accelerators; overview of nuclear reactions; gamma-ray spectroscopy

Current topics in nuclear-physics research
Nuclear angular momentum; nuclear moments of inertia; rotational frequency and rotational alignments; selected topics in current research such as novel deformations, shape coexistence, evolution of magic numbers; superheavy elements; nuclear astrophysics.

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/currentstudents/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 radiation detection and measurement.
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 of the current areas of interest in nuclear-physics 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 10. The student will be required to gain a broad overview of the topics, in the lectures and through background reading and preparation for written assignments. In answering tutorial questions and exam preparation a critical understanding of the concepts will be required. Lectures and in particular assignments will take the student to the forefront and give some insight into how the subject is going forward in these two disciplines.	
Practice: Applied Knowledge and Understanding	SCQF Level 10. In this module the student will use a range of principal skills through completing tutorial questions and review of lecture notes and additional material, s/he will also develop some advanced specialised skills in these topics, for example through use of simulation software.	
Generic Cognitive skills	SCQF Level 10 As above	
Communication, ICT and Numeracy Skills	SCQF Level 10 As above	
Autonomy, Accountability and Working with others	SCQF Level 7 As above	
Pre-requisites:	Before undertaking this module the student should have undertaken the following:	
	Module Code: PHYS09003 PHYS09007 PHYS09008 PHYS09011	**Module Title:** Electromagnetism Thermodynamics & Statistical Physics Quantum Mechanics Atoms & Nuclei
	Other:	
Co-requisites	**Module Code:**	**Module Title:**

*Indicates that module descriptor is not published.

Learning and Teaching
The delivery of this module is primarily by lectures. Lectures will be complemented by tutorial work and discussions. Individual learning is important at an advanced level, in order that students can develop their understanding from week to week. Students are encouraged to read reports and research publications of recent developments in the areas mentioned. It is expected that the student will use the information retrieval systems provided by the university. Adjustments for special needs can be made on request. Students are encouraged to use the Virtual Learning Environment tools to access useful links and obtain computer programmes or other resources provided by staff.

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	30
Tutorial/Synchronous Support Activity	6
Independent Study	164
	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)

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
Changes/Version Number	This version: 3.0 External Examiner details updated v2.0 The prerequisites were updated Moderator updated 16/3/2020 - Summary of module updated. Contact hours corrected. 23/3/2021 - Contact hours corrected, assessment types clarified. (JFS) 31/8/24 Small corrections to the text, moved onto 24/25 template (JFS, Version 3.0)

Assessment: (also refer to Assessment Outcomes Grids below)
The module has two categories of assessment:
• 80% Assessment Category 1 - final examination
• 20% Assessment Category 2 - one or more coursework assignment(s)
(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)

Assessment Type (Footnote B.)	Learning Outcome (1)	Learning Outcome (2)	Learning Outcome (3)	Weighting (%) of Assessment Element	Timetabled Contact Hours
Unseen closed book (standard)	✓	✓	✓	80	2
Assessment Type (Footnote B.)	**Learning Outcome (1)**	**Learning Outcome (2)**	**Learning Outcome (3)**	**Weighting (%) of Assessment Element**	**Timetabled Contact Hours**
Portfolio of written Work	✓	✓	✓	20	0
Combined Total for All Components				100%	2 Hours