# University of the West of Scotland

## Module Descriptor

## Session: 2024/25

| Title of Module: Imaging & Nuclear Medicine | | | |
|---|---|---|---|
| **Code: PHYS09009** | **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 Programme and an optional module for Physics Programme.

This module will cover the principles behind the imaging techniques of computed tomography (CT), Single Photon Emission Computed Tomography (SPECT), Positron Emission Tomography (PET), magnetic resonance imaging (MRI), and ultrasound, and their uses in imaging the structure of the human body. Functional imaging using some of these techniques will also be discussed.

The fundamentals of nuclear medicine will be studied including radioisotopes and radiopharmaceuticals, detectors and principles of counting, the interaction of radiation with matter and tissue, principles of radiation safety and radiation doses, gamma cameras, computing in nuclear medicine.

The application of ionizing radiation in the treatment of cancer will be discussed. An introduction will be given to the use of radioactive sources in the treatment of cancer (brachytherapy). Principles of radiotherapy with X-ray beams and accelerated particles (proton, carbon) radiotherapy will be discussed.

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)**<br>**These should take cognisance of the SCQF level descriptors and be at the appropriate level for the module.**<br>At the end of this module the student will be able to: | |
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| L1 | Demonstrate a critical understanding of the physical principles of equipment and techniques used in hospital nuclear medicine and medical imaging departments. |
| L2 | Demonstrate a knowledge of the basic physics behind a range of imaging and scanning techniques. |
| L3 | Demonstrate a knowledge of key areas of radiotherapy physics. |
| L4 | Carry out practical exercises in radiation detection and imaging techniques, analyse the data and report the results, proper use of laboratory notebook at Level 9 standard. |

| **Employability Skills and Personal Development Planning (PDP) Skills** |
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| **SCQF Headings** | During completion of this module, there will be an opportunity to achieve core skills in: |
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| Knowledge and Understanding (K and U) | SCQF Level **9**<br><br>The student will demonstate a critical understanding of the scope and defining features of medical imaging and nuclear medicine, and an integrated knowledge of its main areas and boundaries.<br><br>The student will demonstrate a critical understanding of the physics and clinical practice of a range of imaging techniques, and the physics underpinning of the use of isotopes in nuclear medicine for treatment and imaging.<br><br>The module includes topics in functional imaging and beam therapy which are informed by developments at the forefront of the field. |
| Practice: Applied Knowledge and Understanding | SCQF Level **9**<br><br>The student will apply knowledge, skills and understanding in the following areas.<br><br>Subject knowledge will be applied during production of assessed work, and in the laboratory and class discussions.<br><br>A range of calculation and analysis techniques will be used during the production of assessed work and during independent study.<br><br>Laboratory sessions will include the use of some specialist equipment and advanced techniques.<br><br>Labs will not be completely defined and will have a degree of unpredictability.<br><br>Students will also have to use routine research and enquiry techniques to find the information on some topics, and to provide background material for assessed work. |
| Generic Cognitive skills | SCQF Level **9**<br><br>Students will undertake critical analysis, evaluation, and synthesis of ideas, concepts and information during independent study and during production of assessed work.<br><br>Students will show 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 judgements. |
| Communication, ICT and Numeracy Skills | SCQF Level **9** |

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|---|---|---|
| | The student will use a wide range of routine communication, ICT and numeracy skills such as production of written work, use of spreadsheets, and use of computers for data collection.<br><br>Numerical and graphical data will be produced, interpreted and evaluated in labs and in problem sessions.<br><br>Advanced specialist skills will be demonstrated in writing a formal report and using a laboratory notebook to record experimental results and procedures.<br><br>Presentation of information on mainstream module topics will take the form of PowerPoint slides, formal lab report, 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**<br><br>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.<br><br>Working in pairs and small group, students will need to use awareness of their own and others' responsibilities.<br><br>In particular in labs and on any visits students will interact with physics technical staff, researchers, and engineers.<br><br>Students will appreciate the principles of risk assessment and be aware of safety issues in the lab. | |
| **Pre-requisites:** | Before undertaking this module, the student should have undertaken the following: | |
| | **Module Code:**<br>PHYS08002<br>PHYS08004<br>PHYS08006<br>PHYS08007<br>PHYS08009 | **Module Title:**<br>Optics & Electronics<br>Properties of Matter<br>Mathematics for Physics 1<br>Classical Mechanics<br>Modern Physics |
| | **Other:** | or equivalent |
| **Co-requisites** | **Module Code:** | **Module Title:** |

*Indicates that module descriptor is not published.

| **Learning and Teaching** |
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| **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 medical imaging techniques, as well as the theory of nuclear medicine, health physics, and radiotherapy physics. Lab-based practical classes will enable the students to gain practical experience of some physical principles and techniques relating to medical imaging and nuclear medicine. 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 will keep a summary of the topics covered and produce mini reports on special topics, which will later be used to produce the 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.

| **Learning Activities**<br>During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below: | **Student Learning Hours**<br>(Normally totalling 200 hours):<br>(Note: Learning hours include both contact hours and hours spent on other learning activities) |
|---|---|
| Lecture/Core Content Delivery | 36 |
| 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:

"Practical Nuclear Medicine", P. F. Sharp, H. G. Gemmell, A. D. Murray, Springer (2005).

“The Physics of Medical Imaging” S. Webb, IOP Publishing 1988 [ISBN 978 0852743492].

(**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.

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| 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

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| **Divisional Programme Board** | Engineering and Physical Sciences |
| **Assessment Results (Pass/Fail)** | Yes ☐No ☒ |
| **School Assessment Board** | Physical Sciences |
| **Moderator** | David O'Donnell |
| **External Examiner** | H Boston |
| **Accreditation Details** | Institute of Physics (IoP) |
| **Changes/Version Number** | **3.0**<br>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)** |
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| 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.<br>(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) | 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** |
| Laboratory | | | | ✔ | 20 | 12 |
| Portfolio of Written Work | ✔ | ✔ | ✔ | ✔ | 20 | 0 |
| **Combined Total for All Components** | | | | | 100 | 14 |