Module Specification

Advanced Radiation Physics and Nuclear Medicine

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Contents

Part 1: Information

Module title: Advanced Radiation Physics and Nuclear Medicine

Module code: USSKLN-30-3

Level: Level 6

For implementation from: 2023-24

UWE credit rating: 30

ECTS credit rating: 15

Faculty: Faculty of Health & Applied Sciences

Department: HAS Dept of Applied Sciences

Partner institutions: None

Field: Applied Sciences

Module type: Module

Pre-requisites: None

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: Not applicable

Features: Module Entry Requirements: Level 5 (or equivalent) medical physics qualification

Educational aims: This module explores advanced topics in radiation physics and nuclear medicine and contains two distinct units, namely:

Unit 1: Framework for Radiation Governance and Risk Management
Unit 2: Physics and Instrumentation

Students complete one of these units as prescribed by their pathway.
Unit 1 aligns to the Healthcare Science (Medical Physics) Radiation Physics pathway.
Unit 2 aligns to the Healthcare Science (Medical Physics) Nuclear Medicine pathway.

Outline syllabus: The syllabus includes:

Radiation Governance and Risk Management (Radiation Physics pathway):

The overall aim of this unit is to ensure that the student has an understanding of the main sources of ionising and non-ionising radiation encountered in the clinical environment, the legislative and organisational framework surrounding their use, and the principles of risk assessment and risk management.

Review of the main clinical sources of diagnostic kV ionising and non-ionising radiation and their interaction with human tissue: external and internal radiation, non-ionising radiation interactions, risks of exposure to ionising and non-ionising radiation
Review of the organisation of radiation protection in hospitals
Review and application of the general principles of radiation protection and international and national legislation, guidance, codes of practice, standards and recommendations
International Commission on Radiological Protection (ICRP) recommendations and rationale
Current regulations and recommendations relating to: radiation protection of staff and the public, comforters and carers, environmental protection, the administration of radioactive substances, transportation of dangerous goods, Health and Safety at Work, electromagnetic fields (EMF), mobile phones, MRI, lasers, UV and intense light sources (ILS), ultrasound, enforcement and prosecution

Quality systems:

Accreditation of calibration laboratories; National Physical Laboratory (NPL), United Kingdom Accreditation Service (UKAS)

Risk assessment, risk management and emergency procedures:
Diagnostic X-ray installations
Radiotherapy using radioactive materials
Diagnostic use of radioactive materials
Ultrasound and MRI
Lasers, UV and ILS

Use of radioactive materials:
Contamination monitors, wipe tests
Instrument types, range of probes
Survey meters and isotope calibrators
Calibration of above instruments

Physics and Instrumentation (Nuclear Medicine pathway):

The overall aim of this unit is to ensure that the student has an understanding of instrumentation and procedures carried out in the nuclear medicine department and understands the physical processes that underpin them.

Performance, application, risk assessment and QC procedures for of each of the following imaging systems used in nuclear medicine: gamma camera, SPECT, SPECT-CT, PET, PET-CT, PET-MR
Dosimetry of unsealed and sealed radionuclide sources
Review of practical administration of radioactivity and specific radiation protection and risk considerations: inpatients, pregnant and breastfeeding patients, paediatrics, comforters and carers, nursing staff on wards with therapy patients, staff and public

Principles of radionuclide production:
Carrier-free radionuclides
Radionuclide generator systems: growth and decay curves, elution profiles
Generator elution

Kit reconstitution
Aseptic techniques
Drawing up
Available generator systems and their construction
Cyclotron and reactors and their role in radionuclide production

Basic mathematical methods as applied to nuclear medicine: counting statistics, precision of net sample counts, radioactive decay and decay calculations, isotope dilution methods, clearance techniques
The assay of radioactivity: problems associated with assay, background and shielding, counting loss associated with dead time and its correction, efficiency and the optimisation of counting conditions, dual isotope counting, geometry of the detecting system, assay of radioactive samples, radionuclide identification, quantification of uptake, relative and absolute, use of standards, background and phantoms, whole body monitors
Department design or refurbishment: services, equipment, room design, clinical workload, patient pathways

Part 3: Teaching and learning methods

Teaching and learning methods: There will be 3 weeks of contact time at UWE in 3 x 1 week blocks. Included in each block week are laboratory workshops, lectures and tutorials. The contact time will equate to approximately 12 hours per block (a total of 36 hours).

In addition to the allocated hours on campus learning, students will engage in synchronous and asynchronous online learning. This will comprise a total of approximately 36 hours of online engagement through a combination of lectures, synchronous online tutorials, synchronous and asynchronous discussions, online quizzes, and collaborative group work.

Theoretical material within the module will be presented to the students in the form of regular lectures throughout each of the semesters in the academic year. During

those times of work based learning, these lectures will be delivered online and involve a number of technological enhancements. The learning of lecture content will be reinforced through time spent in independent learning by the directed reading of recommended texts and through the use of technology enhanced learning resources that will be provided online. This online learning and engagement will be delivered through several avenues:

Synchronous online tutorials in protected learning time where the student will contribute/attend an online activity appropriate to the content at the time at which the academic will be present online to facilitate and lead this scheduled/timetabled session. These tutorials will be themed/planned.

Asynchronous discussions in the student's own time (or during protected time where permitted and appropriate) where they will engage/collaborate with other students on the course or in specified groups, and in which the academic is permitted to moderate where necessary, but is not expected to contribute.

Synchronous surgery sessions timetabled for a specific time in which the academic will be available online to answer live questions via discussion boards/blogs/collaborate or to respond to questions posted/asked prior to the session.

Interactive, online formative quizzes made available either following a particular package of knowledge exchange/learning, or in specified sessions/time periods.

Lectures delivered online through a combination of one or more of the following: visual/audio/interactivity/personal formative assessment.

A number of relevant practical sessions will be incorporated during the campus based blocks in addition to the work based learning that must be achieved under supervision by a workplace supervisor. Practical sessions will both drive hands on learning and the acquisition of technical skills at both an individual and group working level.

The remainder of the independent learning time allocated to the module should be spent preparing for assessments (B1), and undertaking revision for the exams (A1, A2).

Scheduled learning includes lectures, seminars, tutorials, project supervision, demonstration, practical classes and workshops; fieldwork; external visits; work based learning; supervised time in studio/workshop.

Independent learning includes hours engaged with essential reading, case study preparation, assignment preparation and completion etc. These sessions constitute an average time per level as indicated in the table below. Scheduled sessions may vary slightly depending on the module choices you make.

Module Learning outcomes: On successful completion of this module students will achieve the following learning outcomes.

MO1 Critically evaluate the main clinical sources of ionising and non-ionising radiation and their interaction with human tissue (Radiation Governance and Risk Management: Radiation Physics Pathway)

MO2 Evaluate the organisational arrangements for radiation protection and the role of quality management, with particular regard for patient safety (Radiation Governance and Risk Management: Radiation Physics pathway)

MO3 Critically review and evaluate legislation and codes of practice associated with the control of ionising and non-ionising radiation (Radiation Governance and Risk Management: Radiation Physics pathway)

MO4 Describe and evaluate risk assessment and emergency procedures of all clinical diagnostic X-ray and non-ionising radiation sources and their role in ensuring patient safety and comfort (Radiation Governance and Risk Management: Radiation Physics pathway)

MO5 Appraise the safe use of radioactive materials in the clinical environment (Radiation Governance and Risk Management: Radiation Physics pathway)

MO6 Critically evaluate imaging systems used in nuclear medicine, their performance, uses and applications, QC procedures and their role in the patient pathway (Physics and Instrumentation: Nuclear Medicine pathway)

MO7 Explain radiation dosimetry as applicable to nuclear medicine practice (Physics and Instrumentation: Nuclear Medicine pathway)

MO8 Critically evaluate the procedures, radiation protection and legislative issues surrounding the administration of radioactive materials with adult and paediatric patients, with particular regard to patient safety and dignity (Physics and Instrumentation: Nuclear Medicine pathway)

MO9 Explain the principles of radionuclide production, with reference to the different methods of production (Physics and Instrumentation: Nuclear Medicine pathway)

MO10 Critically appraise the problems associated with the assay of radioactive material and the principles of such measurements (Physics and Instrumentation: Nuclear Medicine pathway)

MO11 Describe the design or refurbishment of a nuclear medicine department (Physics and Instrumentation: Nuclear Medicine pathway)

Hours to be allocated: 300

Contact hours:

Independent study/self-guided study = 228 hours

Face-to-face learning = 72 hours

Total = 300

Reading list: The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://uwe.rl.talis.com/modules/usskln-30-3.html

Part 4: Assessment

Assessment strategy: The Assessment Strategy has been designed to support and enhance the development of both subject-based and more general skills, whilst ensuring that the modules learning outcomes are attained, as described below.

Assessment 1: Set Exercise

The set exercise will provide apprentices with an opportunity to demonstrate their knowledge on a broad range of topics.

Assessment 2: Case Study
The apprentices will produce a 1500 word report demonstrating how they would apply what they have learned in this unit to a scenario that they may encounter in the workplace.

Formative feedback is available to students throughout the module through group discussions and in workshops. Apprentices are provided with formative feed-forward for their exam through a revision and exam preparation session prior to the exam and through the extensive support materials supplied through Blackboard.

Assessment tasks:

Set Exercise (First Sit)
Description: Set Exercise
Weighting: 50 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO10, MO11, MO2, MO3, MO7, MO8, MO9

Case Study (First Sit)
Description: Report (1500 words)
Weighting: 50 %
Final assessment: No
Group work: No
Learning outcomes tested: MO4, MO5, MO6

Set Exercise (Resit)
Description: Set Exercise
Weighting: 50 %
Final assessment: Yes
Group work: No

Learning outcomes tested: MO1, MO10, MO11, MO2, MO3, MO7, MO8, MO9

Case Study (Resit)
Description: Report (1500 words)
Weighting: 50 %
Final assessment: No
Group work: No
Learning outcomes tested: MO4, MO5, MO6

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Healthcare Science (Nuclear Medicine) {Apprenticeship-UWE}
[Sep][FT][Frenchay][3yrs] BSc (Hons) 2021-22

Healthcare Science (Radiation Physics) {Apprenticeship-UWE}
[Sep][FT][Frenchay][3yrs] BSc (Hons) 2021-22