Module Specification

Scientific Basis of Medical Physics

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Contents

Part 1: Information

Module title: Scientific Basis of Medical Physics

Module code: USSKLJ-30-1

Level: Level 4

For implementation from: 2020-21

UWE credit rating: 30

ECTS credit rating: 15

Faculty: Faculty of Health & Applied Sciences

Department: HAS Dept of Applied Sciences

Partner institutions: None

Delivery locations: Frenchay Campus

Field: Applied Sciences

Module type: Standard

Pre-requisites: None

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: This module explores the scientific basis of medical physics.

Features: Not applicable

Educational aims: See Learning Outcomes

Outline syllabus: Indicative content includes:

Medical Physics and patient pathway:-

- Diagnostics
- Therapeutics
- The equipment life cycle
- Innovation and service development

Introduction to ionising radiation equipment in Medical Physics:-

- Radiation detectors
- Gamma camera and single-photon emission computed tomography (SPECT)
- Basic diagnostic X-ray equipment
- Computed tomography (CT)
- SPECT-CT
- Positron emission tomography (PET) and PET/CT
- Linear accelerator

- Orthovoltage (kV) radiotherapy unit
- Radiotherapy treatment planning system (TPS)
- Brachytherapy after-loaders
- Cyclotron

Introduction to the basic science and the role of the Healthcare Science Practitioner (HCSP) in radiotherapy:-

- Mould Room
- Treatment planning
- Quality Assurance (QA) and Quality Control (QC)
- Dosimetry
- Brachytherapy

Introduction to the basic science and the role of the HCSP in nuclear medicine:-

- Radiopharmacy

 Scanning

 Radionuclide therapy

Introduction the basic science and the role of the HCSP in radiation protection:-

 Room surveys

 QA and QC

 Environmental monitoring

 Personnel monitoring

 Sealed sources

 Unsealed sources

Basic ionising radiation protection:-

 International and national legislation, guidance, standards and recommendations

 Hospital organisation of radiological protection: radiation safety policy, local rules

 Designation of areas

 Classification of persons

 Roles and responsibilities of staff, including duty holders

 As Low as Reasonable Practicable (ALARP)

 Basic principles of dose limitation: time, distance, shielding

 Radiation protection of patients, public and staff

 Transportation of radioactive materials and administration of radionuclides

 High activity materials

 Disposal of radioactive materials

 Personnel and environmental dose monitoring

Interactions of radiation with matter:-

 Radiation quality – Half Value Layer (HVL) and Tenth Value Layer (TVL), Quality Index

 Exponential attenuation of monoenergetic photons

 Ionisation and excitation

 Electron range and energy

 Filters and filtration

 Effects of electron and photon energy, absorber density and atomic number tissue equivalent materials

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. This tutorial 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 assessments [B1, B2], 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:

MO1 Describe and explain the basic equipment and clinical applications of each type of radiation [A1]

MO2 Describe and explain the biological effects and measurement of each type of radiation [A2, B1]

MO3 Describe and explain the possible health effects and safety of each type of radiation [A2, B1]

MO4 Describe the procedures and need for evaluation of adverse incidents and the potential impact of adverse incidents on patients, carers and healthcare professionals [B1, B2]

MO5 Know and discuss basic radiation protection principles and the basic application of legislation within the workplace [A1]

MO6 Describe the role of a Medical Physics Technology HCSP within their specific practice environment, the patient pathway and within the wider context of healthcare [A2, B2]

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/index.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.

Component A

The online exams will provide students with an opportunity to demonstrate both their knowledge on a broad range of topics through a series of short answer questions, and more in-depth knowledge though a selection of medium length questions.

Component B

The radiation equipment assignment which will provide an opportunity for students to demonstrate their ability to apply the principles of medical physics to radiation equipment and evidence their skills in approaching it appropriately. This will be through a combination of practical and written work. The second element allows students to apply their knowledge and identify examples of the role of a HCSP within Medical Physics through preparation and defence of a poster.

Formative feedback is available to students throughout the module through group discussions, and in workshops. Students 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.

All work is marked in line with the Faculty's Generic Assessment Criteria and conforms to university policies for the setting, collection, marking and return of student work. Where an individual piece of work has specific assessment criteria, this is supplied to the students when the work is set.

Assessment components:

Written Assignment - Component B (First Sit)
Description: Integrated radiation equipment assignment
Weighting: 30 %

Final assessment: No

Group work: No

Learning outcomes tested: MO2, MO3, MO4

Examination (Online) - Component A (First Sit)

Description: Online Examination (24 hours)

Weighting: 20 %

Final assessment: No

Group work: No

Learning outcomes tested: MO1, MO5

Examination (Online) - Component A (First Sit)

Description: Online Examination (72 hours)

Weighting: 20 %

Final assessment: Yes

Group work: No

Learning outcomes tested: MO2, MO3, MO6

Presentation - Component B (First Sit)

Description: Poster presentation and defence (15 minutes)

Weighting: 30 %

Final assessment: No

Group work: No

Learning outcomes tested: MO4, MO6

Written Assignment - Component B (Resit)

Description: Integrated radiation equipment exercise (including case study poster)

Weighting: 60 %

Final assessment: No

Group work: No

Learning outcomes tested:

Examination (Online) - Component A (Resit)

Description: Online Examination (24 hours)

Weighting: 40 %

Final assessment: Yes

Group work: No

Learning outcomes tested:

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Healthcare Science (Radiotherapy Physics) {Apprenticeship-UWE}
[Sep][FT][Frenchay][3yrs] BSc (Hons) 2020-21

Healthcare Science (Nuclear Medicine) {Apprenticeship-UWE}
[Sep][FT][Frenchay][3yrs] BSc (Hons) 2020-21

Healthcare Science (Radiation Physics) {Apprenticeship-UWE}
[Sep][FT][Frenchay][3yrs] BSc (Hons) 2020-21