Module Specification

Advanced Radiation Engineering

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Contents

Part 1: Information

Module title: Advanced Radiation Engineering

Module code: USSKLD-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

Delivery locations: Not in use for Modules

Field: Applied Sciences

Module type: Module

Pre-requisites: Applied Clinical Engineering 2023-24

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: This module examines the science and principles supporting Radiation Engineering.

Features: Module Entry Requirements: Level 5 (or equivalent) biomedical engineering qualification

Educational aims: To learn fundamental principles, systems and methods in radiation engineering, and apply them to specific areas of relevance in the students' own practice.

Outline syllabus: The syllabus covers:

Ionising Radiation Physics:
Atomic structure
The laws of radioactive decay
Mechanism of radioactive decay
Interaction of radiation with matter
Natural Sources of Radiation

Clinical Sources of Radiation:
Production of X-rays
Types of X-ray tube and design features
X-ray generators
Sealed sources
Unsealed radioactive materials

Radiation Protection:
As Low as Reasonably Achievable (ALARA)
Principles of dose limitation
Net positive benefit, dose limits
National and International legislation and recommendations
Controlled and supervised areas, classified persons
Roles and responsibilities of staff, including the Radiation Protection Adviser (RPA) and Radiation Protection Supervisor (RPS)
Hospital organisation of radiological protection; radiation safety policies and local rules
Personnel and environment dose monitoring
Instrument calibrations
Registration, safe custody, transport, use and disposal of radioactive sources
Notification of radiation accidents and incidents

Contingency plans, including radiation emergencies
Biological and effective half life
Record keeping
Design considerations

Radiobiology:
Effects of radiation on cells and tissues
Cell survival concepts of tissue tolerance, fractionation, oxygenation, cell proliferation
Radiation hazards: early and late reactions; genetic and carcinogenic risks

Diagnostic Radiology Techniques:
Diagnostic Radiography
Fluoroscopy: over-couch and under-couch system, fluorography
Computer Tomography (CT)
Digital systems (radiography, subtraction and enhancement techniques)
Mobile units, dental units, dental panoramic tomography, cephalometry
Mammography
Room layouts, control cubicles, shielding
Primary beam, scatter, leakage
Image processes
Factors affecting patient dose

Radiotherapy Treatment:
Room design, shielding
Linear accelerators, technology applications to treatment
X-ray Beam Therapy, Electron Beam Therapy, Intensity Modulated Radiotherapy (IMRT), Image Guided Radiotherapy (IGRT), Proton Therapy, Arc Therapy, Tomotherapy Hybrid Systems (combined imaging and treatment machines)
Superficial Therapy
Beam generation, energy and delivery
Active Source Therapy

Brachytherapy, Cobalt Therapy:
Imaging Techniques

X-Ray, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Nuclear Medicine
Hybrid Systems
Treatment Planning systems and Process

Dose distribution

Dose measurement

Immobilisation devices and their purpose in radiotherapy treatment or Diagnostic Radiology

Quality assurance:
Field quality and alignment

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 written assessments for submission (2) and undertaking revision for the exams (1).

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

MO1 Critically evaluate the science behind and the differences between ionising and non-ionising radiation

MO2 Critically evaluate radiation protection principles, practices and protocols including safety requirements, radiation scatter and leakage

MO3 Critically evaluate the effects of different types of radiation on humans

MO4 Demonstrate an understanding of the principles that underpin the operation of radiation imaging and treatment equipment

MO5 Critically evaluate new technology and applications of existing technologies to be used in the imaging or treatment of the human body

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/usskld-30-3.html

Part 4: Assessment

Assessment strategy: Assessment Task 1:
The set exercise will provide apprentices with an opportunity to demonstrate their knowledge on a broad range of topics

Assessment Task 2:
Assessment Task 2, a 2000 word case study, will provide an opportunity for apprentices to demonstrate their ability to apply the principles of their relevant area

of clinical engineering to an unseen problem and/or case study and evidence their skills in approaching and interpreting it appropriately.

Group discussions, in workshops, underpin the case study. Apprentices are provided with formative feed-forward for their set exercise through a revision and preparation session and through the extensive support materials supplied through Blackboard

Assessment components:

Set Exercise (First Sit)
Description: Set Exercise
Weighting: 50 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO2, MO3, MO4, MO5

Case Study (First Sit)
Description: Case study integrated assignment (2000 words)
Weighting: 50 %
Final assessment: No
Group work: No
Learning outcomes tested: MO2, MO3, MO5

Set Exercise (Resit)
Description: Set Exercise
Weighting: 50 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO2, MO3, MO4, MO5

Case Study (Resit)
Description: Case study integrated assignment (2000 words)
Weighting: 50 %
Final assessment: No

Group work: No

Learning outcomes tested: MO2, MO3, MO5

Part 5: Contributes towards

This module contributes towards the following programmes of study:

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