Module Specification

Advanced Medical Physics

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Contents

Part 1: Information

Module title: Advanced Medical Physics

Module code: USSKLK-30-2

Level: Level 5

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: Scientific Basis of Medical Physics 2023-24

Excluded combinations: None

Co-requisites: Applied Medical Physics 2023-24

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: This module explores advanced topics on medical physics relating to radiation governance and principles of scientific measurement.

Features: Not applicable

Educational aims: The overall aim of this module is to ensure that the student understands and can work safely within the legislative and policy framework around the safe use of ionising and non-ionising radiation in a healthcare environment.

Outline syllabus: The syllabus covers:

Clinical sources of radiation
Net positive benefit, dose limits
Stochastic and deterministic effects
Principles of designation of areas
External audit standards
Registration, safe custody, transport, use and disposal of radioactive sources
Contingency plans, including radiation emergencies
Notification of radiation accidents and incidents
Biological and effective half-life
Record keeping
Personnel and environmental dose monitoring
Operation of a personal monitoring service and approved dosimetry service
Film and thermoluminescent dosimeter (TLD), optically stimulated luminance (OSL) monitoring, real-time dosimeters, e.g. Electronic Personal Dosimeter (EPD)
Instrument calibration
Internal dosimetry
Patient dosimetry
In-vivo dosimetry in radiotherapy, e.g. diodes, TLD, transit dosimetry
Principles of radiation dose limitation (including factors affecting the design of radiation facilities)
Risk assessment
Controls
Calculation of shielding requirements
Environmental radiation surveys
Radiation protection in the administration of radioactive substances
Decontamination of radionuclide spills
Contamination monitoring isotope calibrators
Contamination monitors, wipe tests

Waste management – biological and radioactive hazards
Radioactive source security, e.g. high-activity sources
Principles of scientific medical physics measurement
Components of an instrumentation system, matching, source and internal impedance, fault finding
System parameters (gain, linearity, accuracy, precision, error, resolution, hysteresis, sensitivity, bandwidth, frequency response and damping, time constant, noise, signal to noise)
Power supplies and isolation
Types of signal
Choice of transducers and detectors
Signal capture and process
Image manipulation, e.g. monitor calibration, windowing and filtering
Equipment sensitivity and uncertainty
Sources of error
Physiological test sensitivity and specificity
Calibration and traceability

For each detector system:
Principles
Construction
Limitations
associated equipment
common clinical applications in radiation physics, nuclear medicine and radiotherapy

Detector systems:
ionisation chambers (Farmer, pinpoint, parallel plate, thimble)
detector arrays for dosimetry.
Geiger tubes
sodium iodide and other scintillators
liquid scintillation detection
solid state detectors, e.g. diodes, amorphous silicon (a-Si)
optical detectors, e.g. Cerenkov imaging
TLDs

photographic film
gel dosimeters
alanine
OSL
chemical detectors, e.g. Gafchromic film
Physiological signals
Physiological basis of signals
Methods of measurement
Signal processing and extraction
Use of physiological signals in Medical Physics, e.g. respiratory and cardiac gating
Introduction to ECG (Electrocardiogram) in clinical practice

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 [B1] and undertaking revision for the exams [A].

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 Describe and explain the principles of radiation protection, relevant policy and legislation, and dose limitation

MO2 Discuss and evaluate the governance framework within the workplace to demonstrate legislative compliance

MO3 Describe the different types of personal and environmental dose monitors and explain how they are used in the healthcare environment

MO4 Explain the factors affecting the design of radiation facilities

MO5 Explain the components of an instrumentation system, describe the components of a generalised instrument system and have knowledge of range of system parameters

MO6 Discuss different radiation detector systems, the appropriate choice of detector and counting statistics

MO7 Describe and explain common techniques for the measurement of physiological signals and their impact on patient safety and comfort

MO8 Describe and explain the physiological signals used in cardiac and respiratory gating

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/ussklk-30-2.html

Part 4: Assessment

Assessment strategy: The assessment for this module is designed to test the breadth and depth of apprentices' knowledge, as well as their ability to analyse, synthesize and summarise information critically including published legislation, research and data from the wider literature.

Assessment Task 1 is a set exercise. This assessment provides apprentices with the opportunity to demonstrate their knowledge and understanding of the legislative and policy framework around the safe use of ionising and non-ionising radiation in a healthcare environment.

Assessment Task 2 consists of a case study poster (without presentation). This assessment allows apprentices to demonstrate both their ability to prioritise information and produce a structured & evidenced discussion on techniques. This assessment links directly to requests from employers as they require medical physics graduates proficient at written and visual communication.

Formative feedback is available to apprentices throughout the module through group discussions, and in workshops. 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: No
Group work: No
Learning outcomes tested: MO1, MO2, MO3, MO4, MO8

Case Study (First Sit)
Description: Case study (poster)

Weighting: 50 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO5, MO6, MO7

Set Exercise (Resit)
Description: Set Exercise
Weighting: 50 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO2, MO3, MO4, MO8

Case Study (Resit)
Description: Case study (poster)
Weighting: 50 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO5, MO6, MO7

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Healthcare Science (Radiation Physics) {Apprenticeship-UWE} [Frenchay] BSc (Hons) 2022-23

Healthcare Science (Radiotherapy Physics) {Apprenticeship-UWE} [Frenchay] BSc (Hons) 2022-23

Healthcare Science (Nuclear Medicine) {Apprenticeship-UWE} [Frenchay] BSc (Hons) 2022-23