MODULE SPECIFICATION

Part 1: Information			
Module Title	Practice of Radiation and Radiotherapy Physics		
Module Code	USSKLQ-30-3	Level	3
For implementation from	September 2018		
UWE Credit Rating	30	ECTS Credit Rating	15
Faculty	Health and Applied Sciences	Field	Applied Sciences
Department	Department of Applied Sciences		
Contributes towards	BSc (Hons) Healthcare Science (Medical Physics)		
Module type:	Standard		
Pre-requisites	None		
Excluded Combinations	None		
Co- requisites	None		
Module Entry requirements	Level 5 (or equivalent) medical physics qualification		

Part 2: Description

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

- Unit 1: Practice of Radiation Physics
- Unit 2: Practice of Radiotherapy Physics

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) Radiotherapy Physics pathway.

The syllabus covers:

1. Practice of Radiation Physics [Radiation Physics pathway]

The overall aim of this unit is to ensure that the student has an understanding of the performance testing of a wide range of equipment, understanding the measurement of patient doses and dose optimisation and audit.

Equipment performance testing: quality assurance, calibration and dosimetry
- To include critical examination of diagnostic: X-ray tubes and generators (conventional, CT, dental, mammography), Ultrasound – diagnostic and therapeutic, MRI, Lasers, UV and ILS, Dose measurement devices, Record keeping

Patient dosimetry in diagnostic X-ray
- Factors affecting patient dose

- Patient dose measurements
- Patient dose surveys
- Diagnostic reference levels
- Optimisation and image quality

Patient doses in UV therapy

- Factors affecting patient dose
- Patient dose measurements
- Patient dose surveys

Room design

- Shielding calculations
- Design features
- Engineering controls

Survey procedures

- Measurements of machines, barriers, including appropriate choice of measuring device: diagnostic X-ray departments, dental X-ray rooms and clinics, wards, operating theatres, etc., radiotherapy rooms, brachytherapy, nuclear medicine, lasers, UV and ILS

Procedures for dealing with emergency situations

- Procedure for radioactive patients leaving hospital: patient dose rate, removal of temporary implants, information card with travel dates, work dates, and personal contact dates
- Death of radioactive patients: removal of implants, informing pathologists, etc., of precautions for post-mortems, dose levels for embalming, burial and cremation

2. Practice of Radiotherapy Physics [Radiotherapy Physics pathway]

The overall aim of this unit is to ensure that the student understands the basis of radiotherapy equipment, dose measurement, calibration and QA, and how they affect patient treatment. The student should also have an appreciation of accidents in radiotherapy and the processes in place to mitigate risk.

External beam radiation treatment equipment

- Construction and principles of operation of very low energy, low energy, medium energy X-ray equipment
- Linear accelerator
- Photon beam generation
- Electron beam generation
- Cobalt teletherapy and gamma knife
- Tomotherapy
- Stereotactic equipment for stereotactic ablative radiotherapy (SABR) and stereotactic radiosurgery (SRS)
- Proton therapy equipment
- Operation and controls of treatment equipment
- Imaging equipment (see MPRP(i) and MP(iii))

Dose distribution

- Central axis depth dose, tissue maximum ratio, tissue phantom ratio (TPR)
- Irregular fields – equivalent square – sector integration
- Off-axis dose – dose in shielded regions – scatter, primary beam hardening
- Isodose curves
- Beam quality, source size, source surface distance, source collimator distance, beam flatness, flattening filters, field size, penumbra, oblique incidence, tissue heterogeneity
- Large field treatment techniques, e.g. total body irradiation (TBI) and total skin electron irradiation (TSEI)
- Effect of change in radiation beam energy

Dose measurement

- Kerma and absorbed dose
- Selection of appropriate dosimeter
- Absolute dose measurement
- Relative dose measurement
- Beam data acquisition
- Small field dosimetry
- Patient dosimetry – diodes, thermoluminescent dosimeters (TLD), electronic portal imaging devices
- Electron dosimetry
- Phantoms

Electron beams

- Depth dose characteristics

- Isodose curve characteristics
- Oblique incidence
- Beam shaping

Superficial and Orthovoltage Radiotherapy (SXT and DXT) dosimetry

- Back scatter factors
- Lead cut-outs
- Applicators
- Eyeshields (internal and external)

Proton dosimetry

- Bragg peak
- Stopping power
- Moderators

Radiation protection

- Structural shielding (SXT/CT, Linacs, brachytherapy rooms, protons)
- Measures for reducing radiation dose to staff during brachytherapy
- Source handling and storage
- Procedures for radioactive patients leaving hospital
- Death of radioactive patients – removal of implants: informing pathologists, etc., of precautions for post-mortems, dose levels for embalming, burial and cremation

Quality control and quality assurance

- Example accidents in radiotherapy
- Guidance for avoidance of accidents in radiotherapy
- Reporting accidents in radiotherapy
- QC of external beam radiotherapy equipment
- QC of CT simulator
- QC of CT and MRI
- QC for brachytherapy equipment and systems
- QC for treatment planning systems
- Treatment plan and radiotherapy prescription calculation checks
- QC of dosimetry systems

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 [A2, B1], and undertaking revision for the open book exam [A1].

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.

Part 3: Assessment: Strategy and Details

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 in-class open book test will assess the students' ability to research relevant information and provide critical thinking in a variety of workplace scenarios where the application of knowledge is required.

The 20 minute presentation (with supporting evidence) will be an opportunity for the student to evaluate how theoretical knowledge supports the relevant medical physics field in the clinical environment.

Component B

Component B will provide an opportunity for students to demonstrate their ability to apply the principles of their relevant area of medical physics to an unseen problem and/or case study and evidence their skills in approaching and interpreting it appropriately.

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.

This assessment strategy has been designed following best practice on effective assessment from JISC.

Technical design and deployment of the activities will also follow best practice developed at UWE by the Academic Practice Directorate in collaboration with academic colleagues across the university. Staff guidance and support are already in place (http://info.uwe.ac.uk/online/Blackboard/staff/guides/summative-assessments.asp).

All students will be issued with the same in-class test [A1], integrated assignment [B1] & presentation brief [A2], where they will address the sections specific to their unit, i.e. Unit 1: Practice of Radiation Physics and Unit 2: Practice of Radiotherapy Physics.

Identify final timetabled piece of assessment (component and element)	Component A1	
% weighting between components A and B (Standard modules only)	**A:** 50%	**B:** 50%
First Sit		

Component A (controlled conditions) **Description of each element**	**Element weighting** **(as % of component)**
1. Open book in-class test (1.5 hours)	50%
2. 20 minute presentation with supporting evidence	50%
Component B **Description of each element**	**Element weighting** **(as % of component)**
1. Case study integrated assignment (1500 words)	100%
Resit (further attendance at taught classes is not required)	
Component A (controlled conditions) **Description of each element**	**Element weighting** **(as % of component)**
1. Open book in-class test (1.5 hours)	50%
2. 20 minute presentation with supporting evidence	50%
Component B **Description of each element**	**Element weighting** **(as % of component)**
1. Case study integrated assignment (1500 words)	100%

Part 4: Learning Outcomes & KIS Data	
Learning Outcomes	On successful completion of this module students will be able to fulfil the learning outcomes from 1 of the following 2 Medical Physics themed units of study: • Unit 1: Practice of Radiation Physics • Unit 2: Practice of Radiotherapy Physics Unit 1 aligns to the Healthcare Science (Medical Physics) Radiation Physics pathway. Unit 2 aligns to the Healthcare Science (Medical Physics) Radiotherapy Physics pathway. **1. Practice of Radiation Physics [Radiation Physics pathway]** • Critically evaluate the principles and methods of performance testing of a range of diagnostic X-ray and nonionizing equipment and their role in ensuring patient and staff safety [A2] • Describe dosimetric methods and critically analyse dose reduction options and the risk benefit to patients [A1] • Critically appraise room design and shielding calculations [B1] • Critically evaluate the principles and methods of radiation surveys, and evaluate methods and options for improvement and dealing with radiation incidents and emergencies [A2] • Critically evaluate the principles supporting the selection of appropriate radiation for equipment testing and dosimetry measurements, including calibration and type testing [A1] **2. Practice of Radiotherapy Physics [Radiotherapy Physics pathway]** • Critically evaluate treatment planning, radiation dose measurement and calculation in radiotherapy, applying skills of analysis and judgement [A1, B1] • Critically evaluate radiotherapy equipment and associated QC procedures and systems [A1] • Discuss the requirements relating to the application of medical imaging to radiotherapy and appraise the choice of imaging technique [A2, B1] • Critically appraise the principles relating to the calculation of dose distributions within patients [A1] • Compare and contrast radiotherapy equipment, the beams produced, their characteristics and how they are analysed [B1]

- Explain the principles of radiation protection in radiotherapy [A2]
- Specify the principles supporting the selection of a medical device that will ensure it is fit for purpose, including the ability to develop and evaluate basic specifications to meet user and service requirements [A1]

Key Information Sets Information (KIS)

Key Information Set - Module data

Number of credits for this module: 30

Contact Hours

Hours to be allocated	Scheduled learning and teaching study hours	Independent study hours	Placement study hours	Allocated Hours
300	72	228	0	300

The table below indicates as a percentage the total assessment of the module which constitutes a;

Written Exam: Unseen or open book written exam
Coursework: Written assignment or essay, report, dissertation, portfolio, project or in class test
Practical Exam: Oral Assessment and/or presentation, practical skills assessment, practical exam (i.e. an exam determining mastery of a technique)

Total Assessment

Total assessment of the module:	
Written exam assessment percentage	25%
Coursework assessment percentage	50%
Practical exam assessment percentage	25%
	100%

Reading List

The module reading list can be accessed through the following link:

https://uwe.rl.talis.com/lists/C8D5331F-C2FD-7E40-6BFB-FD266D5A47F4.html

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First UVP Approval Date	20 March 2018			
Revision Approval Date *Update this row each time a change goes to CAP*		Version	*1*	*Link to CAR 4581*