



MODULE SPECIFICATION

Part 1: Information			
Module Title	Advanced Radiation Engineering		
Module Code	USSKLD-30-3	Level	Level 6
For implementation from	2020-21		
UWE Credit Rating	30	ECTS Credit Rating	15
Faculty	Faculty of Health & Applied Sciences	Field	Applied Sciences
Department	HAS Dept of Applied Sciences		
Module type:	Standard		
Pre-requisites	Applied Clinical Engineering 2020-21		
Excluded Combinations	None		
Co- requisites	None		
Module Entry requirements	None		

Part 2: Description
<p>Overview: This module examines the science and principles supporting Radiation Engineering.</p> <p>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.</p> <p>Outline Syllabus: The syllabus covers:</p> <p>Ionising Radiation Physics: Atomic structure The laws of radioactive decay Mechanism of radioactive decay Interaction of radiation with matter Natural Sources of Radiation</p> <p>Clinical Sources of Radiation: Production of X-rays Types of X-ray tube and design features X-ray generators Sealed sources Unsealed radioactive materials</p>

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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

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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 (B) and undertaking revision for the exams (A).

Part 3: Assessment

Component A:

The written exam (1.5 hours) will provide students with an opportunity to demonstrate their knowledge on a broad range of topics

Component B:

Component B, a 2000 word case study, will provide an opportunity for students 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. Students are provided with formative feed-forward for their exam through a revision and exam preparation session and through the extensive support materials supplied through Blackboard

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First Sit Components	Final Assessment	Element weighting	Description
Examination - Component A	✓	50 %	Examination (1.5 hours)
Case Study - Component B		50 %	Case study integrated assignment (2000 words)
Resit Components	Final Assessment	Element weighting	Description
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Case Study - Component B		50 %	Case study integrated assignment (2000 words)

Part 4: Teaching and Learning Methods																	
Learning Outcomes	<p>On successful completion of this module students will achieve the following learning outcomes:</p> <table border="1"> <thead> <tr> <th>Module Learning Outcomes</th> <th>Reference</th> </tr> </thead> <tbody> <tr> <td>Critically evaluate the science behind and the differences between ionising and non-ionising radiation</td> <td>MO1</td> </tr> <tr> <td>Critically evaluate radiation protection principles, practices and protocols including safety requirements, radiation scatter and leakage</td> <td>MO2</td> </tr> <tr> <td>Critically evaluate the effects of different types of radiation on humans</td> <td>MO3</td> </tr> <tr> <td>Demonstrate an understanding of the principles that underpin the operation of radiation imaging and treatment equipment</td> <td>MO4</td> </tr> <tr> <td>Critically evaluate new technology and applications of existing technologies to be used in the imaging or treatment of the human body</td> <td>MO5</td> </tr> </tbody> </table>	Module Learning Outcomes	Reference	Critically evaluate the science behind and the differences between ionising and non-ionising radiation	MO1	Critically evaluate radiation protection principles, practices and protocols including safety requirements, radiation scatter and leakage	MO2	Critically evaluate the effects of different types of radiation on humans	MO3	Demonstrate an understanding of the principles that underpin the operation of radiation imaging and treatment equipment	MO4	Critically evaluate new technology and applications of existing technologies to be used in the imaging or treatment of the human body	MO5				
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Reading List	<p><i>The reading list for this module can be accessed via the following link:</i></p> <p>https://uwe.rl.talis.com/modules/usskld-30-3.html</p>
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Part 5: Contributes Towards

This module contributes towards the following programmes of study: