Module Specification

Applied Radiation and Rehabilitation Engineering

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Contents

Part 1: Information

Module title: Applied Radiation and Rehabilitation Engineering

Module code: USSKLG-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

Field: Applied Sciences

Module type: Module

Pre-requisites: Advanced Clinical Engineering 2023-24, 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 explores the clinical environment and contains two distinct units, namely:

Unit 1: Applied Radiation Engineering
Unit 2: Applied Rehabilitation Engineering

Students complete one of these units as prescribed by their pathway. Unit 1 aligns to the Healthcare Science (Clinical Engineering) Radiation Engineering pathway. Unit 2 aligns to the Healthcare Science (Clinical Engineering) Rehabilitation Engineering pathway.

Features: Module Entry requirements: Students must have a Level 5 (or equivalent) biomedical engineering qualification

Educational aims: On successful completion of this module students will be able to fulfil the learning outcomes from 1 of the following 2 Clinical Engineering themed units of study:

Unit 1: Applied Radiation Engineering

Unit 2: Applied Rehabilitation Engineering

Unit 1 aligns to the Healthcare Science (Clinical Engineering) Radiation Engineering pathway. Unit 2 aligns to the Healthcare Science (Clinical Engineering) Rehabilitation Engineering pathway.

Generic Graduate Skill: Communication
Evidenced

Generic Graduate Skill: Professionalism
Evidenced

Generic Graduate Skill: Critical Thinking
Evidenced

Generic Graduate Skill: Digital Fluency
Evidenced

Generic Graduate Skill: Innovative and Enterprising
Practiced

Generic Graduate Skill: Forward Looking
Practiced

Generic Graduate Skill: Emotional Intelligence
Practiced

Generic Graduate Skill: Globally Engaged
Practiced

Outline syllabus: The syllabus covers:

Applied Radiation Engineering (Radiation Engineering pathway):

Practical safety that applies when working in a radiotherapy department:
Radiation - Safety standards and hazards that apply when working with ionising and non-ionising radiation- national and local rules
Electrical
Mechanical
Radiotherapy and related equipment

Structure of Equipment – major component parts

Operation of Linear Accelerator Technology:
Beam generation: Flatness, Focussing, Symmetry, Energy, Dose rate and dose accuracy, Alignment
Waveguide
Radio Frequency (RF) system
Cooling systems
High Tension (HT) systems
Vacuum systems
Interlocks systems and how they affect the operation of the equipment
Control systems applied to the operation of radiation equipment

Operation and use of:

Laser centring systems
Multi-leaf Collimation (MLC)
Wedges
Image generation equipment

Computer systems used in Diagnostic and Treatment:
Principles of operation
Importance in the modern Radiotherapy departments
Patient Verification systems

Operation of Superficial Treatment

Operation of Imaging Equipment:
Diagnostic x-ray equipment
Simulators
Computed Tomography (CT)
Magnetic Resonance Imaging (MRI)
Positron Emission Tomography (PET)

Machine procedures:
Start, run-up and shut-down procedures
Maintenance and fault finding protocols and procedures
Calibration
Safety testing

Quality Systems:
Procedures and work instructions. ISO9000:2000
Importance of accurate recording of results, reports, certificates of serviceability and other documentation
Quality control of measuring equipment

Introduction of other medical equipment into a Ionising or Non-ionising radiation environment:
Risks

Artefacts
Interference
Possible impact on Patient Outcomes

Review the application of new and impending technology and techniques

Applied Rehabilitation Engineering (Rehabilitation Engineering pathway):

Equipment management applied to Rehabilitation Engineering and Assistive Technology

Quality systems and controls

Product Knowledge:
Researching methods
Principles of device operation
Manuals, protocols and training information
Accessories
Availability
Costing
Construction of device, including transportation requirements
Controls
Control of infection
Operation implications: Safety, suitability, running costs, additional resource implications

Clinical Practice:
Rehabilitation Engineering in The Health Service
The Rehabilitation Engineer in the professional healthcare team
Psychosocial aspects and classification of disabilities (including the International Classification of Functioning)
Assessment Methods
Other Professional Roles (Occupational Therapist, Physiotherapist, Speech Therapist, Consultant in Rehabilitation Medicine)

Communication With Client and Carer
Postural Management
Development and Prevention of Deformity

Assessment:
Disabling Pathologies and prognosis
Psychological state
Communication abilities/limitations
Physical abilities/limitations
Musculo-skeletal abilities/limitations
Neuro muscular abilities/limitations
Social goals/limitations
Mobility goals/limitations
Postural management/needs
Carer needs/abilities

Measurements:
Types and range of measurements
Measurement limitations
Anatomical measurements
Specialist Measuring Equipment
Use of photography

Prescribing:
Limitations
Multi-disciplinary Team

Roles, Scope of practice:
Funding
Services ability to deliver solution

Trialling devices

Modification:

Risk assessments
Specification
Designing
Manufacture
Legislation, regulations and guidance
Testing
Documentation
CE marking
Outsourcing
Inspection
Acceptance

Repairs:
Protocols
Knowledge of equipment
Outsourcing
Monitoring
Inspection
Acceptance
Documentation

Testing:
Mechanical tests
Electrical tests
Functional Tests

Risk assessments:
Environment, local, wider
Users/Carers
Device specific

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 for assessments, and undertaking revision for the exams.

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. These sessions constitute an average time per level. 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 Applied Radiation Engineering (Radiation Engineering pathway): Critically evaluate the construction and structure of radiotherapy and ionising radiation imaging equipment by identifying key component areas and the explaining the part they play in the operation of the equipment

MO2 Applied Radiation Engineering (Radiation Engineering pathway): Understand the practical operation of a variety of systems used to modify or target the delivery of treatment

MO3 Applied Radiation Engineering (Radiation Engineering pathway): Demonstrate an understanding of the installation of imaging and treatment equipment and knowledge of machine procedures

MO4 Applied Radiation Engineering (Radiation Engineering pathway): Understand the use of computer networks in the delivery of radiation imaging and treatment services

MO5 Applied Radiation Engineering (Radiation Engineering pathway): Understand the importance of quality systems and the need for accuracy in documentation and records

MO6 Applied Radiation Engineering (Radiation Engineering pathway): Critically evaluate the problems that may be encountered when bringing other medical devices into the clinical environment

MO7 Applied Radiation Engineering (Radiation Engineering pathway): Understand the empathy and sensitivity needed when dealing with the patient experience of long-term conditions and terminal illness

MO8 Applied Rehabilitation Engineering (Rehabilitation Engineering pathway): Critically evaluate a range of assistive technology solutions, including mobility, posture control, environmental controls and communication aids and appraise the benefits and risks of alternative assistive technology solutions

MO9 Applied Rehabilitation Engineering (Rehabilitation Engineering pathway): Appraise the risks to patients resulting from the modification or incorrect usage of standard assistive devices and propose a plan for reducing patient risk

MO10 Applied Rehabilitation Engineering (Rehabilitation Engineering pathway): Assess clinical needs/patient goals and generate options for suitable assistive technology and interventions, which are within the scope and limitations of the individual patient’s capabilities

MO11 Applied Rehabilitation Engineering (Rehabilitation Engineering pathway): Critically evaluate how assistive technology solutions might into the overall treatment care plan as part of a multidisciplinary approach

MO12 Applied Rehabilitation Engineering (Rehabilitation Engineering pathway): Know how to support and instruct users and carers in use, transport, cleaning and general maintenance of assistive devices

MO13 Applied Rehabilitation Engineering (Rehabilitation Engineering pathway): Design bespoke assistive technology solutions

MO14 Applied Rehabilitation Engineering (Rehabilitation Engineering pathway): Critically evaluate new technologies and materials and appraise the appropriateness or use in rehabilitation engineering and assistive technology

MO15 Applied Rehabilitation Engineering (Rehabilitation Engineering pathway): Understand the empathy and sensitivity needed when dealing with the patient experience of long-term conditions and terminal illness

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/ussklg-30-3.html

Part 4: Assessment

Assessment strategy: Assessment 1:
The 2000 word case study will be an opportunity for the apprentice to demonstrate application of learning from the module to the workplace context.

Assessment 2:
The 15 minute presentation (with 5 minute questions) will be an opportunity for the apprentice to evaluate how theoretical knowledge supports the relevant engineering field in the clinical environment.

Assessment tasks:

Case Study (First Sit)
Description: 2000 word case study
Weighting: 50 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO11, MO14, MO15, MO5, MO6, MO7, MO8

Presentation (First Sit)
Description: 15 minute presentation with 5 minutes of questions
Weighting: 50 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO10, MO11, MO12, MO13, MO14, MO15, MO2, MO3, MO4, MO5, MO6, MO7, MO8, MO9

Case Study (Resit)
Description: 2000 word case study
Weighting: 50 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO11, MO14, MO15, MO5, MO6, MO7, MO8

Presentation (Resit)
Description: 15 minute presentation with 5 minutes of questions
Weighting: 50 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO10, MO11, MO12, MO13, MO14, MO15, MO2, MO3, MO4, MO5, MO6, MO7, MO8, MO9

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