University of the West of England
BRISTOL

MODULE SPECIFICATION

Part 1: Information			
Module Title	Advanced Rehabilitation & Renal Engineering		
Module Code	USSKLF-30-3	Level	3
For implementation from	September 2017		
UWE Credit Rating	30	ECTS Credit Rating	15
Faculty	Health & Applied Sciences	Field	Applied Sciences
Department	Applied Sciences		
Contributes towards	BSc (Hons) Healthcare Science (Clinical Engineering)		
Module type:	Standard		
Pre-requisites	USSKLB-30-2 Advanced Clinical Engineering USSKLC-30-2 Applied Clinical Engineering		
Excluded Combinations	N/A		
Co- requisites	N/A		
Module Entry requirements	Level 5 (or equivalent) biomedical engineering qualification		

Part 2: Description

This module contains two distinct units, namely

- Unit 1: Advanced Rehabilitation Engineering
- Unit 2: Advanced Renal Technology

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

The syllabus covers:

1. Advanced Rehabilitation Engineering [Rehabilitation Engineering pathway]

Scope of Practice
- Scope of Rehabilitation Engineering
- Scope of Assistive Technology
- Range and roles of multidisciplinary teams

Technology (Design and Manufacture, Materials and Equipment)
- Rehabilitation Technology Design
- Mobility, wheelchairs and Special Seating Systems
- Prosthetics and Orthotics

- Electronic Assistive Technology (Environmental Control systems (EC), Functional Electrical Stimulation (FES), Augmentative and Alternative Communication systems (AAC), Switches, Integrated Systems etc)
- Architectural Barriers and Design
- Aids to Daily Living
- Information Technology (IT) in Rehabilitation Engineering
- Materials and Manufacturing

Measurement Technology
- Gait Measurement
- Tissue Interface Measurement
- Outcome Measurement
- Digital Photography
- Physiological Measurement
- Transducers

Biomechanics
- Biomechanical Analysis
- Biomechanical Models
- Biomechanics of major muscular-skeletal structures
- Tissue Biomechanics
- Wheelchair Biomechanics
- Biomechanics of Seating
- Biomechanics of Gait
- Prosthetic and Orthotic Biomechanics

Disabling Pathologies
- International Classification of Functioning, Disability and Health (ICF)
- Sensation and Sensory Loss
- Congenital Pathologies
- Diabetes
- Pressure Sores
- Spinal Pathologies
- Continence and Control
- Joint and Muscle Pathologies
- Neurological Disorders
- Ageing
- Cardiovascular disease

Workshop Practice
- Workshop Safety
- Production planning and processes
- Hand tools, machine tools and computer aided manufacture
- Fixing and fastening
- Materials
    - Metals, plastics, wood, ceramics, biomaterials
- Use drawing packages
- Understand engineering drawings
- Device fabrication methods
- Device construction processes
- Knowledge of engineering test

Health and Safety in Rehabilitation and Assistive Technology
- Control of Substance Hazardous to Health (COSHH)
- Manual Handling

2. Advanced Renal Technology [Renal Technology pathway]

- Renal anatomy, physiology and pathology
- Cardiovascular system and the role of blood
- Biochemistry, microbiology and virology applied to renal replacement therapy

- Solutions and concentrations
- Fluid and chemical transport
- Equilibrium and acid dissociation
- Hydrogen ion regulation
- Electrolytes and buffers
- Chemicals in the renal environment
- Formation of urine, renal perfusion
- Glomerular filtration, tubular function; absorption and secretion
- Homeostasis
- The urinary system
- Functions of the kidney
- Metabolism in cells
- Control of body water distribution
- Renal disease
- Consequences of renal failure
- The artificial kidney
- The history and development of dialysis
- Dialysis techniques and technology
- Access, the permanent and temporary catheter
- The fistula
- Blood temperature and low temperature treatments
- The measurement of blood pressure the importance of monitoring blood pressure data
- Blood volume monitoring
- Dialysis adequacy tools
- Low and high flux dialysis
- Middle molecule clearance
- Degenerative bone disease and dialysis complications
- Dialysis treatment options, long hour, short hour, frequent, alternate day, daily
- Water sources and treatment – Municipal systems
    - Municipal water supplies
    - Municipal water supply treatments
    - Municipal water supply standards
    - Sampling and testing
- The importance of water quality
- Legislation, standards and guidance
- Renal replacement therapy treatment scientific developments
- Transplant, dialysers developments, impact of stem cell research and genetics, service delivery options

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 [A1, A2].

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

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 written exam will provide students with an opportunity to demonstrate both their knowledge on a broad range of topics through a series of short essay questions.

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

Component B

Component B 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.

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 (http://www.jisc.ac.uk/whatwedo/programmes/elearning/assessment/digiassess.aspx) and The Open University's Centre for Excellence in Teaching and Learning (http://www.open.ac.uk/opencetl/centre-open-learning-mathematics-science-computing-and-technology/activities-projects/e-assessment-learning-the-interactive-comp).

Technical design and deployment of the activities will also follow best practice developed at UWE by the Education Innovation Centre 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).

Identify final timetabled piece of assessment (component and element)	A2	
% 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. Examination (1.5 hours)	50%	
2. Open book in-class test (1.5 hours)	50%	
Component B **Description of each element**	**Element weighting** **(as % of component)**	
1. Case study integrated assignment (2000 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. Examination (3 hours)	100%	
Component B **Description of each element**	**Element weighting** **(as % of component)**	
1. Case study integrated assignment (2000 words)	100%	

Part 4: Teaching and Learning Methods

Learning Outcomes

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: Advanced Rehabilitation Engineering
- Unit 2: Advanced Renal Technology

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

1. Advanced Rehabilitation Engineering [Rehabilitation Engineering pathway]

- Describe and analyse human movement and solve quantitative biomechanical problems [A1, B1]
- Demonstrate a knowledge and understanding of the main disabling conditions [A2]
- Critically evaluate medical and social models of rehabilitation [A2, B1]
- Critically evaluate the principles that underpin assistive technology in a range of areas such as mobility, posture control, environmental controls and communication aids [A1, A2]
- Demonstrate an understanding of the use of biomechanical analysis in assessment and assistive technology design [A1, B1]
- Critically evaluate manufacturing techniques used in rehabilitation engineering and assistive technology [A1]
- Critically evaluate the properties of materials used in rehabilitation engineering technology and the key elements of design practice in rehabilitation technology [A1]

2. Advanced Renal Technology [Renal Technology pathway]

- Critically evaluate the biochemistry, microbiology virology and different modalities of renal replacement therapy [A1, B1]
- Demonstrate a knowledge of the standards and quality of water available through the municipal systems and the water quality standards required for dialyses [A1]
- Critically evaluate the role of buffers and electrolytes in dialysis fluids [A1]
- Critically evaluate the fistula and other forms of access and be able to explain recirculation and its measurement, blood flow rates, assessment techniques and the impact of stenosis [A1]
- Critically evaluate the principles of the operation of dialysis equipment and associated consumables [A2, B1]
- Demonstrate an understanding of the various standards and guidelines currently followed in renal units [A2]
- Appreciate the impact, illness, disability and dialysis complications can have on treatment [A2, B1]

Key Information Sets Information (KIS)

Contact Hours

Key Information Set - Module data

Number of credits for this module 30

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

<table>
<tr><td>Total Assessment</td><td>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)

<table>
<tr><td colspan="3">Total assessment of the module:</td><td></td></tr>
<tr><td colspan="3">Written exam assessment percentage</td><td>50%</td></tr>
<tr><td colspan="3">Coursework assessment percentage</td><td>50%</td></tr>
<tr><td colspan="3">Practical exam assessment percentage</td><td>0%</td></tr>
<tr><td colspan="3"></td><td>100%</td></tr>
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<tr><td>Reading List</td><td>Modernising Scientific Careers Programme Training Manual for appropriate Division and Specialist Route. Available from http://www.nshcs.hee.nhs.uk/curricula

Advanced Rehabilitation Engineering

Adrian, M. and Cooper, J.M. (1995) Biomechanics of Human Movement. 2nd ed. New York: Brown & Benchmark.

Rothwell, J. (2013) Control of Human Voluntary Movement. 2nd ed. Berlin: Springer.

Katevas, N. (2001) Mobile Robotics in Healthcare. Amsterdam: IOS Press.

Advanced Renal Technology

James, R. (2013) Foundations in renal technology. Tolworth: Grosvenor House Publishing.

Hansel, D.E., Kane, C.J., Paner, G.P. and Chang, S.S. (2016) The Kidney: A Comprehensive Guide to Pathologic Diagnosis and Management. New York: Springer.</td></tr>
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First CAP Approval Date	23 February 2017			
Revision CAP Approval Date		Version	1	Link to MIA-10627