

Module Details	
Module Title:	Biomaterials with implant design and technology
Module Code:	MHT6013-B
Academic Year:	2019-20
Credit Rating:	20
School:	Department of Biomedical and Electronics Engineering
Subject Area:	Medical and Healthcare Technology
FHEQ Level:	FHEQ Level 6
Pre-requisites:	
Co-requisites:	

Contact Hours	
Type	Hours
Lectures	24
Tutorials	24
Laboratory	74
Directed Study	78

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Academic Year (Sept - May)

Module Aims
For semester one, this module aims to develop the critical knowledge base biomaterials for tissue/joint replacement including biodegradable/bioresorbable polymers and fracture fixation devices, their properties, hip/knee design, testing, evaluation and manufacturing for orthopaedic applications meeting the MDA/FDA requirements. For semester two, the module aims to integrate and apply the existing knowledge from semester one to a wider implant design and technology and to apply general design procedures/methodology to medical devices such as joint replacements , stents, scaffolds and fixation devices.

Outline Syllabus

For biomaterials in semester 1: Introduction to biomaterials- Applications, Properties and Processing. Pre-requisites of biomaterials (biocompatibility concepts). Structure and properties of tissues, metals, polymers/composites and ceramics as biomaterials. Surface engineering of biomaterials, processing and forming techniques. Degradation of biomaterials, corrosion, biotribology (wear, friction and lubrication), and adsorption. Polymer applications in artificial joints. Shape memory polymers. Bioresorbable polymers. Case study 1: Production, design, properties, selection and evaluation of ceramic femoral heads/cups. Case study 2: Fracture fixation devices such as bone plates and screws. Legislative aspects (MDA/FDA requirements), patents, pre-clinical and clinical trials. For implant design in semester 2: General design considerations including design procedures, design specifications and regulatory issues; Surgical considerations; Bearing surfaces; Implant fixation; Implant loosening and wear; Implant manufacturing; Pre-clinical evaluation of orthopaedic implants; Hip/knee joint replacements. Research-led areas of recent developments: shape memory polymer devices; bioresorbable polymer devices; associated manufacturing techniques.

Learning Outcomes

1	Critically evaluate the structure, properties and manufacturing of biomaterials for orthopaedic applications.
2	Understand the important factors in selecting tissue replacement biomaterials to meet the MDA/FDA requirements.
3	Design concepts for implant applications.
4	Sustainability and viability.
5	To solve problems systematically considering biocompatibility, mechanisms of implant failure.
6	Economics and implant testing.

Learning, Teaching and Assessment Strategy

Concepts are introduced using formal lectures, tutorials, laboratory practicals, seminars and invited lectures from the orthopaedic industries. Deeper/better understanding is developed during tutorials by solving practical problems. Oral feedback is given during tutorial and laboratory classes..

For the biomaterials part in semester 1, one 2.00 hour classroom test (35%) in week 12 or 13 to answer three questions out of five, and two case studies (15%) as coursework (2000 words in total) to be submitted in weeks 7 and 11. The case studies will also include testing of implants in the laboratory practicals.

For the implant design part in semester 2, one two hour formal exam in the examination period to answer four questions out of six.

LO1: SM1b, SM2b, EA1b, EA2, EA4b, D6, EL1, P1, P2, P11 LO2: D4, EL2, EL5, P6 LO3: D1, LO4: D2, EL4 LO5: EL6, G1, G2, G4 LO6: D5, EL2, P3

Mode of Assessment

Type	Method	Description	Length	Weighting
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Summative	Laboratory Report	Two Case Studies including implant testing laboratory practicals	-3000 words	15%
Summative	Examination - closed book	Implant Design in Semester 2	2 hours	50%
Summative	Classroom test	Biomaterials in Semester 1	2 hours	35%

Reading List

To access the reading list for this module, please visit <https://bradford.rl.talis.com/index.html>.

Please note:

This module descriptor has been published in advance of the academic year to which it applies. Every effort has been made to ensure that the information is accurate at the time of publication, but minor changes may occur given the interval between publishing and commencement of teaching. Upon commencement of the module, students will receive a handbook with further detail about the module and any changes will be discussed and/or communicated at this point.