

# ES97G-15 Biomedical Materials, Tissue Engineering and Regenerative Medicine

**23/24**

**Department**

School of Engineering

**Level**

Taught Postgraduate Level

**Module leader**

Isaac Liu

**Credit value**

15

**Module duration**

10 weeks

**Assessment**

50% coursework, 50% exam

**Study location**

University of Warwick main campus, Coventry

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## Description

### Introductory description

ES97G-15 Biomedical Materials, Tissue Engineering and Regenerative Medicine

[Module web page](#)

### Module aims

Introduce students to biomaterials and their use in biomedical application. A range of topics will be explored, including biocompatibility and the foreign body response, interfacial properties of biomaterials and factors affecting cellular response and protein adsorption. Polymers and ceramics used in medicine are reviewed with examples including the total hip joint replacement (TFJR), heart valves, catheters and vascular grafts and hydrogels used in ophthalmology. Contemporary topics in biomaterials will be covered such as nanobiomaterials, nanomedicine, drug delivery, tissue engineering and regenerative medicine.

### Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

- Introduction to biomaterials
- Materials for biomaterials applications: polymers, metals and ceramics
- Characterisation of biomaterials properties
- Bio-interfaces
- Protein adsorption and cell-surface interactions
- Surface modification and characterisation
- Mechanical properties of biomaterials for design
- Responsive biomaterials
- Nanobiomaterials
- Nanomedicine and advanced drug delivery
- Stem cell biology and Tissue Engineering and Regenerative Medicine (TERM)
- State-of-the-art techniques used in tissue engineering, including methods of scaffold

## **Learning outcomes**

By the end of the module, students should be able to:

- Explain the concepts and processes involved in the design and testing of biomaterials [M1, M2, M13].
- Analyse how biomaterials can be applied in applications such as tissue engineering and regenerative medicine [M1, M2, M13].
- Discuss and evaluate state-of-the-art technologies in the area of biomaterials, tissue engineering and regenerative medicine [M1, M2, M13].

## **Indicative reading list**

1. Biomaterials Science: An Introduction to Materials in Medicine (3rd ed.), Ed. Buddy D. Ratner, et al., Elsevier, 2013.
2. Principles of Tissue Engineering (3rd ed.), Ed. Robert P. Lanza, Robert Langer, Joseph Vacanti, Elsevier, 2007.

## **Research element**

Writing a literature review for the state-of-the-art technologies in the Biomaterials and TERM.

## **Interdisciplinary**

An Interdisciplinary approach that bridges the gap between engineering, physics, chemistry and materials science will be introduced in the module to manufacture advanced biomaterials and TERM products for clinical applications.

## **Subject specific skills**

1. Ability to conceive and realise products and manufacturing process of Biomaterials and

Tissue Engineering and Regenerative Medicine (TERM)

2. Ability to assess risk, cost, health and safety, and wider professional engineering responsibilities for the development of Biomaterials and TERM.

## Transferable skills

1. Written a report to technical and non-technical audiences.
  2. Ability to formulate and operate within appropriate published guidelines, standards technically, commercially and professionally.
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## Study

### Teaching split

Provider	Weighting
School of Engineering	65%
Chemistry	35%

### Study time

Type	Required
Lectures	20 sessions of 1 hour (13%)
Practical classes	4 sessions of 1 hour (3%)
Other activity	2 hours (1%)
Private study	124 hours (83%)
Total	150 hours

### Private study description

Guided independent learning 124 hours

### Other activity description

2 x 1 hour example classes

### Costs

No further costs have been identified for this module.

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## Assessment

You must pass all assessment components to pass the module.

## Assessment group C3

	Weighting	Study time
Coursework	50%	
An individual coursework with a length of 10 pages.		
Written Examination	50%	
90min written exam		

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- Answerbook Green (8 page)
- Students may use a calculator
- Engineering Data Book 8th Edition
- Graph paper

## Feedback on assessment

Online exam: mark, assignment: mark and comments, cohort level feedback on examination.

[Past exam papers for ES97G](#)

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## Availability

### Courses

This module is Optional for:

- Year 4 of UESA-H116 MEng Engineering with Exchange Year
- Year 5 of UESA-H115 MEng Engineering with Intercalated Year
- Year 1 of TESA-H800 Postgraduate Taught Biomedical Engineering

This module is Option list A for:

- Year 4 of UESA-H163 MEng Biomedical Systems Engineering
- Year 4 of UESA-H114 MEng Engineering

This module is Option list B for:

- Year 4 of UESA-H163 MEng Biomedical Systems Engineering