

Module Template for New and Revised Modules

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| Module Code | ME5BIO3 |
| Module Name | Tissue Engineering |
| ECTS Weighting | 5 ECTS |
| Semester taught | Semester 2 |
| Module Coordinator/s | Prof Daniel Kelly |
| Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline | <p>On successful completion of this module, students should have an:</p> <p>LO1. Understanding of the fundamental principles of tissue engineering</p> <p>LO2. Understanding of stem cells and animal/human cell culture processes</p> <p>LO3. Awareness of current “state of the art”, emerging technologies and advances in the field</p> <p>LO4. Ability to understand biological processes and apply this knowledge to tissue engineering and regenerative medicine</p> <p>LO5. Ability to integrate the knowledge on biomaterial fundamentals and cell and tissue biology toward the development of biomedical applications</p> <p>LO6. Ability to identify, formulate and adapt engineering solutions to unmet biological needs</p> <p>LO7. Understanding and knowledge of the commercial market and the regulatory hurdles in tissue engineering</p> <p>LO8. Appreciation of ethical issues and considerations for regenerative medicine</p> <p>LO9. Ability to present a complex topic in tissue regeneration to a wide audience</p> <p>Graduate Attributes: levels of attainment</p> <p>To act responsibly - Enhanced</p> <p>To think independently - Enhanced</p> <p>To develop continuously - Enhanced</p> <p>To communicate effectively - Enhanced</p> |

Module Content

This module builds upon MEU44BM6/ME5M20 Biomaterials, with the explicit objective to provide students with extensive knowledge on the fundamentals, enabling technologies and applications to generate new tissues through the combination of cells, biocompatible materials and suitable biochemical and biophysical factors to improve or replace biological functions that have been compromised through disease. An overview of contemporary approaches to tissue and cell engineering will be given, including stem cells, cellular signalling, biomaterial scaffolds, use of bioreactors in tissue engineering, and controlled release strategies. Ethical considerations related to clinical application of tissue and cell engineering technology will also be explored. Topics covered include: Stem Cells, Embryogenesis, Cellular Signalling, Extracellular Matrix as a Scaffold, Degradable Biomaterials for Tissue Engineering, Cell-Material Interactions, Scaffold Design and Fabrication, Controlled Drug Release in Tissue Engineering, Bioreactors in Tissue Engineering, Production of Mesenchymal Stem Cells, Industrial Tissue Engineering Manufacturing, Cartilage Tissue Engineering, Bone Tissue Engineering, Cardiovascular Tissue Engineering, Corneal Tissue Engineering and Replacement, Tissue Engineering of the Intervertebral Disc (IVD).

Teaching and Learning Methods

The module is taught using a combination of lectures and assignment. Students are tasked with an independent or group learning assignment to research a specific area in the field of tissue engineering and regenerative medicine which introduces the student to research skills necessary for life-long learning.

| Assessment Details Please include the following: <ul style="list-style-type: none"> • Assessment Component • Assessment description • Learning Outcome(s) addressed • % of total • Assessment due date | Assessment Component | Assessment Description | LO Addressed | % of total | Week due | |
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| | Independent/Group Assignment | Students are tasked with an independent or group learning assignment to research a specific area in the field of tissue engineering and regenerative medicine | 1,3,10 | 20 | 7 | |
| | Written Examination | Timetabled semester 2 examination | 1-9 | 80 | End of Semester 2 | |

Reassessment Requirements
Reassessment is 100% exam

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| Contact Hours and Indicative Student Workload | Contact hours: 30 lecture hours |
| | Independent Study (preparation for course and review of materials): 70 hours |
| | Independent Study (preparation for assessment, incl. completion of assessment): 25 hours |

Recommended Reading List

- **Tissue Engineering, van Blitterswijk & de Boer, 3rd edition, (Elsevier)**

Module Pre-requisite
MEU44BM6

Module Co-requisite
ME5M20 (If MEU44BM6 has not been taken previously)

COVID contingency plan
If necessary, all lectures will be conducted online and assessments will be a mix of online examinations and continuous assessment.

Module Website
<https://www.tcd.ie/Engineering/undergraduate/maiyear5/biomedical/>

Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.
n/a

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| Module Approval Date | 20/08/24 |
| Approved by | Daniel Kelly |
| Academic Start Year | 2024 |
| Academic Year of Date | 2025/26 |