<table>
<thead>
<tr>
<th><strong>Module Code</strong></th>
<th>ME5BIO3</th>
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<tbody>
<tr>
<td><strong>Module Name</strong></td>
<td>Tissue Engineering</td>
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<tr>
<td><strong>ECTS Weighting</strong></td>
<td>5 ECTS</td>
</tr>
<tr>
<td><strong>Semester taught</strong></td>
<td>Semester 2</td>
</tr>
<tr>
<td><strong>Module Coordinator/s</strong></td>
<td>Prof Daniel Kelly</td>
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**Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline**

On successful completion of this module, students should have an:

LO1. Understanding of the fundamental principles of tissue engineering
LO2. Understanding of animal/human cell culture processes
LO3. Awareness of current “state of the art”, emerging technologies and advances in the field
LO4. Ability to understand cell bioengineering processes and its applications to tissue engineering and regenerative medicine
LO5. Ability to integrate the knowledge on biomaterial fundamentals and cell and tissue biology toward the development of biomedical applications
LO6. Ability to design and conduct experiments, as well as to measure, analyse and interpret data from living systems.
LO7. Ability to identify, formulate and adapt engineering solutions to unmet biological needs
LO8. Ability to analyse biological systems as engineering systems
LO9. Understanding and knowledge of the commercial market and the regulatory hurdles in tissue engineering
LO10. Appreciation of ethical issues and considerations for regenerative medicine
LO11. Ability to present a complex topic in tissue regeneration to a wide audience

**Graduate Attributes: levels of attainment**

To act responsibly - Enhanced
To think independently - Enhanced
To develop continuously - Enhanced
To communicate effectively - Enhanced
**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 cell culture, tissue scaffold design, use of bioreactors in tissue engineering, and molecular surface modifications for integration of engineered tissues in situ. Ethical considerations related to clinical application of tissue and cell engineering technology will also be explored. Topics covered include: Fundamental Principles of Tissue Engineering, Stem Cells for Tissue Engineering, Cell Culture for Tissue Engineering, Colony-Forming Unit Assays, Cell Proliferation Kinetics, Scaffolds for Tissue Based Repair, Decellularised Matrices, Bioprinting, Bioreactor Systems and Design, Diffusion & Nutrient Transport Limitations in Tissue Engineered Constructs, Mechanobiology- Response of Cells to Mechanical Forces, Skin Tissue Regeneration, Cartilage Tissue Engineering & Regeneration, Bone Tissue Engineering, Cardiovascular Tissue Engineering, Corneal Tissue Engineering and Replacement, Tissue Engineering of the Intervertebral Disc (IVD), Peripheral Nerve Repair, Cell Separation Technology, Ethical Issues and Considerations for Tissue Engineering.

**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:
- Assessment Component
- Assessment description
- Learning Outcome(s) addressed
- % of total
- Assessment due date

<table>
<thead>
<tr>
<th>Assessment Component</th>
<th>Assessment Description</th>
<th>LO Addressed</th>
<th>% of total</th>
<th>Week due</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short test</td>
<td>Online/In-class test on lecture material covered in the first 5 weeks</td>
<td>1-5</td>
<td>10</td>
<td>27</td>
</tr>
<tr>
<td>Independent/Group Assignment</td>
<td>Students are tasked with an independent or group learning assignment to research a specific area in the field of tissue engineering and regenerative medicine</td>
<td>3,4,9,11</td>
<td>15</td>
<td>29</td>
</tr>
<tr>
<td>Written Examination</td>
<td>Timetabled semester 2 examination</td>
<td>1-10</td>
<td>75</td>
<td>End of Semester 2</td>
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### Reassessment Requirements
There is no reassessment for MAI/MSc

### 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

### 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/](https://www.tcd.ie/Engineering/undergraduate/maiyear5/biomedical/)

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

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<tr>
<td>Module Approval Date</td>
<td>15/07/20</td>
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<tr>
<td>Approved by</td>
<td>Daniel Kelly</td>
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<tr>
<td>Academic Start Year</td>
<td>2020</td>
</tr>
<tr>
<td>Academic Year of Date</td>
<td>2021</td>
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