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	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**

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
Short test	Online/In-class test on lecture material covered in the first 5 weeks	1-5	10	27
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	3,4,9,11	15	29
Written Examination	Timetabled semester 2 examination	1-10	75	End of Semester 2

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

- Tissue Engineering, Fisher, Mikos & Bronzino, 2007, (CRC Press)
- Principles of Tissue Engineering,4th Edition, Lanza, Langer & Vacanti, 2013 (Elsevier)
- Tissue Engineering, Palsson 7 Bhatia, 2004, (Pearson Prentice Hall)

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

n/a

involved in the delivery of this module? If yes, please provide details.	
Module Approval Date	15/07/20
Approved by	Daniel Kelly
Academic Start Year	2020
Academic Year of Date	2021