

Module Template for New and Revised Modules

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| Module Code | MEU44BM6/ME5M20 |
| Module Name | Biomaterials |
| ECTS Weighting¹ | 5 ECTS |
| Semester taught | Semester 1 |
| Module Coordinator/s | Prof Michael Monaghan |
| 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 be able to:</p> <p>LO1. Describe the structure, composition and biocompatibility of commonly employed biomaterials and be capable of selecting an appropriate biomaterial for a given implant design</p> <p>LO2. Describe methods of manufacture of the different types of materials used in medicine and biosciences, their properties and their suitability for a particular function</p> <p>LO3. Describe the various common causes of failure in biomaterial components and explain how components are designed/modified so as to prevent failure.</p> <p>LO4. Describe the various methods of sterilisation for biomaterials</p> <p>LO5. Decide what is the best test protocol to use in characterising a biomaterial.</p> <p>LO6. Knowledge of the regulatory hurdles, challenges and routes to market</p> <p>LO7. Develop an awareness of emerging technologies/biomaterials and their impact on the field</p> <p>LO8. Have performed a group laboratory biomaterials experiment using state of the art technology, performed analysis and produce a technical report</p> <p>LO9. Critically analyse the technical work of others in the field and be able to communicate this critique to a general 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 explores currently used materials in tissue replacement including metallic, ceramic, and natural/synthetic polymeric materials. Implant applications and design considerations for these materials as well as the associated problems with long term survival will be described so that the mechanical, chemical and physiological interactions between in vivo host environment and the implanted biomaterial can be better understood. Integration of biomaterial structure and function will be emphasized throughout the module. Advanced manufacturing and fabrication technologies to generate biomaterials with specialized structural and interfacial properties will also be introduced. At the end of this module, it is anticipated that students will have obtained a detailed understanding of the composition and properties of the major classes of biomaterial used in medical devices. The required functionality for a range of synthetic implantable biomaterials and how this relates to material choice for specific applications will also be covered. Associated failure modes are introduced through a series of real-life case studies. Sterilisation techniques, regulatory aspects and standards with relation to quality and safety will be introduced.

Teaching and Learning Methods

The module is taught using a combination of lectures, laboratories and tutorials. Assessment is through assignments and a final online test.

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| Assessment Details² 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 |
| | Journal Article Review | Understanding and assessment of peer reviewed work | 1,2,3,4,5,6,9 | 25 | 5 |
| | Seminar Series Report | One report on randomly assigned TCBE Seminar Series Speaker Presentation | 1, 2, 5, 7, 8 | 10 | 12 |
| | Group Laboratory Programme | Laboratory practical with workshops over several weeks with submission of group technical summary and discussion from material synthesis to physicochemical characterisation | 3,4,5,7,8 | 35 | 9 |
| | Online Test | Online test made up of multiple choice, essay and calculation questions | 1,2,3,4,5,6,7,8 | 30 | 15 |
| Reassessment Requirements | Reassessment is composed solely on the submission of a comprehensive review of three related published works chosen by the module coordinator | | | | |
| Contact Hours and Indicative Student Workload² | Contact hours: 100 (including 33 lecture hours). | | | | |
| | Independent Study (preparation for course and review of materials): 32.5 | | | | |
| | Independent Study (preparation for assessment, incl. completion of assessment): 37.5 | | | | |
| Recommended Reading List | Biomaterials- An Introduction, Park, Joon & Lakes, R. S., 3rd ed., 2007 (Springer) An Introduction to Biomaterials, Guelcher & Hollinger (Eds), 2006, (Taylor & Francis Group) | | | | |
| Module Pre-requisite | n/a | | | | |
| Module Co-requisite | n/a | | | | |
| Module Website | https://www.tcd.ie/Engineering/undergraduate/bai/year-4/ | | | | |

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| Are other Schools/Departments involved in the delivery of this module? If yes, please provide details. | No |
| Module Approval Date | |
| Approved by | |
| Academic Start Year | 2023 |
| Academic Year of Date | 2023/2034 |