

Module Code	ME5BIO7
Module Name	Advanced Medical Imaging
ECTS Weighting	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. A theoretical understanding of the fundamental physical and mathematical principles underlying major modern medical imaging technologies in both clinical and research settings.</p> <p>LO2. An appreciation of the pre-requisites of imaging modalities in clinical and research settings and the safety</p> <p>LO3. The ability to function on multidisciplinary teams</p> <p>LO4. Understand how the structure and composition of tissues and cells influences and determines the application and/or combination of imaging modalities</p> <p>LO5. Awareness of current “state of the art”, emerging technologies and advances in the field.</p> <p>LO6. An understanding of the application of medical imaging in the quality control of implants and tissue engineered constructs</p> <p>LO7. Ability to identify, formulate and adapt advance medical imaging solutions to unmet biological needs</p> <p>LO8. Ability to perform a quantitative analysis of in vitro multiphoton imaging data, and interpretation thereof.</p> <p>LO9. The ability to extract, through comprehensive analysis of the literature, information pertinent to the design of an imaging solution to an unfamiliar problem</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 objective of this module is to equip students with an understanding of engineering approaches to advanced biomedical imaging. A strong focus is placed on understanding the physical processes that occur between a particular imaging modality and the biological material being investigated. This module introduces the physical concepts of advanced medical imaging followed by lectures focused on specific imaging modalities. Modules will cover various imaging techniques to provide an advanced understanding of the physics of the signal and its interaction with biological tissue; image formation or reconstruction; modality-specific issues for image quality; clinical applications; and biological effects and safety. State-of-the-art emerging imaging modalities in research will be studied in detail and engineering approaches to advance such techniques to the clinic. Finally, the importance of advanced medical imaging in the quality control of medical devices and tissue engineered constructs will be covered along with their implantation and monitoring in vivo.

Teaching and Learning Methods

The module is taught using a combination of lectures, laboratories, flipped classroom and study assignments. At the end of each lecture students will receive more specific learning outcomes for the lecture and be expected to undertake self-directed further reading and research.

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			
	Written Examination	Timetabled semester 1 examination	1,4,6,7,	65	n/a			
	Group Assignment	Technology Lecture and Exam Question	1,2,3,4,5,6,	15	5			
	Image Analysis Report	ImageJ analysis and interpretation of data acquired in ongoing research activities	1,2, 3,4, 8,9	10	8			
	Online Test	An MCQ and short online test performed within a defined time period online	1,2,4,6	10	13			
Reassessment Requirements	In the event of reassessment, candidates must repeat the annual examination for which 100% of the module mark will be dependent. There is no reassessment for the MSc in Bioengineering.							
Contact Hours and Indicative Student Workload	<table border="1"> <tr> <td>Contact hours: 115 (includes 30 lecture hours)</td> </tr> <tr> <td>Independent Study (preparation for course and review of materials): 40</td> </tr> <tr> <td>Independent Study (preparation for assessment, incl. completion of assessment): 45</td> </tr> </table>					Contact hours: 115 (includes 30 lecture hours)	Independent Study (preparation for course and review of materials): 40	Independent Study (preparation for assessment, incl. completion of assessment): 45
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Independent Study (preparation for course and review of materials): 40								
Independent Study (preparation for assessment, incl. completion of assessment): 45								
Recommended Reading List	<ul style="list-style-type: none"> ▪ Medical Imaging: Principles and Practices Analoui (Ed) ▪ Fluorescence Microscopy: from Principles to Biological Applications Kubitscheck (Ed) ▪ A wide range of introductory and advanced reading materials will also be provided via blackboard. 							
Module Pre-requisite	None							
Module Co-requisite	None							
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							
Module Approval Date	30/06/20							

Approved by	Michael Monaghan
Academic Start Year	2020
Academic Year of Date	2020