Module Code	MEP56BM8
Module Name	Active Implanted Devices and Systems
ECTS Weighting[1]	10 ECTS
Semester taught	Semester 2
Module Coordinator/s	Assistant Professor Alejandro Lopez Valdes
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should be able to: LO1 Understand the concepts involved in implanted devices and systems. LO2 Be able to perform quantitative analysis of data from implanted systems. LO3 Be able to design and implement signal processing algorithms for chronically implanted systems LO4 Be able to identify, formulate and adapt engineering solutions to unmet biological needs. **Graduate Attributes: levels of attainment** To act responsibly - Enhanced To think independently - Enhanced To develop continuously - Enhanced To communicate effectively - Enhanced
Module Content	The objective of this module is to provide a quantitative background to active implanted neural systems. Focus will also be placed on the neuromodulation effects of electrical stimulation and on the goals of real time, closed loop control of implanted system. The module will be based around a substantial individual assignment (grant proposal) and lectures based on state-of-the-art publications. Section 1 Fundamental of Recording: • Principles of Recording neural activity • Recording neural activity in freely moving animals • Neural Spike trains and Analysis Section 2 Fundamental of Neuromodulation • Principles of Electric Field Generation for Stimulation of CNS • Mechanism of Action of Deep Brain Stimulation • Computational Modelling of Deep Brain Stimulation Section 3 Biomedical Engineering and Neuroscience Considerations • Electrodes for the Neural Interface

	• Implantable microelectrodes • Implantable Neural Stimulators • Nonlinear dynamical modelling • Closed loop control Section 4 Clinical Applications of Neuromodulation • Neuromodulation for Movement Disorders • Neuromodulation for Psychiatry • Neuromodulation for Functional Restoration: Hearing • Deep Brain Stimulation for Cognitive Modulation • Regulatory Approval of Implantable Medical Devices
Teaching and Learning Methods	The module will be based on the combination of podium lectures, group discussion and a substantial individual assignment. In the event of a COVID-19 lockdown, the teaching methods for this module may have to be revised. Your module coordinator will keep you updated.

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
	Individual/Group Assignments	Development of a research proposal around state-of-the-art Active Implantable Devices.	L01-L04	75%	27,33,34
	Individual Assignment	End of module assignment demonstrating integration of knowledge acquired in the field of novel active implantable devices. Due end of semester	L01-L04	25%	36

Reassessment Requirements	Reassessment Assignment 100%

Contact Hours and Indicative Student WorkloadError! Bookmark not defined.	**Contact hours: 33**
	Independent Study (preparation for course and review of materials): 66 hours: Researching journals, reviewing lecture material and class notes.
	Independent Study (preparation for assessment, incl. completion of assessment): 66hours: Searching, locating, retrieving, analysing, synthesising, discussing research literature related to the chosen topic for the project assignment. Writing of the project report in the form of a research proposal to a funding agency. Preparation of 10min presentation.

Recommended Reading List	
Module Pre-requisite	EEU33BM1 Anatomy and Physiology, PG7901 Form and Function of Nervous System and EEU44C05 Digital Signal Processing, Processing; **or** equivalent knowledge plus supplementary reading as advised by module coordinator
Module Co-requisite	

Module Website	Blackboard
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	2023-24