Module Code	5BIO8
Module Name	Active Implanted Devices and Systems
ECTS Weighting[1]	10 ECTS
Semester taught	Semester 2
Module Coordinator/s	Prof Richard Reilly
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 - Attained
Module Content	The objective of this module is to provide a quantitative background to implanted neural systems. Focus will also be placed on the neuromodulation effects of electrical stimulation and on the goals of real time, objective, 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 Computational and Mathematical Modelling of Neural Systems

	• Biological and theoretical neural networks • Information processing in complex systems • Learning models; Reinforcement learning • Self-organization in nervous system • Synchronization of oscillators in memory formation Section 3 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 4 Biomedical Engineering and Neuroscience Considerations • Electrodes for the Neural Interface • Implantable microelectrodes • Implantable Neural Stimulators • Nonlinear dynamical modelling • Closed loop control Section 5 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, a substantial individual assignment and student presentations.

Assessment Details[2]
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 assignment	Submission of a proposed new implanted device or system. Due end of semester	L01-L04	75	32
Examination		L01-L04	25	

Reassessment Requirements

Contact Hours and Indicative Student Workload[2]

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

3BIO1 Anatomy and Physiology, 4C5 Digital Signal Processing

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

Academic Year of Date