

NEW/UPDATED MODULE DESCRIPTOR

Module Title	Biomedical Electronics
Course Title(s)	BEng Electrical and Electronic Engineering
School	School of Engineering
Division	Division of Electrical and Electronic Engineering
Parent Course (If applicable)	None
Level	6
Semester	Semester 1
Module Code (showing level)	EEE_6_BEL
Joint Academic Coding System / Higher Education Classification of Subjects Code	
Credit Value	20 credit points
Student Study Hours	Contact hours: 48 Student managed learning hours: 152 Placement hours: 0
Pre-requisite Learning	None
Co-requisite Module(s)	None
Excluded Combinations	None
Module Co-ordinator	TBC
Short Description	This module aims to provide students with the in-depth understanding of modern medical electronics. Through lectures, tutorials and laboratory sessions, the

(max. 100 words)	module describes how biomedical electronics are used, and exemplar applications are discussed.
Aims	This course aims to provide students with: 1. Detailed knowledge of Systems Physiology. 2. Detailed knowledge of Bio-sensor technologies and IMDs 3. Detailed knowledge of Non-Invasive Techniques 4. The numerical and electrical design skills to work with medical electronics
Learning Outcomes (4 to 6 outcomes)	Science and Mathematics: • Appraise the use of physiology and modern medical electronics. (C1) Engineering Analysis: • Survey suitable engineering methods to solve complex problems in the areas of medical electronics and use fundamental knowledge to investigate new sensor and new measurement technologies. (C2, C3, C4) Design and Innovation: • Devise an engineering solution to a given biomedical electronics problem. (C5) The Engineer and Society: • Plan and analyse surveys of the ethical issues that a bioengineer faces in the research and development of medical devices, evaluate and mitigate medical risks. (C8, C9) Engineering Practice: • Illustrate and correlate the use of software and medical instruments working with sensors and electronics. (C12, C13, C15) • Organise to work effectively both as individual and within a team and effectively communicate and critically evaluate and summarise information from a range of sources and reference them accurately. (C16, C17)
Employability	This module will provide students with knowledge and skills of modern biomedical electronics. It also provides hand-on practical experiences of working with biomedical electronic instruments. Successful graduate can find work in the relevant fields of biomedical engineering and healthcare.

Teaching and Learning Pattern	Contact hours includes the following: (Please click on the checkboxes as appropriate) X Lectures Group Work Seminars X Tutorials X Laboratory Workshops Practical X VLE Activities
Indicative Content	• Physiology and Bio-signals: Physical properties of the human body (conductivity / permittivity / blood / bone / muscle / skin) • Bio-potentials and Bio-sensor Technologies: How bio-potentials are generated in human body. How to measure them with electrodes and sensors. How to design the electronics circuits. • Digital Processing: Sampling, digital filtering and Fourier analysis in digital domain, after recording to signals. • Medical Imaging: CT, MRI and ultrasound
Assessment Method (Please give details – of components, weightings, sequence of components, final component)	There are two main components for assessment: Coursework - Laboratory-based assignments (50%) End of module examination of duration 2 hours (50%) CW1: Coursework (50%) SC1_50 – Laboratory report (50%) (C12, C13, C15, C16, C17) SC2_50 – Assignment (50%) (C5, C8, C9) Exam: 2-hour exam (50%) (C1, C2, C3, C4) All coursework assignments are summative, formal reports will contain formative feedback.
Mode of Resit	Standard mode referral. The same as the above CW1: Coursework (50%) Exam: 2-hour exam (50%)
Indicative Sources (Reading lists)	Core materials: 1. Anne Waugh, Allison Grant, Ross & Wilson Anatomy and Physiology in Health and Illness, 13th Edition, Elsevier, 6 Jun. 2018, ISBN-13: 978-0702072765. 2. W. Mark Saltzman, Biomedical Engineering: Bridging Medicine and Technology, ISBN-10 : 1107037190, Cambridge University Press; 2nd edition (21 May 2015)

	Optional reading: 1. Paul Horowitz , Winfield Hill, The Art of Electronics, 3rd Edition, Cambridge University Press, 30 Jun. 2015. ISBN-13: 978- 0521809269 2. David Prutchi, Design and Development of Medical Electronic Instrumentation: A Practical Perspective of the Design, Construction, and Test of Medical Devices, W.I., 8 Nov. 2004, ISBN-13: 978-0471676232. 3. L. D. M. Nokes, Introduction to Medical Electronics Applications, Butterworth-Heinemann, 17 Mar. 1995, ISBN-13: 978- 0340614570. 4. John G. Webster, Halit Eren, Measurement, Instrumentation, and Sensors Handbook: Spatial, Mechanical, Thermal, and Radiation Measurement, 2nd Edition, CRC Press, 14 Aug. 2017, ISBN-13: 978-1138072176 5. John R. Haaga, Daniel Boll, CT and MRI of the Whole Body, 2-Volume Set, 6th Edition, Elsevier, 2 Aug. 2016, ISBN-13: 978- 0323113281
Other Learning Resources	VLE, Matlab online courses