

Module Specification

Module Summary Information

1	Module Title	Medical Instrumentation and Measurements
2	Module Credits	20
3	Module Level	5
4	Module Code	ENG5107

5	Module Overview
<p>Rationale:</p> <p>This module will build upon the foundation knowledge and skills that you have developed earlier as part of this programme. It is intended that by engaging in this module, you will be able to apply various principles underpinning; science, biology and medicine alongside mechanical, electrical and electronic engineering in acquiring measurements from various physiological systems. This involves being able to:</p> <ul style="list-style-type: none"> • Understand Bio-potentials (a voltage produced by a tissue of the body) and analyse various types of electrodes available for recording such measurements. • Evaluate the characteristics of Bio-amplifiers and recorders. • Design simple circuits used in the development of biosensors for clinical applications. <p>These skills are essential to enable you to become a competent and skilful biomedical engineer.</p> <p>Alignment with Programme Philosophy and Aims</p> <p>The programme aims to develop your understanding and knowledge of medical devices commonly used in the clinical setting. Therefore, undertaking this module at this level will enable you to develop an in-depth knowledge of Bio-potentials, Bio-electrodes, and Bio-amplifiers which is essential for understanding the principles underpinning the operation of various medical devices used within a clinical context and thus an important part of your role as a future Biomedical Engineer. A sound knowledge and understanding of medical instrumentation at this level is essential in providing you the basis for future learning in your area of professional practice. This module further explores the facts pertaining to the interaction of technology to your human body by allowing you to measure various physiological parameters thereby linking theory to practice. Such a module will provide a solid basis for other modules such as the – Medical devices and equipment life cycle and Medical devices technology management, that you undertake at subsequent levels of your studies. This is a specialism module delivered as part of this programme. Nevertheless, the module may involve lecturers from various physiological and electro-mechanical backgrounds, thereby encouraging interprofessional teaching.</p> <p>Learning and Teaching Strategy</p> <p>Medical Instrumentation and Measurements module will have its own Moodle page which you will have access to. This page will contain resources that are specific to the module such as the key note lectures; supporting materials and activities; assessment details and important notices. It is important that you</p>	

access the site regularly as part of your learning will be to undertake sessional preparatory activities for each session followed by attempting short online formative activities to help with your learning. As part of this module, various workshops will be facilitated to encourage peer –learning or group activities and example exam questions will be used during these sessions.

Assessment Strategy

Assessment will be via a case study based closed book examination. To ensure that the team are able to assess if you have met all the four learning outcomes of this module, you will be required to sit a case study (appropriate to your level) based closed book examination, which will introduce you to real life scenarios. This will allow you to reflect on various biological, mathematical, electrical/electronic and other electro-mechanical design principles and apply the same to the given scenarios to demonstrate your level of knowledge, understanding and application of sensors and transducers used in biomedical engineering, which you have gained from this module.

6	Indicative Content
	<ol style="list-style-type: none"> 1. Module and assessment Launch. 2. Origin of Bio-potentials and Bio-electrodes Lecture and Workshop 3. Introduction to Bio-amplifiers and Bioelectric signals– ‘Electronic Amplifiers’- Lecture and Lab / Demonstration. 4. Bio-amplifiers, Bioelectric signals and their characteristics in response to amplifiers’ - Lecture and Workshop on the design aspects of the amplifiers for Biomedical applications based on the foundation knowledge in engineering 5. Consolidation of previous lectures: Tutorials. 6. Bio transducers and Sensors 1 – Analytical Equipment’s – Gas sensor, temperature sensors, Blood cell counters, etc. Lecture and Workshop on the principles underpinning the design and development of Biosensors 1 and ab / Demonstration (2 hours). 7. Bio transducers and Sensors 2 - Analytical Equipment’s continued – Glucose sensor, pH, pO₂, pCO₂, etc. - Lecture and Workshop on the principles underpinning the design and development of Biosensors 2 and Lab / Demonstration. 8. Patient monitoring systems 1 – Blood pressure, Cardiac output measurement systems – Dilution and Impedance techniques, Temperature, respiratory rate, and pulse oximeters - Lecture and Workshop illustrating the real time applications and nitty-gritty of medical technology when used in such applications. 9. Patient monitoring systems 2 (continued) –, ECG, plethysmography, Heart Lung Machines, oxygenators, and Bedside monitors - Lecture (1hour) and Workshop illustrating the real time applications and nitty-gritty of medical technology when used in such applications. Potential engagement of specialist engineers from private medical device industries in this workshop 10. Patient monitoring systems: EEG and EMG Case study – Lecture and Demonstration. 11. Biotelemetry - Basic components and its types 1 – Central Monitoring systems – Antenna design, frequency modulation and Pulsed RF- Lecture and Workshop on extended application of Bio telemetry in various day-to-day applications. 12. Biotelemetry - Basic components and its types 2 – Phase Locked Loops in medical instrumentation and distributed networks - Lecture and Workshop on the current research and development in this area alongside the pros and cons of telemetry within a clinical setting. Potential engagement of specialist engineers from industries. 13. Reliability and safe handling of medical instruments – Lecture. 14. Plenary. 15. Revision / group tutorial. 16. Module Feedback.

7	Module Learning Outcomes	
	On successful completion of the module, students will be able to:	
	1	Explain the physiological principles underpinning bio-potentials.
	2	Identify and evaluate the characteristics of wide range of bio-electrodes, bio-amplifiers and different types of recorders available for various physiological measurements.
	3	Apply the knowledge of sensor types and technology commonly used in the design and development of medical instrumentation for various clinical and non-clinical purposes.
	4	Describe in detail the detection and visualisation of physiological signals using bio-potential and bio impedance modalities.

8	Module Assessment		
Learning Outcome			
	Coursework	Exam	In-Person
1,2,3,4		x	

9	Breakdown Learning and Teaching Activities	
Learning Activities	Hours	
Scheduled Learning (SL) includes lectures, practical classes and workshops, peer group learning, Graduate+, as specified in timetable	35	
Directed Learning (DL) includes placements, work-based learning, external visits, on-line activity, Graduate+, peer learning, as directed on VLE	N/A	
Private Study (PS) includes preparation for exams	165	
Total Study Hours:	200	