BIOMEDICAL SENSORS AND SIGNALS - 2024/5

Module code: ENGM262

Module Overview

This module describes the use of equipment (such as electroencephalography and electrocardiography among others) and technology to measure important information about the physiological state of a patient that may be used in diagnosis or patient monitoring. The module also provides the student with an up-to-date knowledge base on the theory and professional practice of engineering applied to the rehabilitation of people with sensory and neurological disability.

Module provider Mechanical Engineering Sciences Module Leader GILSON Rosanna (Mech Eng Sci) Number of Credits: 15 ECTS Credits: 7.5

Framework: FHEQ Level 7

Module cap (Maximum number of students): N/A

Overall student workload

Independent Learning Hours: 84

Lecture Hours: 22

Tutorial Hours: 11

Guided Learning: 11

0

Captured Content: 22

Module Availability

Semester 2

Prerequisites / Co-requisites

None

Module content

Indicative content includes:

Basic Principles

- Principles of physiological measurement.
- Physiological transduction.
- Electrical Properties of tissues and electrode design and function.
- Detection of Physiological signals.

Physiological Measurement

Cardiovascular Instrumentation and Clinical Applications

- Blood flow measurement: Doppler, electromagnetic, cardiac output, regional flows.
- Electrocardiography. Defibrillators.

Respiratory System

• Respiratory gas flow: lung volumes, airways resistance, forced expiration, ventilation.

Neurological Measurement

- Peripheral nerve signal measurement.
- Measurement of conduction velocity.

• Evoked responses - visual/ auditory.

Diagnostic methods using electroencephalography.

Clinical Practice

• Practical implementation of management procedures in intensive care and routine hospital practice.

Biomedical signals for Rehabilitation

- Functional Electrical Stimulation.
- Implanted stimulators and sensors.
- Electrically Assistive Technology and alternative communication methods.

Biosensors for Diagnostics and Monitoring

- Electrochemical biosensors
- Point of Care diagnostics

Assessment pattern

Assessment type	Unit of assessment	Weighting
Coursework	Coursework	20
Examination Online	Online (Open Book) Exam within 4hr window (2 hours)	80

Alternative Assessment

N/A

Assessment Strategy

The assessment strategy is designed to provide students with the opportunity to demonstrate understanding of scientific principles, methodologies, and mathematics methods as well as the ability to describe particular systems and processes in the final examination. Thus, the summative assessment for this module consists of:

Coursework [Learning outcomes 1, 2, 3, 4, 5]

Examination [Learning outcomes 1, 2, 3, 4, 5] (2 hours in a 4 hour window)

Formative assessment and feedback will be provided throughout the module.

Module aims

- Specialist knowledge about the use of apparatus and procedures in order to measure the physiological state of a subject, and the associated procedures in order to ensure the safety of that subject in a healthcare setting.
- An up-to-date knowledge base on the theory and professional practice of engineering applied to the rehabilitation of people with sensory, neurological or communication disability.

		Attributes Developed		
Ref				
001	Identify and review the appropriate methods of clinical measurement to use in a given dynamic situation showing a systematic understanding and critical awareness of the problems faced in clinical measurement.	КСР	M1	
002	Explain and understand the placement and use of surface electrodes for measurement of bioelectric signals, nerve conduction measurement, and methods for flow measurements of body fluids, being aware of their limitations.	КСР	M1	
003	Integrate multiple information sources to synthesise an evaluation of the physiological state.	KC	M1,M6	
004	Evaluate critically clinical monitoring techniques, evaluating the advantages and/or disadvantages of different approaches.	PT	M1,M2,M6,M16,M15	
005	Apply critical approaches to implementing rehabilitation solutions, with particular reference to communication devices, environmental controls, and neurological implants.	КСР	M1,M5,M9,M15	
Attributes Developed				
C - Cognitive/analytical				
K - Subject knowledge				
T - Transferable skills				
P - Professional/Practical skills				

Methods of Teaching / Learning

The <u>learning and teaching</u> strategy is designed to:

The principal teaching approach is through the delivery of formal lectures and different demonstrations relevant to physiological measurement.

The learning and teaching methods include face-to-face lectures and captured content.

Indicated Lecture Hours (which may also include seminars, tutorials, workshops and other contact time) are approximate and may include in-class tests where one or more of these are an assessment on the module. In-class tests are scheduled/organised separately to taught content and will be published on to student personal timetables, where they apply to taken modules, as soon as they are finalised by central administration. This will usually be after the initial publication of the teaching timetable for the relevant semester.

Reading list

https://readinglists.surrey.ac.uk

Upon accessing the reading list, please search for the module using the module code: ENGM262

Other information

The School of Mechanical Engineering Sciences is committed to developing graduates with strengths in Employability, Digital Capabilities, Global and Cultural Capabilities, Sustainability, and Resourcefulness and Resilience. This module is designed to allow students to develop knowledge, skills, and capabilities in the following areas:

Digital capabilities: The students will use appropriate technology to complete authentic assignments including Microsoft Office software and MATLAB. Students will also use interactive formative tools to conclude and recall learning (unassessed) in lecture sessions.

Employability: Students will be supported to develop their knowledge of devices and technologies used by biomedical engineers in the field. Throughout the teaching of this module, the deliverer will introduce provisions that persons undergoing physiological testing or persons with disabilities may receive from the National Health Service or private companies. This will afford students the opportunity to consider what various biomedical applications there are in the UK and abroad, which companies are active in the production of various devices and to consider whether these are areas of interest for career pursuits. Students will also have the opportunity to consider research carried out at the University of Surrey in the hopes that this will give insight into 'what comes next' after an undergraduate degree.

Global and Cultural capabilities: Students will learn about the prevalence of disease and disability with respect to the medical devices and sensors seen in this module. Students will be encouraged to consider the experience of device users and to understand what the various gains and risks would be for a user of each device.

Resourcefulness and resilience: Through participation in regular unassessed formative activities, students will develop their fluency and recall of information delivered throughout the module, building resilience and a growth mindset.

Programmes this module appears in

Programme	Semester	Classification	Qualifying conditions
<u>Biomedical Engineering</u> <u>MEng</u>	2	Optional	A weighted aggregate mark of 50% is required to pass the module

Please note that the information detailed within this record is accurate at the time of publishing and may be subject to change. This record contains information for the most up to date version of the programme / module for the 2024/5 academic year.