

BME4101: BIOMEDICAL INSTRUMENTATION

Effective Term

Semester B 2023/24

Part I Course Overview

Course Title

Biomedical Instrumentation

Subject Code

BME - Biomedical Engineering

Course Number

4101

Academic Unit

Biomedical Engineering (BME)

College/School

College of Engineering (EG)

Course Duration

One Semester

Credit Units

3

Level

B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

MBE2029/MNE2029 Electrical and Electronic Principles I/
BME2029 Electrical and Electronic Principles and BME3121 Biomedical Signals and Systems/
EE3919 Medical Imaging and Signal Processing#

Precursors

Nil

Equivalent Courses

MBE4101 Biomedical Instrumentation

Exclusive Courses

Nil

Additional Information

Prerequisites which are not part of the Major Requirement are waived for students admitted with Advanced Standing.

Part II Course Details

Abstract

The goal of the course is to teach students about the principles, applications and design of different instruments/equipment used in the healthcare industry. This subject will enable students to gain the basic knowledge of medical and clinical instrumentation, medical diagnosis, biosensors, biopotential amplifiers and electrophysical methods. Upon completion of this course, students should develop the necessary skills to design and analyze basic biomedical instrumentation systems.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if DEC-A1 DEC-A2 DEC-A3 app.)			
1	Describe and Compare different biomedical instruments commonly used in the healthcare industry.			x	
2	Explain the basic working principle of various biomedical instruments and Assess their performance			x	
3	Design and Evaluate basic amplifiers and filters for biomedical signal processing systematically		x	x	x
4	Implement signal processing techniques for processing and analyzing common electrophysiological signals			x	x

A1: Attitude

Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability

Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments

Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Activities (TLAs)

TLAs	Brief Description	CILO No.	Hours/week (if applicable)	
1	Lecture	Introduce fundamental concepts, theories and skills related to biomedical instrumentation.	1, 2, 3, 4	3 hrs/week
2	Laboratory Works	Require students to implement the theories and skills learned in class to process real biomedical signals.	3, 4	3 hrs/week for 4 weeks

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	In-class quiz	1, 2, 3	15	
2	Assignment	2, 3	15	
3	Lab Reports	3, 4	20	2-3 reports to be submitted

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2.5

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

Assessment Rubrics (AR)**Assessment Task**

In-class quiz

Criterion

Capability of applying the concepts introduced in lectures for analysis of problems in biomedical instrumentation.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

Assignment

Criterion

Capability of applying the concepts introduced in lectures for analysis of problems in biomedical instrumentation.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

Lab Reports

Criterion

Ability to perform testing and develop engineering solutions for biomedical instrumentation problems.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

Examination

Criterion

Capability of applying the concepts introduced in lectures for analysis of problems in biomedical instrumentation.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Part III Other Information

Keyword Syllabus

- Medical measurement systems: Electrocardiogram, Blood Pressure, Blood flow and volume, Ultrasound, MRI, CT, Optical imaging.
- Biopotential amplifiers: Sensor characterization, Instrumentation amplifier, signal conditioning, digital/analog conversion.

Reading List

Compulsory Readings

Title	
1	Nil

Additional Readings

Title	
1	Introduction to Instrumentation and Measurements, Third Edition, Robert B. Northrop, Taylor and Francis, 2014.
2	Noninvasive Instrumentation and Measurement in Medical Diagnosis, Robert N. Northrop, CRC press, 2001.
3	Design and Development of Medical Electronic Instrumentation: A Practical Perspective of the Design, Construction, and Test of Medical Devices, D. Prutchi and M. Norri, Wiley-Interscience, 2005.
4	Medical Instrumentation – Application and Design, Fourth Edition, John G. Webster, Editor, Wiley, 2010.