BME6111: BIOMEDICAL INSTRUMENTATION

Effective Term
Semester B 2024/25

Part I Course Overview

Course Title
Biomedical Instrumentation

Subject Code
BME - Biomedical Engineering
Course Number
6111

Academic Unit
Biomedical Engineering (BME)

College/School
College of Biomedicine (BD)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
MBE6111/BME8127 Biomedical Instrumentation

Exclusive Courses
Nil

Part II Course Details

Abstract
Bioinstrumentation, owing to numerous applications in global healthcare, has dramatically impacted the way we live. This course will provide a coherent and comprehensive introduction to the fundamental concepts, working principles, design

underpinning the bioinstrumentation systems, in the context with contemporary applications in engineering and medicine. Various approaches to model, analyse, and optimize the bioinstrumentation systems at different length scales will be covered. Some specific topics such as unobtrusive sensing, wearable devices, blood pressure measuring devices, cardiac pacemakers, defibrillators, cochlear implant, etc will be discussed. The challenges facing the current bioinstrumentation systems and inspiration from the nature for the design of new bioinstrumentation will be addressed as well.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe basic concepts relevant with the biomedical instrumentation system			x	
2	Discuss the working principles of various important components (various biological, chemical and physical transducers) underpinning in important bioinstrumentation systems			x	
3	Interpret the integration and convergence concepts for the design of biomedical sensors and bioinstrumentation systems		x	x	
4	Apply the system-level integration and scaling principles to design novel bioinstrumentation systems for multifunctional applications.			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.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Explain the fundamental concepts, working principles, design as well as the analytical methods related with the bioinstrumentation.	1, 2, 3, 4	3 hrs/week

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Problem-based learning	3, 4	10	
2	Mid-term	1, 2	20	
3	Presentations/projects	3, 4	20	

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

Problem-based learning (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Ability to interpret the convergence concept of medical device design.

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Below marginal level

Assessment Task

Mid-term (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Ability to understand basic concepts and working principles about the biomedical instrumentation system.

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching to marginal level

Assessment Task
Presentations/projects (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Ability to Apply the system-level integration and scaling principles to design novel bioinstrumentation systems for multifunctional applications.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Below marginal level

Assessment Task
Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Ability to understand basic concepts, working principles, design methods and analysis skills related with bioinstrumentation.

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
Problem-based learning (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to interpret the convergence concept of medical device design.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Basic

Failure
(F) Below marginal level

Assessment Task
Mid-term (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to understand basic concepts and working principles about the biomedical instrumentation system.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Basic

Failure
(F) Not even reaching to marginal level

Assessment Task
Presentations/projects (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to Apply the system-level integration and scaling principles to design novel bioinstrumentation systems for multifunctional applications.

Excellent
(A+, A, A-) High

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Assessment Task
Examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

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Ability to understand basic concepts, working principles, design methods and analysis skills related with bioinstrumentation.

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Part III Other Information

Keyword Syllabus
Static and dynamic characteristics of instrumentation systems, sensors (chemical, biological, physical⋯) and actuators
Unobtrusive sensing
Wearable devices
BioMEMS
Bioinspiration
Pacemakers
Defibrillators
Cochlear implant
Global healthcare

Reading List

Compulsory Readings

	Title
1	Medical Instrumentation: Application and Design. -4th Ed or later by John G. Webster Wiley, 2010

Additional Readings

	Title
1	Nakra, B.C. and Chaudhry, K.K., Instrumentation, measurement and analysis, McGraw-Hill.
2	Morris, A.S., Measurement and instrumentation principles, Butterworth-Heinemann.