BME6123: FLEXIBLE BIOELECTRONICS FOR MEDICAL APPLICATIONS

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Flexible Bioelectronics for Medical Applications

Subject Code
BME - Biomedical Engineering
Course Number
6123

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
BME8134 Flexible Bioelectronics for Medical Applications

Exclusive Courses
Nil

Part II Course Details

Abstract

Flexible bioelectronics is the application of multidisciplinary principles to biology, medicine and human healthcare. Since biological tissues are very soft, which are typically six orders of magnitude to the existing bio-instrumentation, thus, results in disadvantages such as irritating inconvenient and invasive for nowadays diagnosis and treatment methods. Combining advantages of desire "soft" materials, optimized device design, reliable system, the technology of flexible bioelectronics enables development of innovative devices or processes, such as skin-like sensors, for prevention, diagnosis, monitoring and treatment of disease.

In this course, students can learn knowledge of soft bioelectronics technology from bio-sensing materials' selection, properties, to device integration, and then to system-level sensing and data acquisition, and finally the clinical implementations and applications.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the basic background of flexible bio-integrated electronics.			x	
2	Explain fundamental concepts of biomedical related sensing parameters.			x	
3	Understand the biomedical-related principle of materials, chemistry, physics and mechanics, then the integration of bioelectronics, to the development of novel soft bio-sensing technologies.		x	x	
4	Select an existing biomedical sensing, diagnosis or treatment problem, and suggest a solution to address the existing problems.		x	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	Introduction of key concepts.	1, 2, 3, 4	2 hrs/week
2	Tutorial	Sample questions and case studies.	1, 2, 3, 4	1 hr/week

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Assignment	1, 2, 3	20	-	No
2	Project Reports	3, 4	30	-	No

Continuous Assessment (%)
50

Examination (%)
50

Examination Duration (Hours)
2

Minimum Continuous Assessment Passing Requirement (%)
30

Minimum Examination Passing Requirement (%)
30

Assessment Rubrics (AR)

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

Criterion
Ability to Explain the principle and procedure of corresponding flexible bioelectronics.

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

Criterion
Ability to Explain and Analyze the problems related to flexible bioelectronics.

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
Project Reports (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Capacity for Self-directed Learning Discovery and Innovation of the new bio-electronics technology.

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

Criterion
Ability to Explain the principle and procedure of corresponding flexible bioelectronics.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task

Assignment (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to Explain and Analyze the problems related to flexible bioelectronics.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Basic

Failure
(F) Not even reaching marginal levels

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

Criterion
Capacity for Self-directed Learning, Discovery and Innovation of the new bio-electronics technology.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Basic

Failure
(F) Not even reaching marginal levels

Part III Other Information

Keyword Syllabus
Principles: basic bioelectronics; flexible electronics; bio-sensing; skin electronics; bio-signal processing.
Sensing and monitoring: tissue pathology; blood pressure, body temperature, sleep monitoring, non-invasive disease diagnosis.
Biomaterials and Biomechanics: biocompatible materials, tissue mechanical properties.
Biomedical-inspired System and Engineering: integration of biocompatible materials; transient electronics, design of bio-devices.
Other Issues: Bio-MEMS and nano technology; advanced bio-electronics.

Reading List

Compulsory Readings

	Title
1	Rogers, J. A., Ghaffari R., Kim, D.H., (2016). Stretchable Bioelectronics for Medical Devices and Systems, New York, NY, Springer.

Additional Readings

	Title
1	Wong, W.S., Dalleo A., (2009). Flexible Electronics: Materials and Application. New York, NY Springer.
2	Merkoci A. (2009). Biosensing Using Nanomaterials, John Wiley and Sons, Inc.
3	Reinhard, R., Lisdat F., (2007). Biosensing for the 21st Century, Berlin Heidelberg New York, Springer.
4	Pruitt, L., A., Chakravartula A.M., (2011). Mechanics of Biomaterials: Fundamental Principles for Implant Design, Cambridge University Press, New York.