City University of Hong Kong
Course Syllabus

offered by
Department of Biomedical Engineering
with effect from Semester A 2022 / 2023

Part I Course Overview

Course Title:	Flexible Bioelectronics for Medical Applications
Course Code:	BME8134
Course Duration:	1 Semester
Credit Units:	3
Level:	R8
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	Nil
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	BME6123 Flexible Bioelectronics for Medical Applications
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. 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.

2. Course Intended Learning Outcomes (CILOs)

No.	CILOs	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	**Describe** the basic background of flexible bio-integrated electronics.			✓	
2.	**Explain** fundamental concepts of biomedical related sensing parameters.			✓	
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.		✓	✓	
4.	**Select** an existing biomedical sensing, diagnosis or treatment problem, and **suggest** a solution to address the existing problems.		✓	✓	✓
	** If weighting is assigned to CILOs, they should add up to 100%.*	N.A.			

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 self-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.

3. Teaching and Learning Activities (TLAs)

TLA	Brief Description	CILO No.				Hours/week (if applicable)
		1	2	3	4	
Lecture	Introduction of key concepts.	✓	✓	✓	✓	2 hrs/week
Tutorial	Sample questions and case studies.	✓	✓	✓	✓	1 hr/week

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.				Weighting*	Remarks
	1	2	3	4		
Continuous Assessment: 50%						
Assignment	✓	✓	✓		20%	
Project Reports			✓	✓	30%	
Examination: 50%						
Examination	✓	✓	✓	✓	50%	Duration: 2 hours
** The weightings should add up to 100%.*					100%	

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

5. Assessment Rubrics

Applicable to students admitted in Semester A 2022/23 and thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
1. Examination	Ability to Explain the principle and procedure of corresponding flexible bioelectronics.	High	Significant	Basic	Not even reaching marginal levels
2. Assignment	Ability to Explain and Analyze the problems related to flexible bioelectronics.	High	Significant	Basic	Not even reaching marginal levels
3. Project Reports	Capacity for Self-directed Learning, Discovery and Innovation of the new bio-electronics technology.	High	Significant	Basic	Not even reaching marginal levels

Applicable to students admitted before Semester A 2022/23

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Examination	Ability to Explain the principle and procedure of corresponding flexible bioelectronics.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Assignment	Ability to Explain and Analyze the problems related to flexible bioelectronics.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Project Reports	Capacity for Self-directed Learning, Discovery and Innovation of the new bio-electronics technology.	High	Significant	Moderate	Basic	Not even reaching marginal levels

Part III Other Information (more details can be provided separately in the teaching plan)

1. 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.

2. Reading List

2.1 Compulsory Readings

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

2.2 Additional Readings

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.