City University of Hong Kong
Course Syllabus

offered by
Department of Biomedical Engineering
with effect from Semester B 2018 / 19

Part I Course Overview

Course Title:	Flexible Bioelectronics for Medical Applications
Course Code:	BME6123
Course Duration:	1 semester
Credit Units:	3 credits
Level:	P6
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)*	Nil
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)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

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.		✓	✓	✓
		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)

(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.					Hours/week (if applicable)
		1	2	3	4	5	
Lecture	Introduction of key concepts.	✓	✓	✓	✓	✓	2 hrs/week
Tutorial	Sample questions and case studies.	✓	✓	✓	✓	✓	1 hr/week

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.					Weighting	Remarks
	1	2	3	4	5		
Continuous Assessment: 50%							
Assignment	✓	✓	✓			20%	
Project Reports			✓	✓	✓	30%	
Examination: 50% (duration: 2 hours)							
						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

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

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

(An indication of the key topics of the course.)

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

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

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

(Additional references for students to learn to expand their knowledge about the subject.)

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.