City University of Hong Kong

Course Syllabus

offered by Department of Materials Science and Engineering
with effect from Semester A 2018 / 19

Part I Course Overview

Course Title:	**Advanced Technology in Biomedical Devices**
Course Code:	**MSE4175**
Course Duration:	**One semester**
Credit Units:	**3**
Level:	**B4**
Proposed Area: *(for GE courses only)*	☐ Arts and Humanities ☐ Study of Societies, Social and Business Organisations ☐ Science and Technology
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)*	**AP4175 Advanced Technology in Biomedical Devices**
Exclusive Courses: *(Course Code and Title)*	**Nil**

Part II Course Details

1. Abstract

To introduce basic understanding of biomedical devices, working principles and applications of various biomedical devices, and knowledge of various aspects of biology and material engineering. To introduce the research frontiers of various biomedical devices.

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.	Recognize and explain the working principles and applications of various biomedical devices.	20%		√	
2.	Contrast the properties and importance of various biomaterials.	10%	√		
3.	Explain the principle of various controlled release devices.	20%		√	
4.	Explain the principle of various biosensors and diagnostic devices.	20%		√	
5.	Distinguish the function of various BioMEMS and microfluidics.	10%		√	
6.	Familiarize with the research frontiers of biomedical devices.	20%			√
** If weighting is assigned to CILOs, they should add up to 100%.*		100%			

[#] Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.

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	**6**	
Lecture	Explain key concepts, theories, and applications etc.	√	√	√	√	√	√	2
Tutorials	Exercise practice	√	√	√	√	√		0.5
Group Project and Presentation	Take on the roles of consulting teams and create a detailed sustainability assessment of a company, including proposals for the design of better procedures improved organizational performance relative to sustainability principles.	√	√	√	√	√	√	1
Term Essay	Requires students to individually read and analyze a research article/book chapter and report their findings.	√	√	√	√	√	√	0.5

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	6		
Continuous Assessment: 40%								
Tutorials and Mid-term Tests	√	√	√	√	√		14%	
Group Project and Presentations	√	√	√	√	√	√	20%	
Term Essays	√	√	√	√	√	√	6%	
Examination^: 60% (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 the examination must 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)
Tutorials and Mid-term Tests	Understand the scientific principles and the working mechanisms. Identify and explain how the principles are applied to science and technology for solving physics and engineering problems.	High	Significant	Moderate	Basic	Not even reaching marginal levels
Group Projects and Presentations	Understand the chosen scientific topic, provide in-depth analysis, suggest potential solutions and improvement strategy, with good communication skills	High	Significant	Moderate	Basic	Not even reaching marginal levels
Term Essays	Self-directed learning to understand the scientific principles.	High	Significant	Moderate	Basic	Not even reaching marginal levels
Exam	Demonstrate understanding of the scientific principles and the working mechanisms. Identify and explain how the principles are applied to science and technology for solving physics and engineering problems.	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

- Biomedical devices defined. Types of biomedical devices.
- Background of biomaterials
  Biomaterial surfaces: protein-surface interactions, cell-surface interactions, engineering biological recognition of biomaterials, protein-resistant and cell-resistant surfaces, surface modification methods, surface characterization in vacuum and in vivo. Degradable biomaterials. Hydrogels as biomaterials. Bioceramics and biocomposites.
- Controlled release devices
  Types of controlled release devices. Degradable materials in controlled release devices. Principles in delivering small molecules vs. proteins. Delivery of drugs to tissues via systemic circulation. Materials for anti-cancer drug delivery. Case studies in complex controlled release.
- Biosensors and diagnostic devices
  Biological elements. Transduction mechanisms. Properties. Fiber optic biosensors, Nanobarcode. Photonic crystals-based sensors. Cell behaviour monitors.
- BioMEMS and microfluidics
  Microfluidic circuits. Micro-pumps, micro-flowsensors and mixers. Application examples: PCR for DNA amplification, fully automated DNA analysis systems.
  Micro/nano processing technology: lithography, soft Lithography, etching (wet and dry).
- Molecular devices
  Molecular switches via proteins and 'smart' polymers. Temperature, pH, and light-sensitive switches.

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.)

Nil

2.2 Additional Readings

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

1.	Biological and Pharmaceutical Nanomaterials, edited by C S S R Kumar, Wiley-VCH, 2006
2.	Drug Delivery: Principles and Applications, edited by B Wang, T Siahaan, and R Soltero, Wiley-Interscience 2005.
3.	Novel Approaches in Biosensors and Rapid Diagnostic Assays, edited by Z Liron, A Bromberg, and M Fisher, Kluwer Academic/Plenum Publishers, 2001.
4.	Biomedical Diagnostic Science and Technology, edited by W T Law, N Akmal, and A M Usmani, Marcel Dekker, 2002.
5.	Smart Biosensor Technology (Optical Science and Engineering)edited by G K Knopf, and A. S. Bassi, CRC 2006.
6.	S S Saliterman, Fundamentals of BioMEMS and Medical Microdevices, Wiley-VCH, 2006.
7.	Nanofabrication Towards Biomedical Applications: Techniques, Tools, Applications, and Impact, edited by C S S R Kumar, J Hormes, C Leuschner, Wiley-VCH, 2005.
8.	Biomedical Photonics Handbook, editor-in-chief, Tuan Vo-Dinh, CRC Press, 2003.