City University of Hong Kong
Course Syllabus

offered by Department of Materials Science and Engineering
with effect from Semester A 2024/25

Part I Course Overview

Course Title:	**Nanomaterials Design for Energy Applications**
Course Code:	**MSE6176**
Course Duration:	**One Semester**
Credit Units:	**3**
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

Energy has become a large societal issue due to the current reliance on non-renewable energy resources and their negative impact on the environment. A growing interest in clean and renewable energy resources makes researchers around the globe to discover new materials. This course aims to introduce nanomaterials design with various energy options. The materials that control the performance of various energy applications, such as energy storage devices, fuel cells, photovoltaic devices, and light-emitting diodes, are explored.

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 differences between bulk and nano materials	20%		√	
2.	Explain the design principles for energy storage devices	20%			√
3.	Explain the design principles for fuel cells	20%		√	
4.	Explain the design principles for photovoltaic devices	20%			√
5.	Explain the design principles for light-emitting diodes	20%		√	
		100%			

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.

3. Learning and Teaching Activities (LTAs)

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

LTA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4	5		
Lectures	Students will engage in formal lectures to gain knowledge about nanomaterials, energy storage devices, fuel cells, photovoltaic devices and light-emitting diodes.	√	√	√	√	√		12 weeks
Test/assignments	Students will engage in completing the tests/assignments to check and consolidate their learnings	√	√	√	√	√		1 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: 60%								
Tests	√	√	√				40%	
Assignments	√	√	√	√	√		20%	
Examination (duration: 2 hours)				√	√		40%	
							100%	

5. Assessment Rubrics

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

Applicable to students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Tests/Assignments	Understanding and explaining fundamental problem. Ability to identify new materials to solve such problems. Ability to explain prospects to solve the problem occurred.	High	Significant	Moderate	Basic	Not reaching marginal level
2. Examination	Able to define material design for various energy harvesting devices	High	Significant	Moderate	Basic	Not reaching marginal level

Applicable to students admitted from Semester A 2022/23 to Summer Term 2024

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-,C+, C)	Failure (F)
1. Tests/Assignments	Understanding and explaining fundamental problem. Ability to identify new materials to solve such problems. Ability to explain prospects to solve the problem occurred.	High	Significant	Basic	Not reaching marginal level
2. Examination	Able to define material design for various energy harvesting devices	High	Significant	Basic	Not reaching marginal level

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.)

Energy storage devices

- Super capacitors
- Batteries

Fuel cells

- Proton transport materials
- Redox catalysts

Photovoltaic devices

- Photovoltaic materials
- Dye sensitised solar cells

Light-emitting diodes

- LED epitaxial growth, processing and packaging
- LED fundamentals
- Micro LEDs

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.	Journal: Nature Materials, Nature Photonics, Advanced Materials, American Chemical Society Journals, American Institute of Physics Journals and Elsevier Journals.