香港城市大學
City University of Hong Kong

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:	**Materials Chemistry**
Course Code:	**MSE8017**
Course Duration:	**One 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)*	**Nil**
Exclusive Courses: *(Course Code and Title)*	**Nil**

Part II Course Details

1. Abstract

This course is aimed at providing both the generalized understanding and in-depth knowledge on certain selected subjects on materials chemistry. It will also provide substantial chemistry foundation for students from a non-chemistry background. It started with a lecture on the fundamental of materials chemistry, followed by a series of lectures on chemistry principles including quantum chemistry, molecular structures, chemical bonding, molecular orbital theory and coordination complex, intermolecular forces, band theory of solid, basic organic chemistry, and fundamental electrochemistry and associated applications. It will also include one lecture on chemistry of the emerging two-dimensional materials. Upon successful completion of the course, students are expected to gain sufficient knowledge on chemistry of materials, including the fundamental principles behind essential chemical reactions and materials properties, as well as potential applications targeting at solving various material issues on future technologies.

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 fundamental concepts of materials chemistry.	5%	✓	✓	
2.	Explain the fundamentals of chemical principles quantum theory, atomic orbitals, molecular structures, chemical bonding, coordination complex, intermolecular forces.	50%	✓	✓	
3.	Explain the fundamentals of organic and polymer materials.	15%	✓	✓	
4.	Explain the fundamentals of molecular orbital theory, band theory, and the properties of semiconductor materials.	15%			
5.	Explain the fundamental electrochemistry and applications in harvesting and storing energy.	15%	✓	✓	
		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 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. Learning and Teaching Activities (LTAs)

LTA	Brief Description	CILO No.					Hours/week (if applicable)
		1	2	3	4	5	
Lecture	Students will engage in formal lectures to gain knowledge about materials chemistry. The lectures are divided into 9 chapters covering quantum theory, atomic orbitals, molecular structures, chemical bonding, coordination complex, intermolecular forces, molecular orbital theory and band theory of solid, basic organic chemistry, and fundamental electrochemistry and associated applications	✓	✓	✓	✓	✓	2
Tutorial	Students will engage in tutorial activities to solving related questions and reinforce the knowledge base.	✓	✓	✓	✓	✓	1

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.						Weighting*	Remarks
	1	2	3	4	5			
Continuous Assessment: 40%								
Midterm Exam (duration: 2 hours)	✓	✓					40%	
Examination: (duration: 2 hours)	✓	✓	✓	✓	✓		60%	
							100%	

5. Assessment Rubrics

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. Midterm test	Demonstrate sufficient understanding on fundamental principles of quantum theory, atomic orbitals, chemical bonds.	High	Moderate	Basic	Not even reaching marginal levels
2. Examination	Demonstrate sufficient understanding on fundamental principles of coordination complex, intermolecular forces, molecular orbital theory and band theory of solid, basic organic chemistry, and fundamental electrochemistry. Capable to describe basic chemistry theories explain all fundamental properties of materials taught in this series of lectures.	High	Moderate	Basic	Not even reaching marginal levels

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. Midterm test	Demonstrate sufficient understanding on fundamental principles of quantum theory, atomic orbitals, chemical bonds.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Examination	Demonstrate sufficient understanding on fundamental principles of coordination complex, intermolecular forces, molecular orbital theory and band theory of solid, basic organic chemistry, and fundamental electrochemistry. Capable to describe basic chemistry theories explain all fundamental properties of materials taught in this series of lectures.	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

(a) Fundamentals that underlie materials chemistry
(b) Fundamentals of quantum chemistry
(c) Fundamentals of chemical bond, molecular structures and coordination complex
(d) Fundamental of molecular orbital theory and band theory of solid
(e) Fundamental of intermolecular forces
(f) Fundamentals and applications of organic chemistry
(g) Fundamentals on electrochemistry and relevant applications
(h) Chemistry of two-dimensional materials

2. Reading List

2.1 Compulsory Readings

1	Lecture slides
2	Tutorial problems and solutions

2.2 Additional Readings

1.	Harry R. Allcock, "Introduction to Materials Chemistry, 2nd Edition", John Wiley & Sons Inc. (2019)
2.	Anthony R. West, "Solid State Chemistry and its Applications, 2nd Edition", John Wiley & Sons Inc. (2014)
3.	Bradley D. Fahlman, "Materials Chemistry, 3rd Edition", Springer Nature, (2018).