

**City University of Hong Kong
Course Syllabus**

**offered by Department of Materials Science and Engineering
with effect from Semester A 2022/23**

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: Nil
(Course Code and Title)

Precursors: Nil
(Course Code and Title)

Equivalent Courses: Nil
(Course Code and Title)

Exclusive Courses: Nil
(Course Code and Title)

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 structure, chemical bonding, molecular orbital theory, 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 two-dimensional materials. Upon successful completion of the course, students are expected to gain sufficient knowledge on chemistry of materials, including the syntheses, characterizations and 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.	10%	✓	✓	✓
2.	Understand the fundamentals of chemical principles including quantum chemistry, molecular structure, chemical bonding, molecular orbital theory, coordination complex, and intermolecular forces.	50%	✓	✓	
3.	Understand the fundamentals of organic and polymer chemistry.	15%	✓	✓	
4.	Understand the fundamental electrochemistry and applications in harvesting and storing energy.	15%	✓	✓	
5.	Understand the chemistry involved in 2D materials including synthesis, intercalation and applications.	10	✓	✓	
		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. Teaching and Learning Activities (TLAs)

TLA	Brief Description	CILO No.					Hours/week (if applicable)
		1	2	3	4	5	
Lecture	Explain fundamental chemical principles about quantum chemistry, molecular structure, chemical bonding, molecular orbital theory, coordination complex, intermolecular forces, band theory of solid, basic organic chemistry, and fundamental electrochemistry and associated applications	✓	✓	✓	✓	✓	2
Tutorial	Discuss tutorial questions, and provide consultation	✓	✓	✓	✓	✓	1

4. Assessment Tasks/Activities (ATs)

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

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. Midterm test	Demonstrate sufficient understanding on fundamental principles of materials chemistry.	High	Moderate	Basic	Not even reaching marginal levels
2. Examination	Capable to describe basic chemistry theories and synthetic principles for materials, explain all fundamental properties of materials taught in this series of lectures, explain materials/devices working principles.	High	Moderate	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. Midterm test	Demonstrate sufficient understanding on fundamental principles of materials chemistry.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Examination	Capable to describe basic chemistry theories and synthetic principles for materials, explain all fundamental properties of materials taught in this series of lectures, explain materials/devices working principles.	High	Significant	Moderate	Basic	Not even reaching marginal levels

Part III Other Information

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