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:	**Corrosion and Surface Engineering**
Course Code:	**MSE6303**
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

Corrosion is a natural process by which a material degrades due to chemical interactions with the environment. Every year, corrosion of metallic materials leads to huge economic losses and risks to personnel in our daily life. This course aims to deliver fundamental knowledge of corrosion behavior of metallic materials (both in kinetic and thermodynamic aspects) to students. Apart from the corrosion of metallic materials, corrosion (degradation) of polymeric materials will also be introduced. Through a detailed understanding of the corrosion behaviour of various materials, a series of surface engineering techniques against corrosion, such as coating, inhibitors, passivators, etc., will be explored and discussed.

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 definition of corrosion and explain corrosion mechanisms of metals and polymeric materials; describe various types of corrosion and their impacts in our daily life.		√	√	
2.	Explain the thermodynamic and kinetic aspects in corrosion of metals and differentiate two aspects in the corrosion process of metals.			√	√
3.	Explain the advantages and limitations of different types of protection methods, such as passivation, inhibitors, coating, etc., and describe the proper protection methods against corrosion in different applications.			√	√
4.	Apply surface engineering techniques for the protection of metals against corrosion.			√	√
		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			
Lecture	Students will engage in lectures to learn different types of corrosion, understand the kinetic and thermodynamic aspects in corrosion of metallic materials, and study various types of protection methods.	√	√	√				20 hrs
Laboratory	Students will perform experiments related to surface engineering of metals.		√	√	√			3 hrs
Tutorial	Students will participate in tutorial activities to discuss and solidify their understanding on lecture content.	√	√	√				10 hrs
Group project	Students will participate in groups to identify corrosion in our daily life and identify the proper protection methods against corrosion.	√	√	√				6 hrs

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				
Continuous Assessment: 50 %								
Course assignments	√	√	√				10%	
Laboratory report		√	√	√			10%	
Group project	√	√	√				30%	
Examination (duration: 2 hours)	√	√	√				50%	
							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. Assignments	Understanding fundamentals of electrochemistry, corrosion, materials selection and coatings for corrosion protection	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Laboratory Report	Having the ability to perform experiments and analyse the data.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Group Project	Identifying corrosion in our daily life and discussing the proper protection methods against corrosion.	High	Significant	Moderate	Basic	Not even reaching marginal levels
4. Final Examination	Having the ability to compare and contrast various corrosion mechanisms and the capability of selecting materials against corrosion	High	Significant	Moderate	Basic	Not even reaching marginal levels

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. Assignments	Understanding fundamentals of electrochemistry, corrosion, materials selection and coatings for corrosion protection	High	Moderate	Basic	Not even reaching marginal levels
2. Laboratory Report	Having the ability to perform experiments and analyse the data.	High	Moderate	Basic	Not even reaching marginal levels
3. Group Project	Identifying corrosion in our daily life and discussing the proper protection methods against corrosion.	High	Moderate	Basic	Not even reaching marginal levels
4. Final Examination	Having the ability to compare and contrast various corrosion mechanisms and the capability of selecting materials against corrosion	High	Moderate	Basic	Not even reaching marginal levels

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

- Electrochemical mechanism
- Thermodynamics: Nernst equation, Pourbaix diagram
- Kinetics: Polarizations (Evans diagram), Tafel plot
- Different types of corrosion
- High-temperature corrosions, Ellingham diagram
- Anodic and cathodic protection
- Inorganic and organic coating, inhibitors and passivators
- Thermoplastic and thermoset polymers
- Corrosion of polymeric materials

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.	Corrosion Science and Engineering, by Pietro Pedeferri, Springer Cham (2018)
2.	Corrosion and Corrosion Control: An Introduction to Corrosion Science and Engineering (4^{th} edition), by R. Winston Revie, Herbert H. Uhlig, John Wiley & Sons, Inc. (2008)

2.2 Additional Readings

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

Hidemitsu Hojo, Ken Tsuda*, Masatoshi Kubouchi* and Dong-Seop Kim, Corrosion of Plastics and Composites in Chemical Environments. *Metals and materials* **1998**, *4*, 1191.