MSE4170: CORROSION AND PROTECTION OF MATERIALS

Effective Term
Semester A 2024/25

Part I Course Overview

Course Title
Corrosion and Protection of Materials

Subject Code
MSE - Materials Science and Engineering
Course Number
4170

Academic Unit
Materials Science and Engineering (MSE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
AP4170 Environmental Degradation

Exclusive Courses
Nil

Part II Course Details

Abstract

The course is designed to describe the basic principles of electrochemistry, degradation of materials, corrosion protection and applications of these principles in engineering practice. Students will engage with sufficient knowledge to analyze corrosion processes and will be able to solve corrosion problems as well as select materials for corrosion protection.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the basis of electrochemistry, kinetics and passivation.		x	x	
2	Justify and apply standard corrosion test and interpret the test data.		x	x	
3	Relate the principles of electrochemistry to various forms of corrosion and breakdown of passivation.		x	x	x
4	Select proper resistant materials for use in corrosive environment.			x	x

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.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Explain principles of electrochemistry and kinetics	1	3 hrs/week
2	Laboratory	Engage in polarization test and corrosion rate measurements	2	1 hr/week
3	Lecture and tutorial	Describe mechanisms of corrosion and its breakdown	3	3 hrs/week
4	Lecture and group discussion	Engage in discussion of the proper use of materials against crevice and pitting corrosion, stress corrosion cracking and hydrogen embrittlement	4	3 hrs/week

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Oral Presentation and Q&As*	1, 2, 3	20	
2	Writing of laboratory report, analysis of experimental data and assignment	2, 3, 4	10	

Continuous Assessment (%)

30

Examination (%)

70

Examination Duration (Hours)

2

Additional Information for ATs

* You are required to locate a place in CityU campus, where corrosion occurs,
1. identify the details of materials and specific environments
2. diagnose the corrosion (i.e. types, causes and factors)
3. find ways to reduce/prevent the corrosions
4. present your report in oral not over 25 minutes in the form of small groups (4 or 5 students each group)

For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained

Assessment Rubrics (AR)

Assessment Task

1. Oral Presentation and Q&As

Criterion

Describing fundamentals of electrochemistry and corrosion

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

2.Laboratory report

Criterion
Ability to perform experiment and analyse the data

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
3.Final examination

Criterion
Ability to explain and analyse various corrosion mechanisms and capability of selecting materials against corrosion

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Part III Other Information

Keyword Syllabus

- Overview of electrode potential
- Nernst equation
- Pourbaix diagram
- Anodic and cathodic protection
- Electrode kinetics and corrosion rate
- Passivation
- Forms of corrosion

- Materials selection
- Degradation of polymers

Reading List

Compulsory Readings

	Title
1	Corrosion Engineering, by Mars G Fontana, McGraw -Hill (1986)
2	Principles and Prevention of Corrosion, by Denny A Jones, MacMillan Publishing Company (1996)

Additional Readings

	Title
1	http:// www.corrosion-doctors.org