

MSE4170: CORROSION AND PROTECTION OF MATERIALS

Effective Term

Semester A 2022/23

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 aims to cover the basic principles of electrochemistry, degradation of materials, corrosion protection and applications of these principles in engineering practice. Upon successful completion of the course, students will be equipped 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	Carry out 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.

Teaching and Learning Activities (TLAs)

TLAs	Brief Description	CILO No.	Hours/week (if applicable)	
1	Lecture	Explain principles of electrochemistry and kinetics	1	12 hrs
2	Laboratory	Polarization test and corrosion rate measurements	2	8 hrs
3	Lecture and tutorial	Mechanisms of corrosion and its breakdown	3	10.5 hrs
4	Lecture and group discussion	Discuss the proper use of materials against crevice and pitting corrosion, stress corrosion cracking and hydrogen embrittlement	4	8 hrs

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

Understanding 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