MSE6303: CORROSION AND SURFACE ENGINEERING

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Corrosion and Surface Engineering

Subject Code
MSE - Materials Science and Engineering
Course Number
6303

Academic Unit
Materials Science and Engineering (MSE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

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.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-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.		x	x	
2	Explain the thermodynamic and kinetic aspects in corrosion of metals and differentiate two aspects in the corrosion process of metals.			x	x
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.			x	x
4	Apply surface engineering techniques for the protection of metals against corrosion.			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	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.	1, 2, 3	20 hrs

2	Laboratory	Students will perform experiments related to surface engineering of metals.	2, 3, 4	3 hrs
3	Tutorial	Students will participate in tutorial activities to discuss and solidify their understanding on lecture content.	1, 2, 3	10 hrs
4	Group project	Students will participate in groups to identify corrosion in our daily life and identify the proper protection methods against corrosion.	1, 2, 3	6 hrs

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Course assignments	1, 2, 3	10	-	No
2	Laboratory report	2, 3, 4	10	-	No
3	Group project	1, 2, 3	30	-	No

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Assessment Rubrics (AR)

Assessment Task

Assignments (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Understanding fundamentals of electrochemistry, corrosion, materials selection and coatings for corrosion protection

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
Laboratory Report (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Having the ability to perform experiments 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
Group Project (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Identifying corrosion in our daily life and discussing the proper protection methods 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

Assessment Task
Final Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Having the ability to compare and contrast various corrosion mechanisms and the 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

Assessment Task
Assignments (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Understanding fundamentals of electrochemistry, corrosion, materials selection and coatings for corrosion protection

Excellent
(A+, A, A-) High

Good
(B+, B) Moderate

Marginal
(B-, C+, C) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
Laboratory Report (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Having the ability to perform experiments and analyse the data.

Excellent
(A+, A, A-) High

Good
(B+, B) Moderate

Marginal
(B-, C+, C) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
Group Project (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Identifying corrosion in our daily life and discussing the proper protection methods against corrosion.

Excellent
(A+, A, A-) High

Good
(B+, B) Moderate

Marginal
(B-, C+, C) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
Final Examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Having the ability to compare and contrast various corrosion mechanisms and the capability of selecting materials against corrosion

Excellent
(A+, A, A-) High

Good
(B+, B) Moderate

Marginal
(B-, C+, C) Basic

Failure
(F) Not even reaching marginal levels

Part III Other Information

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

Reading List

Compulsory Readings

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

Additional Readings

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