UNIVERSITI TEKNOLOGI MARA

CMT550: ELECTROCHEMISTRY AND CORROSION TECHNOLOGY

Course Name (English)	ELECTROCHEMISTRY AND CORROSION TECHNOLOGY APPROVED
Course Code	CMT550
MQF Credit	3
Course Description	The course is aimed at giving the student a wide overall spectrum on the industrial aspects of corrosion science, including corrosion behavior and corrosion protection of metals.
Transferable Skills	Electrochemistry and corrosion knowledge and applications
Teaching Methodologies	Lectures, Case Study, Directed Self-learning
CLO	CLO1 Explain the concept of electrochemistry and corrosion science (LO1). CLO2 Demonstrate the methods of effective corrosion prevention and the use of electrochemical cell in corrosion study, interpret the experimental data and report experimental findings (LO2). CLO3 Apply kinetics of corrosion equations in corrosion rate calculations (LO3). CLO4 Employ thermodynamics, electrochemical processes governing the corrosion behavior of metals and applications of corrosion prevention/protection techniques in industrial operations (LO3)
Pre-Requisite Courses	No course recommendations

Topics
1. 1.0 Electrochemical Nature of Aqueous Corrosion 1.1) 1.1 Electrochemical cells 1.2) 1.1.1 Components of a cells 1.3) 1.1.2 Conventional representation of a cell 1.4) 1.1.3 Potentials of cells and electrodes 1.5) 1.2 Electrochemical Thermodynamics 1.6) 1.2.1 Work and free energy 1.7) 1.2.2 Standard electrode potentials 1.8) 1.2.3 Nernst equation 1.9) 1.2.4 Equilibrium constant 1.10) 1.2.5 Solubility constant 1.11) 1.3 Potential/pH (Pourbaix) diagram 1.12) 1.3.1 Introduction – uses and limitation 1.13) 1.3.2 Water and dissolved oxygen 1.14) 1.3.3 Construction of aluminium
2. 2.0 Electrolyte Conductance 2.1) 2.1 Introduction to conductance of electrolyte 2.2) 2.2 Theory of ionic conductance 2.3) 2.1.1 Weak electrolytes: The Arhenius theory and Ostwald's dilution law 2.4) 2.1.2 Strong electrolytes: Debye-Huckel theory 2.5) 2.3 Molar conductivities 2.6) 2.4 Molar conductivities at infinite dilution, Kohlrausch's law and Ionic molar conductivities 2.7) 2.5 Degree of dissociation 2.8) 2.6 Ionic equilibia: Equilibium constant and solubility products

3. 3.0 Introduction to Corrosion
3.1) 3.1 Rusting of iron
3.2) 3.2 Types of corrosion
3.3) 3.2.1 General Corrosion
3.4) 3.2.2 Localized Corrosion
3.5) 3.2.2.1 Pitting corrosion
3.6) 3.2.2.2 Crevice corrosion
3.7) 3.2.2.3 Filiform corrosion
3.8) 3.2.3 Galvanic corrosion
3.9) 3.2.4 Cracking Phenomena
3.10) 3.2.4.1 Stress corrosion cracking
3.11) 3.2.4.2 Hydrogen embrittlement
3.12) 3.2.5 Velocity Phenomena
3.13) 3.2.5.1 Erosion corrosion
3.14) 3.2.5.2 Cavitation corrosion
3.15) 3.2.5.3 Impingement corrosion
3.16) 3.2.6 Integranular corrosion
3.17) 3.2.7 Dealloying

4. 4.0 Electrochemical Kinetics of Corrosion
4.1) 4.1 Introduction
4.2) 4.1.1 Faraday's law
4.3) 4.1.2 Exchange current density
4.4) 4.2 Electrochemical polarization
4.5) 4.2.1 Activation polarization
4.6) 4.2.2 Concentration polarization
4.7) 4.2.3 Combined polarization
4.8) 4.3 Mixed potential theory
4.9) 4.3.1 Corrosion potential and current density
4.10) 4.3.2 The E vs log i diagram
4.11) 4.4 Experimental polarization curve
4.12) 4.4.1 Cathodic polarization
4.13) 4.4.2 Anodic polarization
4.14) 4.4.3 Tafel extrapolation

5. 5.0 Corrosion Prevention and Control
5.1) 5.1 Material selection and design
5.2) 5.2 Alteration of environment
5.3) 5.3 Cathodic and anodic protection
5.4) 5.4 Protective coatings
5.5) 5.4.1 Metallic coatings
5.6) 5.4.2 Organic coatings

6. 6.0 Inhibitors
6.1) 6.1 Definition of corrosion inhibitor
6.2) 6.2 Types of inhibitors
6.3) 6.2.1 Anodic inhibitors
6.4) 6.2.2 Cathodic inhibitors
6.5) 6.2.3 Mixed inhibitors
6.6) 6.3 Inhibitor's efficiency

7. 7.0 Passivation
7.1) 7.1 Passive film
7.2) 7.2 Passive potential
7.3) 7.3 Trans-passive state

8. 8.0 Assignment
8.1) Write an assignment regarding corrosion that occurred all around us. The paper must have a clear purpose that explains why it is interesting, a thesis statement or main idea that defines the problem to be addressed, and background information wherever necessary. In addition, you should include evidence in the form of figures, graphs, or tables to support your argument.

Assessment Breakdown	%
Continuous Assessment	50.00%
Final Assessment	50.00%

Details of Continuous Assessment

Assessment Type	Assessment Description	% of Total Mark	CLO
Assignment	Assignment 1	20%	CLO2
Test	Test 1	15%	CLO1
Test	Test 2	15%	CLO3

Reading List	This Course does not have any book resources
Article/Paper List	This Course does not have any article/paper resources
Other References	• **Book Fontana, M. G. 2010, *Corrosion engineering*, MacGraw-Hill, New York** • **Book Denny, A. J. 1992, *Principles and Prevention of Corrosion*, Macmillan, New York**