



Course Code MENG-472	Course Title Corrosion Engineering	ECTS Credits 6
Department Engineering	Semester Fall, Spring	Prerequisites CHEM-106 or MENG-260
Type of Course Elective	Field Engineering	Language of Instruction English
Level of Course 1 st Cycle	Year of Study 4 th	Lecturer(s) Dr Constantinos Hadjistassou
Mode of Delivery Face-to-face	Work Placement N/A	Co-requisites None

Objectives of the Course:

- Outline the problem of corrosion, corrosion induced catastrophic damage and financial costs;
- Present the principles of corrosion and corrosion protection;
- Explain the electrochemical corrosion mechanisms;
- Detail the thermodynamics of materials to corrode;
- Emphasise the importance of Pourbaix diagrams;
- Acquaint attendees with corrosion kinetics;
- Elaborate on the mechanics of metallic material corrosion;
- Substantiate the corrosion of polymers, paints and linings;
- Analyse corrosion induced material failures, marine and high-temperature corrosion;
- Explore the concept of passivity as it pertains to corrosion;
- Focus on corrosion control strategies such as coatings;
- Expand on cathodic protection and the application of corrosion inhibitors;
- Provide guidelines for material selection and heat treatment.

Learning Outcomes:

Upon completion of the course students are expected to:

- Appreciate the problem of corrosion, corrosion related failures, and economic burden of corrosion;
- Acknowledge the mechanisms of corrosion and corrosion protection;
- Become aware of the types of electrochemical cells;
- Acquaint themselves with tendency of materials to corrode;
- Know the characteristics of Pourbaix diagrams for various substances;
- Understand the concepts of polarisation and corrosion rates;
- Recognise the factors which govern the corrosion of plastic materials, linings and paints;
- Familiarise themselves with marine corrosion and the impact of temperature on corrosion dynamics;

- Understand the important aspects of corrosion electrochemistry, material thermodynamics and corrosion behaviour;
- Be able to describe the concept of passivity;
- Propose protective coatings and select materials so as to guard against corrosion.

Course Contents:

Course syllabus comprises:

- Corrosion induced failures, economic impact, various corrosion examples, corrosion related hazards, indirect losses, contamination, environmental damage;
- Overview of corrosion mechanisms, causes of corrosion, functional aspects of corrosion;
- Electrochemical mechanisms, anodic and cathodic reactions, types of cells, classification of corrosion damage;
- Gibb's free energy, electromotive force (emf) of a cell, Nerst equation, pH, galvanic series, liquid junction potentials, influence of acidity;
- Galvanic corrosion, intergranular corrosion, crevice corrosion, pitting corrosion, erosion and biological corrosion, corrosion fatigue, hydrogen damage and liquid metal attack;
- Fundamentals of Pourbaix diagrams, Pourbaix diagrams for iron, water, aluminium, etc;
- Thermodynamics of corrosion, corrosion evaluation and monitoring, electrode kinetics;
- Causes of polarisation, polarised cell, corrosion rates from polarisation data, anode-cathode area ratio;
- Corrosion of polymers: permeation radiation, thermoset polymers;
- Corrosion of linings: liquid and sheet applied linings, elastomeric linings;
- Corrosion of paints: surface preparation, composition of paints, application of paints;
- Selection and application of coatings, cathodic protection, materials selection;
- Corrosion inhibitors, classification of inhibitors, inhibition in acid solutions, applications in near neutral solutions;
- Heat affected zones, design for corrosion in the oil & gas, pipeline and marine industries.

Learning Activities and Teaching Methods:

Lectures, in-class exercises, examples

Assessment Methods:

Problem sheets, mid-term, final exam

Required Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
Roberge R.P.	Corrosion Engineering: Principles and Practice	McGraw Hill	2008	0-07-148243-1

Recommended Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
Javaherdashti R., Nwaoha C. & Tan H.	Corrosion and Materials in the Oil and Gas Industries	CRC Press	2013	978-1-4665- 5625-6
Ahmad Z.	Principles of Corrosion Engineering and Corrosion Control	Elsevier-BH	2006	978-0-7506- 5924-6