



## Course Syllabus

<b>Course Code</b>	<b>Course Title</b>	<b>ECTS Credits</b>
MENG-472	Corrosion Engineering	6
<b>Prerequisites</b>	<b>Department</b>	<b>Semester</b>
CHEM-106	Engineering	Fall, Spring
<b>Type of Course</b>	<b>Field</b>	<b>Language of Instruction</b>
Elective	Engineering	English
<b>Level of Course</b>	<b>Lecturer(s)</b>	<b>Year of Study</b>
1 <sup>st</sup> Cycle	Dr Marios Constantinou	3 <sup>rd</sup> or 4 <sup>th</sup>
<b>Mode of Delivery</b>	<b>Work Placement</b>	<b>Corequisites</b>
Face-to-face	N/A	None

### Course Objectives:

The main objectives of the course are to:

- 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:

After completion of the course students are expected to be able 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 Content:

- 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 / Readings:**

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

**Recommended Textbooks / Readings:**

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