CORROSION ENGINEERING
(Professional Elective-III)

Course Code: 15CH1130	L	T	P	C
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Course Outcomes :

At the end of the Course, the Student will be able to:

CO 1 Recognize the factors that play a role in selection of engineering materials.

CO 2 Differentiate various types of corrosion.

CO 3 Classify various corrosion types and the remedial measures.

CO 4 Identify the methods for preventing corrosion.

CO 5 Select materials of construction for chemical engineering processes and operations to minimize corrosion rates.

UNIT-I   (10 Lectures)

Definitions-explanation with suitable examples Factors affecting the choice of Engineering Material-Factors affecting Corrosion resistance-Dry Corrosion, Wet Corrosion- Corrosive media or environments-acidic, basic, neutral marine-Corrosion Rate expressions-Effect of aeration, flow rate of the medium, corrosive concentration, temperature, pH on the rates of Corrosion. Direct and indirect costs due to corrosion in Industrial practice- Corrosion rates determination from weight loss measurements.

Basic electrochemical relevant to corrosion-Anode, Cathode, electrolyte, conductivity, resistivity,

Electrochemical theories of Corrosion- relevant reactions at the respective metal/alloy electrodes, Mixed Potential theory of Electrochemical Corrosion, Electrode potentials- reversible and irreversible - EMF series, Galvanic Series their significance in

corrosion monitoring-Corrosion Potential-representation by Evans Diagrams-Polarization-Over voltage, Activation and Concentration polarization- Tafels Equation, Tafels constants in determination of Corrosion Current densities and Corrosion rates- Nernst Equation and determination of Corrosion potentials. Thermodynamic aspects of Corrosion reactions- Pourbaix diagram. Potential-pH phase diagram for Iron-Water system.

UNIT-II   (10 Lectures)

A Corrosion Cell –its components with examples –types of corrosion cells generally encountered-concentration cells, galvanic or dissimilar metal cells, temperature differentiation cells, Differential aeration cells. Forms of Corrosion-Uniform, Pitting, crevice corrosion, Cavitation erosion, impingement attack, Corrosion fatigue-metallurgical aspects affecting corrosion reactions Area effect, Grain boundary effect.

UNIT-III   (10 Lectures)

Dezincification, Intergranular Corrosion, mechanism and remedial measures, Stress Corrosion Cracking, Caustic embrittlement, Hydrogen embrittlement mechanism and remedial measures-mechanism of differential aeration corrosion and remedial measures. Biological corrosion due to bacterial habitat, Combination of two dissimilar metal electrodes and relevant current-potential diagrams to evaluate corrosion rates-galvanic Corrosion.

UNIT-IV   (10 Lectures)

Combating Corrosion – Corrosion testing methods: Weight Loss methods, standard expression for corrosion rates-Huey Test, Streicher Test, Warren Test for corrosion. Linear Polarization Technique to evaluate corrosion, interpretation of corrosion data by Nelson's Method.

Corrosion Prevention Methods generally followed-Coatings, Organic (paints) and Inorganic coatings-Chemical Conversion coatings-Altering the environment, inhibitors organic and inorganic, altering or modifying the material, alloying essential design rules during fabrication and other precautions during the choice of the material

for a given service environment. Passivity, Anodic Protection and Cathodic Protection, Sacrificial anode Method –Current impressed Method- galvanizing of steel.

UNIT-V   (10 Lectures)

Selection for a given Chemical Engineering Service Environment-Materials for Chemical Engineering Industry to resist the given chemical Environment-Ferritic, Austenitic steels and stainless steels-Copper and its alloys-Brasses, bronzes, Nickel and its alloys- Monel alloys-materials for a petroleum refinery industry.

TEXT BOOKS:

Fontana. M.G, and Grene., "Corrosion Engineering", 3rd Edition, Tata McGraw Hill, New York, 2005.

REFERENCES:

Uhlig. H.H., "Corrosion and Corrosion Control", 3rd Edition, John Wiley and Sons, New York, 1985.