

Title: Electrochemistry and Protective Coatings (3 units)

1- Fundamental of electrochemistry: concept of the electrode, reversible and irreversible reactions.

2-Charge interfaces: metal-solution interfaces, the electrical double layer, Helmholtz and Gouy-Chapman layers, significance of the electrical double layer to corrosion, the concept of electrode potential and measurement, potential difference across a metal- solution interface, relative electrode potential, the electromotive forces series.

3- Thermodynamic of corrosion: the Nernst equation, Pourbaix diagrams, Pourbaix diagrams for iron, nickel and aluminum, applications and limitations of Pourbaix diagrams.

4-Electrochemical cells: galvanic cells, electrolytic cells, differential cells, oxygen concentration cell, measurement of potential of the cells.

5-Types of the corrosion: uniform corrosion, galvanic corrosion, galvanic series, crevice corrosion, pitting corrosion.

6-The phosphating of metals: type of phosphating, iron phosphating, zinc phosphating, manganese phosphating, kinetic of phosphating, accelerators, effect of practical conditions on its properties, physical and chemical properties of coatings.

7-Anodizing: fundamentals, anodizing in different acids, effect of operating conditions on physical and chemical properties and also structure of anodizing.

8- Organic coatings: coating components, role of resin in coatings, role of anti corrosive pigments in corrosion resistance coatings, permeability of water and oxygen into coatings.

References:

1-E.McCafferty, Introduction to corrosion science, springer 2010

2- Werner Rausch, The phosphating of metals, ASM international, finishing publications, 1990

3-Philip A. Schweitzer P.E, Paint and coatings, applications and corrosion resistance, Taylor and Francis, 2006