



CORROSION - PART I

PROF. KALLOL MONDAL

Department of Metallurgy and Material Science
IIT Kanpur

TYPE OF COURSE : Rerun | Core | UG

COURSE DURATION : 8 weeks (24 Jan' 22 - 18 Mar' 22)

EXAM DATE : 27 Mar' 2022

PRE-REQUISITES : Chemical Thermodynamics, Phase transformation and Electrochemistry

INTENDED AUDIENCE : Bachelor and Master students / Industry people, PhD student

INDUSTRIES APPLICABLE TO : Oil companies, Chemical companies and Power sector

COURSE OUTLINE :

The course will begin with emphasis on the importance of studying Corrosion of materials. Fundamentals of corrosion will be addressed from the angle of thermodynamics and kinetics of electrochemical phenomena. Different forms of corrosion related to materials and mixed potential theory will be discussed. Finally, electrochemical ways of protection of metals and alloys will be explained.

ABOUT INSTRUCTOR :

Prof. Kallol Mondal is an associate professor in the department of Materials Science and Engineering, IIT Kanpur. His specializations are phase transformations of metals and alloys, corrosion and oxidation behavior and multi-phase steel development.

COURSE PLAN :

- Week 1:** Introduction: Definitions, Different forms of Environmental degradation, Cost of Corrosion, Electrochemical Nature, Aims
- Week 2:** Thermodynamics of Corrosion: Process at Interface, Free Energy and Electrochemical Potential, EMF Series
- Week 3:** Thermodynamics of Corrosion: Nernst Relationship, Important Reactions, Cell Potential, Reference Electrodes
- Week 4:** Thermodynamics of Corrosion: Pourbaix diagram and its important in metal corrosion, Calculation of Pourbaix diagram for Al, Cu, Ni and Fe. Kinetics of Corrosion: Current Density and Corrosion Rate, Corrosion Rate Expressions, Exchange Current Density
- Week 5:** Kinetics of Corrosion: Polarization, Activation, Concentration and Resistance polarization
- Week 6:** Mixed potential theory for understanding common corrosion of metals and alloys: Fundamental, Applications to Active metals
- Week 7:** Mixed potential theory for understanding common corrosion of metals and alloys: Passivation, Application of mixed potential theory in passivating metals
- Week 8:** Corrosion protection: Electrochemical ways: Sacrificial anode, Impressed current cathodic protection, Anodic protection