



## Corrosion - Part I

Metallurgy and Material Science

**Instructor Name:** Dr. Kallol Mondal

**Institute:** IIT Kanpur

**Department:** Metallurgy and Material Science

**Course Intro:** : 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.

**Pre Requisites:** : Chemical Thermodynamics, Phase transformation and Electrochemistry

**Core/Elective:** : Core

**UG/PG:** : UG

**Industry Support** : Oil companies, Chemical companies and Power sector

**Reference** : None

**About Instructor:** Kallol Mondal: He is a 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

SL.NO	Week	Module Name
1	1	Introduction: Definitions, Different forms of Environmental degradation, Cost of Corrosion, Electrochemical Nature, Aims
2	2	Thermodynamics of Corrosion: Process at Interface, Free Energy and Electrochemical Potential, EMF Series
3	3	Thermodynamics of Corrosion: Nernst Relationship, Important Reactions, Cell Potential, Reference Electrodes
4	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
5	5	Kinetics of Corrosion: Polarization, Activation, Concentration and Resistance polarization
6	6	Mixed potential theory for understanding common corrosion of metals and alloys: Fundamental, Applications to Active metals
7	7	Mixed potential theory for understanding common corrosion of metals and alloys: Passivation, Application of mixed potential theory in passivating metals
8	8	Corrosion protection: Electrochemical ways: Sacrificial anode, Impressed current cathodic protection, Anodic protection