# Corrosion- Part1

## SWAYAM Prabha Course Code- M19

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| **PROFESSOR'S NAME** | Dr. Kallol Mondol |
| **DEPARTMENT** | Metallurgy and Material Science |
| **INSTITUTE** | IIT Kanpur |
| **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 electrochemicalphenomena. 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. |
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## COURSE DETAILS

| S. No | Module ID/ Lecture ID | Lecture Title/Topic |
|---|---|---|
| 1 | M1L1 | Introduction to corrosion - I |
| 2 | M1L2 | Introduction to corrosion - II |
| 3 | M1L3 | Types and forms of corrosion |
| 4 | M1L4 | Uniform and Galvanic corrosion |
| 5 | M1L5 | Crevice and Pitting corrosion |
| 6 | M2L1 | Forms of corrosion: Explanation with Examples |
| 7 | M2L2 | Electrochemical Nature of Corrosion and its Thermodynamics |
| 8 | M2L3 | Thermodynamics aspects of corrosion-I |
| 9 | M2L4 | Thermodynamics aspects of corrosion-II |
| 10 | M2L5 | Thermodynamics aspects ofcorrosion-III |
| 11 | M3L1 | Relation Between Free Energy and Equilibrium Constant |

| 12 | M3L2 | Derivation of Nernst Equation |
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| 13 | M3L3 | Standard Reduction Potential Series for Pure Metals |
| 14 | M3L4 | Reduction Potentials in Acidic and Neutral Solutions |
| 15 | M3L5 | Nernst equation in terms of pH |
| 16 | M4L1 | Limitations of Standard Reduction Potential Series of Pure Metals |
| 17 | M4L2 | Concentration Cell Formation and Galvanic Series |
| 18 | M4L3 | Examples of Concentration cell and Spontaneity of Corrosion Process |
| 19 | M4L4 | Spontaneity of Corrosion Process and Introduction to Pourbaix Diagram |
| 20 | M4L5 | Construction of Pourbaix Diagram |
| 21 | M5L1 | Construction of Pourbaix diagram for Ni-H2O system-I |
| 22 | M5L2 | Construction of Pourbaix diagram for Ni-H2O system-II |
| 23 | M5L3 | Construction of Pourbaix diagram for Ni-H2O system-III |
| 24 | M5L4 | Pourbaix diagram of Ni-H2O and Al-H2O |
| 25 | M5L5 | Inferences from Pourbaix diagram of Fe-H2O and Al-H2O |
| 26 | M6L1 | Estimation of Corrosion Rate - I |
| 27 | M6L2 | Estimation of Corrosion Rate - II |
| 28 | M6L3 | Estimation of corrosion Rate -III |
| 29 | M6L4 | Exchange current Density |
| 30 | M6L5 | Exchange current Density and Standard hydrogen electrode |
| 31 | M7L1 | Electrical Double Layer and Polarization |
| 32 | M7L2 | Correlation between Current Density and Overvoltage |
| 33 | M7L3 | Introduction to Buttler-Volmer Equation |
| 34 | M7L4 | Derivation of Tafel Equation |

| 35 | M7L5 | Tafel Plot and Activation Polarization |
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| 36 | M8L1 | Activation polarization, concentration polarization and total polarization |
| 37 | M8L2 | Summary of concentration polarization (CP) and introduction to mixed potential theory-I |
| 38 | M8L3 | Mixed potential theory-II |
| 39 | M8L4 | Understanding of mixed potential theory through the case studies and events of corrosion-I |
| 40 | M8L5 | Understanding of mixed potential theory through the case studies and events of corrosion-II |
| 41 | M8L6 | Understanding of mixed potential theory through the case studies and events of corrosion-III |

**References if Any: None**