

MANGALORE UNIVERSITY
Department of Materials Science
MSc Materials Science

MSS 454: SURFACE PHENOMENA AND ELECTROCHEMISTRY (3 Credits)

Objectives: Surface of a material where numerous physical and chemical phenomena are possible and it is one of important aspects of Materials. Thus, this course provides a comprehensive knowledge on surface phenomena, catalysis, electrochemistry and corrosion of materials is the objective this course.

Expected course outcomes: The student should understand the theoretical aspects of catalysis and electrochemical phenomena, which will benefit to pursue research on batteries, fuel cells and corrosion prevention techniques.

Unit I

Surface phenomena - Adsorption, characteristics of adsorption, classification of adsorbents, molecular interactions in adsorption, energetic and desorption, physical and chemical adsorption, adsorption isotherms (Freundlich, Langmuir, BET), determination of surface area of adsorbent, application of adsorption.

Catalysis: Characteristics of catalytic reaction, Classification of catalyst, Kinetics of homogeneous and heterogeneous catalytic reactions, Application of catalysis.

Solid-state chemical reactions: Introduction, Classification, and thermodynamics.

Chemical transport reaction in solid state Experimental methods to study solid state reactions, kinetic features, diffusion mechanism, factors affecting the reactivity of solid state reaction.
14 hours

Unit II

Electrochemistry - Electrolytic conduction- Debye Huckel theory of Interionic attraction- Debye Huckel Limiting Law- Energetics of electrochemical reactions- Electrode potential and EMF-Application of EMF measurements- Potentiometric titration- Electrochemical devices: Galvanic cells (primary and secondary)-concentration cells and fuel cells, polarisation, over voltage, decomposition potential and electrodeposition techniques.
14 hours

Unit III

Corrosion - Introduction and importance of corrosion studies- Theories of corrosion-factors influencing corrosion- Forms of corrosion, Corrosion control measures through Paints, metal coatings, anodic and cathodic protection, Polarization studies-corrosion rate measurement, Tafel extrapolation, passivity, analysis of corrosion failure.

14 hours

References

1. Principles of Material science and Engineering – William.F Smith (McGraw Hill, 1988)
2. Material science and Engineering – V.Raghavan (Printice Hall, 1998)
3. An introduction to Metallic Corrosion and its prevention – Raj Narayan (Oxford and IBH, 1983)
4. Introduction to Electrochemistry – S Glasstone (East West, 1942)
5. Advanced Physical Chemistry – Gurudeep Raj (Goel, 1992)
6. Solid state Chemistry – Hannay (Printice Hall, 1967)
7. Text Book of Material science and Metallurgy – O P Khanna (Dhanpat Rai & Sons, 1984)
8. Engineering Chemistry – Jain & Jain (Dhanpat Rai and Sons, 1993)
9. Solid state Chemistry – Ram Prakash (Radha Publications, 1989)
10. Adsorption – J Oseik (Chichester: Ellis Horwood, 1982)

