

Elective Paper IV (Group C)

Electrochemistry:

60 hrs.

I. Electrokinetic Phenomena:

12 hrs.

Electrokinetic Effects, Electrokinetic potential / Zeta potentials, Determination of zeta potential, influence of ions on electrokinetic phenomena, Electro-Osmosis, Streaming potential, Sedimentation potential. Theoretical and quantitative treatment of electrokinetic phenomena, Electrokinetic Mobility and Bound hydrogen ion.

II. Bioelectrochemistry:

12 hrs.

Threshold phenomena, Donnan Membrane Equilibrium, Membrane Potential, Application of Donnan Membrane Equilibrium, Hodgkin-Huxley Equation, Core conductor model.

Quantum Aspects of Charge transfer at electrode-solution interfaces, quantization of charge transfer tunneling.

Semiconductor Interfaces: Theory of double layer semiconductor solution interfaces, Limiting current in semiconductor electrode.

III. Irreversible Electrode Processes:

12 hrs.

Electrode polarization, Concept of overpotential / overvoltage, Types of overvoltage (Hydrogen overvoltage/Oxygen overvoltage), Measurement of overvoltage, Theories of overvoltage, Importance of overvoltage, Exchange current density, Phase overvoltage, Low overvoltage limit, High overvoltage limit. Passivity and its explanation, Redox Electrochemical Cells, Redox indicators.

IV. Polarography and Voltametry:

12 hrs.

Principle of polarography, variations of the conventional polarographic methods, Pulse Polarography, Oscillographic polarography, Tensammetry, AC polarography, square wave polarography, Anodic stripping and cyclic voltametry, Qualitative and quantitative application of polarography, Determination of stoichiometry and formation constants of complexes. Amperometric titrations and advantages.

V. Solid State Electrochemistry:

12 hrs.

Solid Fuel Cells and Solid state batteries, General principles of semiconductivity and semiconductors, Temperature dependence of electrical resistances, Coherent Length, Piezoelectric effect, Piezoelectric and pyroelectric materials, Conducting polymers, Fullerenes-Doped conductors. Brief idea of Electrochemistry of molten electrolytes and non-aqueous solvents.

Books Suggested

1. Modern Electrochemistry, Vol. I & II, J.M.Bockris and A.K.N.Reddy, Plenum.
2. Introduction to Electrochemistry, S.Glasstone, Van Nostrand.
3. Electroanalytical Chemistry, J.J.Lingane, Wiley Interscience.
4. Polarography, D.R.Crow, J.V. Westwood, Methuen and Co.
5. Principles of Polarography, J.Heyrovsky, P.Zuman and L.Kuta.

6. Solid State Electrochemistry, Haldik, Academic Press.
7. Electrochemistry of solids, H.Rickett, Springer Book.
8. Ions, Electrodes and Membranes, J.Koryta, Wiley & Sons.
9. Electrochemistry, C.W.Devis, George Newone, London
10. Polarography and Voltametry, H.H.Bauer & J.E.O'Reilly.
11. Physical Chemistry, Thomas Engel & Philip Reid, L P E, Pearson Education.
12. Analytical Chemistry, Theory & Practice, U.N.Das, sultan Chand & Sons, New Delhi.
13. Principles of Physical Chemistry, S.H.Maroon & C.F.Prutton, Oxford.