

M.Sc. Semester -IV

Physical Chemistry

CHNN-702(P)

Paper-II

Unit:-1 Solvation and Solvent Effects: 25% (15 Hours)

Qualitative understanding of solvent-solute effects on reactivity. Thermodynamic measure of solvation. Effects of solvation on reaction rates and equilibria.

Various empirical indexes of solvation based on physical properties, solvent sensitive reaction rates, spectroscopic properties and scales of specific solvation, use of solvation scales in mechanistic studies. Solvent effects from the curve crossing model.

Electrochemistry of material science: Corrosion of ultrapure material, cathodic reaction in corrosion, thermodynamics and stability of metals, uses and abuses of Pourbaix diagram, corrosion and Evans diagram, methods of studying corrosion, types of corrosion, inhibition of corrosion, passivation and depassivation. Corrosion of iron in presence and absence of oxygen.

Unit:-2 Ionic liquids: 25% (15 Hours)

Definition, features of ionic liquids, models of ionic liquids (lattice-oriented models and gas-oriented models), solvent properties of fused nonmetallic oxides, fused oxide system in metallurgy.

Protons in solution: conditions of proton solvation, heat of hydration of proton, proton transport (abnormal mobility of proton, conduction by chain reaction, quantum mechanical proton jumps), proton mobility in ice.

Electrochemical energy conversion and storage: Electrochemical generator (Hydrogen oxygen cell, hydrocarbon air cells, natural gas co air cells, dissolved fuel air cells), quantities of electricity storage (storage density, energy density and power), electricity storage using alkali metals and non-aqueous solutions.

Unit:-3 Electro Kinetic Phenomena: 25% (15 Hours)

Electroosmosis, streaming potential, electrophoresis, determination of Zeta potentials, Zeta potentials, influence of ions on electro kinetic phenomena, electrophoretic mobility and bound hydrogen ion.

Quantum aspects of charge transfer: quantum aspects of charge transfer reaction or electrode solution interface, mechanics of electron, penetration of electrons in to classically forbidden regions, probability of electron tunneling through barriers, tunneling condition and proton transfer curve, de-electrons, reaction. A symmetry factor B.

Bio electro chemistry: electrical conduction in biological cells (electronic, protonic), electrochemical mechanism in neurons, interfacial electron transport in biological systems, conduction and electron transport in biological systems.

Unit:-4 Solutions of Non-Electrolytes: 25% (15 Hours)

Solutions of liquids in liquids, Raoult's law, Vapor pressures of ideal solutions

Activity of component in an ideal solution, Chemical potentials of ideal and non-ideal solutions, Gibbs-Duhem-Margules equation, Temperature dependence of vapor pressure of solution, Thermodynamics of ideal solutions, Free energy change of mixing for an ideal solution, Volume change and enthalpy change of mixing for an ideal solution, Entropy change of mixing for an ideal solution

Pressures of non-ideal solutions, Pressure composition and boiling point

Composition curves of completely miscible binary solutions, Fractional distillation of binary liquid solutions, Azeotropic mixtures, Lever rule and fractional distillation, Distillation of immiscible liquids, Solubility of partially miscible liquids, UCST and LCST, Phenol-water system, Aniline-hexane system

Triethylamine-water system, Nicotine-water system, Solutions of gases in liquids, Factors influencing solubility of a gas, Henry's law, Henry's law and Raoult's law Questions and problems

Books:

- (1) Modern Electrochemistry, J OM Bockeris / A.K.N. Reddy, vol. 1 and 2, third edition, plenum press, 1977
- (2) Modern Electrochemistry, J OM Bockeris / A.K.N. Reddy, vol. 1,2 and 3, second edition, springer, 2008
- (3) An introduction to electrochemistry, Samuel Glasstone, 10th edition, D. van Nostrand company, INC 1962
- (4) Evings analytical instrumentation handbook, edited by Jack Cazes, third edition, Instrumental methods of chemical analysis, Galen W. Ewing, fourth edition, Mac Graw hill 1975