Physical Chemistry Semester III

Total Hours:- 90 hrs.

(A) Solid State Chemistry: 30 hrs.

I. Solid State Reactions 4 hrs.

General principles, experimental procedures, co-precipitation as a precursor to solid state reactions, kinetics of solid state reactions.

II. Crystal Defects and Non-Stoichiometry 6 hrs.

Perfect and imperfect crystals, intrinsic and extrinsic defects – point defects, line and plane defects, vacancies-Schottky defects and frenkel defects. Thermodynamics of Schottky and Frenkel defect formation, colour centers, non-stoichiometry and defects.

III. Electronic Properties and Band Theory 15 hrs.

Metals, insulators and semiconductors, electronic structure of solids- band theory, band structure of metals, insulators and semiconductors. Intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions, super conductors.

Optical Properties – Optical reflectance, photoconduction-photoelectric effects.

Magnetic Properties – Classification of materials: Quantum theory of paramagnetics- cooperative phenomena- magnetic domains, hysteresis.

IV. Organic Solids 5 hrs.

Electrically conducting solids, organic charge transfer complex, organic metals, new superconductors.

(B) Photochemistry: 30 hrs.

I. Photochemical Reactions 3 hrs.

Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum yield, transfer of excitation energy.

II. Determination of Reaction Mechanism 5 hrs.

Classification, rate constants and life times of reactive energy states – determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions. Types of photochemical reactions – photo-dissociation, gas-phase photolysis.

III. Energy States of Molecules 10 hrs.

Phosphorescence and the triplet state, Delayed Fluorescence, Energy level diagrams, Intersystem crossing (Jablonski diagram), Franck – Condon Principle, Physical properties of excited molecules, Light emission and chemical reaction from excited states, Radiationless deactivation of excited states, Application of

classical kinetics and thermodynamics to photochemical reactions, Energetic feasibility of a reaction.

IV. Photochemical Process **7 hrs.**

Photoreductions, Photo oxidations, Electron transfer reactions, Photoconduction, Chemiluminiscence, Atom sensitized reactions, sensitization and quenching, Photosensitization, Stern – Volmer equation.
Photosynthesis, Photomorphogenesis and Photochemistry of vision.

V. Experimental Techniques **5 hrs.**

Spectrometry, Actinometry, Flash Photolysis and Laser Beam.

(C) Biophysical Chemistry: **30 hrs.**

I. Biological Cell and its Constituents **2 hrs.**

Biological cell, structure and functions of proteins, enzymes, DNA and RNA in living systems. Helix coil transition.

II. Bioenergetics **3 hrs.**

Standard free energy change in biochemical reactions, exergonic, endergonic. Hydrolysis of ATP, synthesis of ATP from ADP.

III. Statistical Mechanics in Biopolymers **5 hrs.**

Chain configuration of macromolecules, statistical distribution end to end dimensions, calculation of average dimensions for various chain structures. Polypeptide and protein structures, introduction to protein folding problem.

IV. Biopolymer Interactions **5 hrs.**

Forces involved in biopolymer interactions. Electrostatic charges and molecular expansion, hydrophobic forces, dispersion force interactions. Multiple equilibria and various types of binding processes in biological systems. Hydrogen ion titration curves.

V. Thermodynamics of Biopolymer Solutions **4 hrs.**

Thermodynamics of biopolymer solutions, osmotic pressure, membrane equilibrium muscular contraction and energy generation in mechanochemical system.

VI. Cell Membrane and Transport of Ions **3 hrs.**

Structure and functions of cell membrane, ion transport through cell membrane, irreversible thermodynamic treatment of membrane transport. Nerve conduction.

VII. Biopolymers and their Molecular Weights **5 hrs.**

Evaluation of size, shape, molecular weight and extent of hydration of biopolymers by various experimental techniques. Sedimentation

equilibrium, hydrodynamic methods, diffusion, sedimentation velocity, viscosity, electrophoresis and rotational motions.

VIII. Applications of Diffraction Methods in Biopolymers **3 hrs.**

Light scattering, low angle X-ray scattering, X-ray diffraction and photo correlation spectroscopy. ORD.

Books Sugested

1. Solid State Chemistry and its Applications, A.R.West, Plenum.
2. Principles of the Solid State, H.V.Keer, Wiley Eastern.
3. Solid State Chemistry, N.B.Hannay.
4. Solid State Chemistry, D.K.Chakrabarty, New Age International.
5. Fundamentals of Photochemistry, K.K.Rohtagi-Mukherji, Wiley-Eastern.
6. Essentials of Molecular Chemistry, A.Gilbert and J.Baggott, Blackwell Scientific Publication.
7. Molecular Photochemistry, N.J.Turro, W.A.Benjamin.
8. Introductory Photochemistry, A.Cox and T.Camp, McGraw-Hill.
9. Photochemistry, R.P.Kundall and A.Gilbert, Thomson Nelson.
10. Organic Photochemistry, J.Coxon and B.Halten, Cambridge University Press.
11. Principles of Biochemistry, A.L.Lehninger, Worth Publishers.
12. Biochemistry, L.Stryer, W.H.Freeman.
13. Biochemistry, J.David Rawn, Neil Patterson.
14. Biochemistry, Voet and Voet, John Wiley.
15. Outlines of Biochemistry, E.E.Conn and P.K.Stumpf, John Wiley.
16. Bioorganic Chemistry: A Chemical Approach to Enzyme Action, H.Dugas and C. Penny, Springer-Verlag.
17. Macromolecules: Structure and Function, F.Wold, Prentice Hall.