

SEMESTER-VI

PAPER-17

Marks: 150

THEORY

SECTION A- INORGANIC: CHEMISTRY OF INORGANIC SOLIDS, NANOMATERIALS

Unit I: Synthesis and modification of inorganic solids

Conventional heat and beat methods, Co-precipitation method, Sol-gel methods, Hydrothermal method, Ion-exchange and Intercalation methods.

Unit II: Inorganic solids of Technological Importance

Solid electrolytes – Cationic, anionic, mixed Inorganic pigments – coloured solids, white and black pigments

Molecular material and fullerides, molecular materials & chemistry – one-dimensional metals, molecular magnets, inorganic liquid crystal.

Unit III: Nanomaterials

Preparation of gold and silver metallic nanoparticles, self assembled nanostructures-control of nanoarchitecture-one dimensional control. Carbon nano tubes and inorganic nanowires. Bio-inorganic nanomaterials, DNA and nanomaterials, natural and antisical nanomaterials, bionano composites.

Recommended Texts:

1. Shriver & Alkins. Inorganic Chemistry, Peter Alkins, Tina Overton, Jonathan Rourke, Mark Weller and Fraser Armstrong, 5th Edition, Oxford University Press (2011-2012)
2. Adam, D. M. Inorganic Solid; An introduction to concepts in solid-state structural chemistry.

SECTION B-PHYSICAL: MOLECULAR SPECTROSCOPY

Unit I: Molecular Spectroscopy:

Interaction of electromagnetic radiation with molecules and various types of spectra; Born-Oppenheimer approximation.

Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation

energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies.

Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches.

Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion.

Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet states, fluorescence and phosphorescence, dissociation and predissociation, calculation of electronic transitions of polyenes using free electron model.

Recommended Texts:

1. Banwell, C. N. & McCash, E. M. *Fundamentals of Molecular Spectroscopy 4th Ed.*, Tata McGraw-Hill: New Delhi 2006.
2. Brown, J. M. *Molecular Spectroscopy*, Oxford Science Publications, New York 1998.

PRACTICAL

SECTION-A INORGANIC: DETERMINATION OF CATION EXCHANGE AND PREPARATION OF NEWER MATERIALS

1. Synthesis of silver nanoparticles and their spectroscopic characterization
2. Preparation and characterization of polyacrylamide hydrogels by the co precipitation method
3. To determine the percentage of tin and lead present in the given amount of solder by complexometric titrimetric procedures.
4. Spectrometric determination of manganese in steel.

Recommended Text:

1. Fahan, *Materials Chemistry*, Springer 2004.

SECTION-B PHYSICAL: UV-VISIBLE SPECTROSCOPY, COLOURIMETRY AND ADSORPTION

UV/Visible spectroscopy

- I. Study the 200-500 nm absorbance spectra of KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ (in 0.1 M H_2SO_4) and determine the λ_{max} values. Calculate the energies of the two transitions in different units (J molecule^{-1} , kJ mol^{-1} , cm^{-1} , eV)
- II. Record the 200-350 nm UV spectra of the given compounds (acetone, acetaldehyde, 2-propanol, acetic acid) in water. Comment on the effect of structure on the UV spectra of organic compounds.

Colourimetry

- I. Determination of dissociation constant of phenolphthalein indicator.

- II. Study the kinetics of interaction of crystal violet/phenolphthalein with sodium hydroxide colourimetrically.

Adsorption

- I. Verify the Freundlich and Langmuir isotherms for adsorption of acetic acid on activated charcoal.

Recommended Texts:

1. Khosla, B. D.; Garg, V. C. & Gulati, A., *Senior Practical Physical Chemistry*, R. Chand & Co.: New Delhi 2011.
2. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8th Ed.*; McGraw-Hill: New York 2003.
3. Halpern, A. M. & McBane, G. C. *Experimental Physical Chemistry 3rd Ed.*; W.H. Freeman & Co.: New York 2003.
4. Sindhu, P.S. *Practicals in Physical Chemistry 1st Ed.* Macmillan: India 2006.