FOURTH SEMESTER

Code : **CHT-401**   Univ Code :401

Contact Hours :54   Work load : 4 hours per week

Credit Points :

Evaluation: Continuous Internal Assessment   - 30   marks

        Semester and Examination   -   70   marks

PAPER-4

UNIT-I:INORGANIC CHEMISTRY   **18 Hours**

Coordination compounds   **07 hours**

Introduction, nomenclature of coordination compounds. Werner's theory of complexes, experimental evidences in support of Werner's theory.

Classification of ligands: monodentate, bidentate & polydentate ligands with examples, ambidentate ligands, macrocyclic ligands, chelating ligands & chelates. Coordination number & geometry of complexes,

Isomerism in coordination compounds - structural isomerism and stereoisomerism in coordination number 4 & 6.

Stability of complexes, factors affecting the stability of complexes.

Metal-Ligand bonding in complexes   **06 hours**

Sidgwick's electronic interpretation of coordination, Effective atomic number (EAN) rule Limitations of Sidgwick's theory

Valence bond theory (VBT) or Pauling's theory of coordination: postulates, VBT applied to octahedral complexes with example, VBT applied to tetrahedral complexes with example, VBT applied to square planar complexes with example, Limitations of VBT Crystal field theory (CFT): Salient features, CFT applied to octahedral complexes and tetrahedral complexes.

Crystal field stabilization energy (Δ or 10 Dq), Factors affecting crystal field stabilization energy. Spectrochemical series, Measurement of crystal field stabilization energy (Δ or 10 Dq)

Oxidation – Reduction   **05   hours**

Redox potentials, standard redox potentials, use of redox potential data, redox cycle. Redox stability in water- reduction of water, oxidation of water, disproportionation & comproportionation. Diagramatic representation of potential data – Latimer diagrams, Frost diagrams, Porbaux diagrams.

UNIT-II: ORGANIC CHEMISTRY-4 18 Hours Ethers and Epoxides 03 hours

Ethers: Definition, nomenclature, methods of preparation by dehydration of alcohols, heating alkyl halides with Ag_2O and Williamson's ether synthesis. Reactions of ethers (halogenations, auto-oxidation, reactions with dilute H_2SO_4, PCl_5, HX)

Epoxides: Definition, synthesis of epoxides (ethylene oxide may be taken as example), ring opening reactions of ethylene oxide.

Aldehydes and ketones   **06 hours**

Preparation of aldehydes and ketones by alcohols, gem dihalides and alkynes (acetaldehyde and acetone may be taken as examples). Mechanism of nucleophilic addition reactions (with HCN and $NaHCO_3$) and condensation reactions (NH_2OH, NH_2NH_2 and $C_6H_5NHNH_2$) of aldehydes and ketones (acetaldehyde and acetone may be taken as examples). Mechanism of aldol condensation (in acetaldehyde). Mechanism of Cannizaro and Perkin's reactions (in benzaldehyde). Mannich reactionand Wolf-Kishner reduction (mechanism not expected).

Organic compounds of nitrogen   **09 hours**

Reduction reactions of nitrobenzene in acid, alkaline and neutral medium

Amines: Definition, classification with examples of aliphatic and aromatic amines.

Methods of preparation of primary aliphatic amine (methylamine) by alkyl halides, alcohols and Gabriel's method. Distinguishing tests between primary, secondary and tertiary amines by nitrous acid, basic character of amines. Comparison of basic character in the following group of amines (a) CH_3NH_2 , $(CH_3)_2NH$ and $(CH_3)_3N$ (b) $C_6H_5NH_2$, $C_6H_5NHCH_3$ and $C_6H_5N(CH_3)_2$ (c) aniline, p-nitroaniline and p-Toluidine.

Introduction of diazonium salts. Preparation and applications of benzene diazonium chloride. Diazo coupling reactions.

UNIT-III: PHYSICAL CHEMISTRY   **18 Hours**

Liquid mixtures   **06 hours**

Different types of solutions with examples. Binary mixtures of completely miscible liquids, Raoult's law, Ideal and non-ideal solutions (based on Raoult's law). Positive and negative deviations from Raoult's law with examples. Vapor pressure – composition and boiling point – composition diagrams for above types. Principle of fractional distillation, azeoptropic mixtures. Partially miscible liquids – Critical solution temperature, (phenol-water, triethylamine-water & nicotine-water systems)

Phase equilibria   **06 hours**

Statement and meaning of terms – phase, component and degree of freedom. Derivation of Gibb's phase rule. Phase equilibria for one component system (water), phase equilibria for two component system (Lead-silver). Solid-liquid equilibria, KI-water system, Freezing mixtures. Solid solution- compound formation Mg-Zn and $FeCl_3$-H_2O systems.

Colligative properties   **06 hours**

Concept of vapor pressure. Relative lowering of vapor pressure of solvent. Calculation of molecular mass from relative lowering of vapor pressure.

Elevation in boiling point and its relationship with relative lowering of of vapor pressure (to be derived from Clapeyron-Clausius equation). Ebulioscopic constant of solvent, relationship between molar mass and elevation in boiling point. Determination of molar mass of a solute by Land Berger's method.

Depression in freezing point and its relationship to the lowering of vapor pressure, cryoscopic constant of the solvent, relation between depression in freezing point and molecular mass of the solute (to be derived from Clapeyron-Clausius equation). Relation between K_f, m, ΔH and freezing point of solvent.

Abnormal colligative properties, VantHoff's factor, numerical problems.

Code : **CHP-401**   Univ Code :401

Contact Hours :84   Work load : 4 hours per week

Credit Points :

Evaluation: Continuous Internal Assessment   - 10   marks

        Semester and Examination   - 40   marks (30 marks for examination,

05 marks for Practical record and 05 marks for viva-voce)

LABORATORY COURSE-4   **84 Hours**

1. **Physical non-instrumental**

   - **In the beginning two practical durations may be used for instructions and demonstration. Instructions should cover theory and principle of each experiment.**

   - **Minimum 16 experiments are to be given for practical exercise.**

   1. Determine the viscosity of a given liquid using Ostwald's viscometer (determine the density of the liquid).

   2. Determine the viscosity of the two given liquids using Ostwald's viscometer (densities are given).
   3. Determine the percentage composition of given liquid mixture (glycerol and water) using Ostwald's viscometer.
   4. Determine the specific rate constant of hydrolysis of methyl acetate by HCl at room temperature.
   5. Compare the strength of HCl and H_2SO_4 in the hydrolysis of ethyl acetate (K for one acid is given)

   6. Determine the activation energy in the hydrolysis of methyl acetate (K value for one temperature is given)
   7. Determine the heat of neutralization of strong acid and strong base.

   8. Determine the critical solution temperature of phenol-water system.

   9. Determine the percentage of NaCl solution using solubility of phenol in water.

   10. Determine the molecular weight of non-volatile solute by ebullioscopic method.

   11. Investigate the reaction between hydrogen peroxide and hydrogen iodide.

   12. Determine the surface tension of a given liquid using stalagmometer and determine the density of liquid.

13. Determine the surface tension of two given liquids using stalagmometer and calculate the parachor (densities of liquids are given)
14. Determination of percentage composition of liquid mixture (ethyl alcohol and water) by surface tension method).
15. Determine the specific rate constant of second order reaction between KI and $K_2S_2O_8$.
16. Study of adsorption of acetic acid on activated charcoal.
17. Determination of partition coefficient of benzoic acid between water and benzene.
18. Determination of partition coefficient of I_2 between CCl_4 and H_2O.
19. Determine the equilibrium constant of $KI + I_2 \leftrightarrow KI_3$ by distribution law method.
20. Determine the specific rate constant of saponification of ethyl acetate by NaOH.
21. Determination of the molecular weight of non-volatile solute by Rast's method.
22. Studies on a 'clock reaction'. Determination of the activation energy of the bromide bromate reaction.
23. Determination of order of hydrolysis of ethyl acetate by NaOH.
24. Determination of transition temperature of $CaCl_2$ by thermometric method.