

## B.Sc. IVth Semester-Chemistry

**Course No: DSC-2D**

**Course Weightage: 04 Credit**

**No. of Contact hours: 60**

**Attendance: 10**

**Max. Marks: 80**

**End Term Exam: 60**

**Continuous Assessment: 10**

### **Unit-I Coordination Chemistry and Bio inorganic Chemistry: (16 Contact hours)**

#### **Coordination Chemistry:**

Werner Theory and its experimental verification. Effective Atomic number: Concept and its significance.

**Stereochemistry of Coordination compounds:** With coordination numbers 2-6. Optical and Geometrical isomers of  $MA_4B_2$ ,  $MA_3B_3$  and  $MABCD$  type Complexes.

**Bonding in Complexes:** Comparison of valence bond and Crystal field theories; CFT of tetrahedral, square planar and octahedral systems. Spectrochemical Series. Factors affecting magnitude of  $\Delta$  ; pairing energy and CFSE of weak and strong field ligands. Limitations of Crystal field theory.

Applications of Coordination compounds. Jahn Teller Distortion

#### **Bioinorganic chemistry:**

**Introduction to bio-inorganic chemistry:** Biomolecules and their Metal coordination behaviour: Proteins, Nucleic acids.

Abundance of elements in living systems; Concept and Criteria for essentiality of elements in living systems.

**Distribution and biological role of essential elements in life:**  $Na^+$ ,  $K^+$ ,  $Ca^{2+}$ ,  $Mg^{2+}$ ,  $Fe^{2+}$  and halogens.

**Structural and Biological role:** Haemoglobin, and Chlorophyll.

### **UNIT-II Equilibrium and Solution:**

**(14 Contact hours)**

**Equilibrium:** Equilibrium constant and free energy change. Thermodynamic derivation of law of mass action. Clapeyron equation and Clausius-Clapeyron equation, applications.

**Phase Equilibria:** Phase rule, Meaning of the terms: phase, component and degree of freedom, statement and derivation of Gibbs phase rule, phase diagrams of one component system – water and sulphur systems.

Phase equilibria of two component system: solid-liquid equilibria, simple eutectic system (Pb-Ag), desilverisation of lead. Solid solutions - compound formation with congruent melting point (Mg-Zn) and incongruent melting point ( $\text{FeCl}_3\text{-H}_2\text{O}$  systems). Freezing mixtures, acetone- dry ice. Non-ideal systems, azeotropes ( $\text{HCl-H}_2\text{O}$  and  $\text{C}_2\text{H}_5\text{OH-H}_2\text{O}$  systems.) Partially miscible liquids: Lower and upper consolute temperatures, (examples of phenol-water, trimethylamine-water, nicotine-water systems).

**Thermodynamics of Solutions:** Thermodynamics of elevation in boiling point and depression in freezing point. Activity and activity coefficient, determination of activity and activity coefficient with freezing point and EMF methods. Excess thermodynamic functions of non-ideal solutions.

### **Unit-III Amines and Nitrogen bearing Heterocyclic compounds: (14 Contact hours)**

**Amines:** Classification of amines. Basicity of amines, factors affecting basicity of amines. Mechanistic details of methods of preparation of alkyl and aryl amines; reduction of nitro compounds, nitriles. Gabriel-Phthalamide reaction and Hofmann rearrangement. Mechanisms involved in the preparation and properties of arenediazonium salts including Azo coupling. Synthesis of dyes.

**Heterocyclic compounds bearing one nitrogen atom:** Mechanisms involved in the preparations of Indole and quinoline using Fischer-Indole and Bishlier-Napierlaski syntheses. Aromaticity and electrophilic substitution reactions of pyrrole and their comparison with those of furan and thiophene. Structural features of pyrrole, pyrrolidine, pyridine and piperidine and comparative account of their basic strength.

### **Unit-IV Spectroscopy: (16 Contact hours)**

**Spectroscopy:** Electromagnetic radiation, regions of the spectrum, basic features of different spectrometers. Statement of Born-Oppenheimer approximation.

**Rotational spectrum:** Moment of inertia, classification of molecules on the basis of moment of inertia. Energy of a rigid diatomic rotor, selection rules for rotational transition and associated spectrum, relative population of rotational levels and spectral intensity, determination of bond length.

**Vibrational Spectrum:** Classical and quantum mechanical (qualitative) treatment of simple harmonic oscillator, selection rules for vibrational transition, pure vibrational spectrum of a diatomic molecule, determination of force constant, relation of force constant with bond length and bond energy, vibrational degrees of freedom.

**IR Spectrum:** The infrared region, Molecular vibrations, significance of Hook's law and selection rules. The infrared spectrum. Fingerprint region and its significance. Effect of resonance, inductive effect and H-bonding on infrared absorptions. Characteristic absorptions of Alkanes, alkenes, alkynes, alcohols, ethers, carbonyl compounds, amines and carboxylic acids and their derivatives.

***Books Recommended***

1. Coordination Chemistry; Banerjee, D.; Tata Mc Graw Hill; 1997.
2. Concise Coordination Chemistry; Gopalan, R. & Ramalingam, V.; Vikas; 2003.
3. The Biological Chemistry of Elements; Frausto de Silva, J.J. R. & Williams, R.J.P.; Oxford; 1994.
4. Bio-inorganic Chemistry of Elements; Hussain Reddy, K.; New Age; 2005.
5. A textbook of Organic Chemistry; Bansal, R.K.; 4<sup>th</sup> ed.; Wiley Eastern; 2003.
6. Organic Chemistry; Morrison and Boyd ; 6<sup>th</sup> ed. ; PHI; 2003.
7. Fundamentals of Organic Chemistry; Solomons and Fryhle ; 10<sup>th</sup> ed.; John-Wiley; 2012.
8. Reaction Mechanism in Organic Chemistry; Mukherji and Singh; 3<sup>rd</sup> ed.; Macmillan; 2007.
9. Physical Chemistry; Barrow, G. M.; 5<sup>th</sup> ed.; McGraw-Hill; International Student edition; 1992.
10. Physical Chemistry; Alberty , Selby et al; Wiley Eastern Ltd.
11. Fundamentals of Molecular Spectroscopy; Banwell, C.N., E.M.Mc. Cash; 4<sup>th</sup> ed.; Tata McGrawHill; 1994.
12. Electronic Absorption Spectroscopy and related techniques; Sathyanarayana, D N; Universities Press.

## **B.Sc. IVth Semester-Chemistry**

**Course No: DSC-2D Lab**

**Course Weightage: 02 Credit**

**Max. Marks: 20**

**End Term Exam: 15**

**Attendance : 05**

**No. of Contact hours: 30**

### **Section A: Inorganic Chemistry:**

#### **A. Gravimetry:**

1. Estimation of Copper as  $\text{CuSCN}$ .
2. Estimation of Nickel as  $[\text{Ni}(\text{dmg})_2]$ .
3. Estimation of Barium as  $\text{BaSO}_4$

#### **B. Titrimetry:**

1. Preparation of Standard Solution (Oxalic-acid, Sodium Hydroxide, Potassium permanganate and Potassium dichromate) and their dilution. (0.1M-0.001M).
2. Determination of Acetic acid concentrations in commercial Vinegar using NaOH.
3. Determination of alkali content in antacid tablets using HCl.
4. Estimation of hardness of water by EDTA.
5. Estimation of Copper using thiosulphate.

#### **C. Spectrophotometry:**

1. Spectrophotometric determination of Fe (II), using 1, 10-Phenanthroline
2. Spectrophotometric determination of Fe (III) with EDTA.

### **Section B: Organic Chemistry:**

#### **A. Separation and Identification of binary mixtures of Organic Compounds:**

Qualitative analysis of Organic mixture containing two solid components using  $\text{H}_2\text{O}$ ,  $\text{NaHCO}_3$  or NaOH for separation.

#### **B. Synthesis of Organic Compounds (Any two of the following single stage preparations).**

- a) Acetylation of Salicylic acid
- b) Preparation of Iodoform from acetone.
- c) Preparation of m-dinitrobenzene from benzene.
- d) Preparation of p-bromo acetanilide from acetanilide.

#### **Books Recommended:**

1. Vogel's text book of Quantitative Inorganic Analysis (revised); Bassett, J., Denney, R.C., Jeffery, G. H and Mendham, J.; 6<sup>th</sup> ed.; ELBS; 2007.
2. Experimental Inorganic Chemistry; Palmer, W.G.; Cambridge.
3. Analytical Chemistry; Gary D-Christian; 6<sup>th</sup> ed.; Wiley; 2008.

4. Vogel's Textbook of Quantitative Inorganic Analysis; Bassett, J.; Denny, R.C; 6<sup>th</sup> ed.; ELBS; 2007.
5. *Vogel's Qualitative Inorganic Analysis*; Svehla, G.; Pearson Education; 2012.
6. *Vogel's Quantitative Chemical Analysis*; Mendham, J.; Pearson; 2009..
7. Vogel's book of Practical Organic Chemistry; Furniss, B.S., Hannaford, A.J.; Rogers, V.; Smith P.W.G.; 5<sup>th</sup> ed.; ELBS; 2009.
8. Laboratory manual in Organic Chemistry; Bansal, R.K.; Wiley Eastern.
9. Experimental Organic Chemistry; Singh, P.R.; Gupta, D.S. and K.S. Barpal; Vol I & II; Tata McGraw Hill.
10. *Comprehensive Practical Organic Chemistry*; Ahluwalia, V.K. & Aggarwal, R.; Universities Press.
11. *Practical Physical Chemistry*; Khosla, B. D.; Garg, V. C. & Gulati, A., Chand, R. & Co.; 2011.
12. Selected Experiments in Physical Chemistry; Mukherjee N.G.& Ghosh, J.N.; S. Chand & Sons.
13. Experiments in Physical Chemistry; Das, R. C, and Behra, B.; Tata McGraw Hill.