

**B.Sc. Pt.-II / Semester-III**  
**Subject Code: BCH-C301**  
*w.e.f. the session 2021-22 and onwards*

**CHEMISTRY DSC 2C: SOLUTIONS, PHASE EQUILIBRIUM,  
CONDUCTANCE, ELECTROCHEMISTRY & FUNCTIONAL GROUP  
ORGANIC CHEMISTRY-II**

MM : 70  
Credits: 04

Exam.Hrs.: 03  
Lectures: 60

**NOTE:** The question paper shall consist of Two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer (about 150 words) type questions of SIX marks each and student shall be required to attempt any five questions. Sec.-B shall contain 08 descriptive type questions of TEN marks each and student shall be required to attempt any four questions. Both sections shall have questions from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

**Section A: Physical Chemistry-2**

**(30 Lectures)**

**Solutions**

Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperature-composition curves of ideal and non-ideal solutions. Distillation of solutions. Lever rule. Azeotropes.

Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids- Principle of steam distillation. Nernst distribution law and its applications, solvent extraction.

**Phase Equilibrium**

Phases, components and degrees of freedom of a system, criteria of phase equilibrium. Gibbs Phase Rule and its thermodynamic derivation. Derivation of Clausius – Clapeyron equation and its importance in phase equilibria. Phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics, congruent and incongruent melting points (lead-silver, KI-H<sub>2</sub>O and Na-K only).

**Conductance**

Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions. Transference number and its experimental determination using Hittorf and Moving boundary methods. Ionic mobility. Applications of conductance measurements: determination of degree of ionization of weak electrolyte, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt. Conductometric titrations (only acid-base).

**Electrochemistry**

Reversible and irreversible cells. Concept of EMF of a cell. Measurement of EMF of a cell. Nernst equation and its importance. Types of electrodes. Standard electrode potential. Electrochemical series. Thermodynamics of a reversible cell, calculation of thermodynamic properties:  $\Delta G$ ,  $\Delta H$  and  $\Delta S$  from EMF data.

Calculation of equilibrium constant from EMF data. Concentration cells without transference. Liquid junction potential and salt bridge.

pH determination using hydrogen electrode and quinhydrone electrode.  
Potentiometric titrations -qualitative treatment (acid-base and oxidation-reduction only).

### **Section B: Organic Chemistry-3**

**(30 Lectures)**

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

Mono Carboxylic acids (aliphatic and aromatic)

*Preparation:* Acidic and Alkaline hydrolysis of esters.

*Reactions:* Hell – Vohlard - Zelinsky Reaction.

**Carboxylic acid derivatives (aliphatic):** (Upto 5 carbons)

*Preparation:* Acid chlorides, Anhydrides, Esters and Amides from acids and their interconversion.

*Reactions:* Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin condensation. **(6 Lectures)**

### **Amines and Diazonium Salts**

Aliphatic Amines (Upto 5 carbons), Aromatic Amines

*Preparation:* from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction.

*Reactions:* Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with  $\text{HNO}_2$ , Schotten – Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination, sulphonation.

**Benzene Diazonium salts:** *Preparation:* from aromatic amines.

*Reactions:* conversion to benzene, phenol, dyes.

**(6 Lectures)**

### **Amino Acids, Peptides and Proteins:**

*Preparation of Amino Acids:* Strecker synthesis using Gabriel's phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis.

*Reactions of Amino acids:* ester of  $-\text{COOH}$  group, acetylation of  $-\text{NH}_2$  group, complexation with  $\text{Cu}^{2+}$  ions, ninhydrin test.

Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins.

Introduction to peptide & polypeptide, relationship with proteins.

**(10 Lectures)**

**Carbohydrates:** Classification, and General Properties, Glucose and Fructose (open chain and cyclic structure), Determination of configuration of Glucose, Mutarotation, Osazone formation. Drawing the Structure only of disacharrides (sucrose, cellobiose, maltose, lactose) and polysacharrides (starch and cellulose) excluding their structure elucidation. **(8 Lectures)**

### **Reference Books:**

- G. M. Barrow: *Physical Chemistry* Tata McGraw-Hill (2007).
- G. W. Castellan: *Physical Chemistry* 4th Ed. Narosa (2004).
- J. C. Kotz, P. M. Treichel, J. R. Townsend, *General Chemistry*, Cengage Learning India Pvt. Ltd.: New Delhi (2009).
- B. H. Mahan: *University Chemistry*, 3rd Edn. Narosa (1998).
- R. H. Petrucci, *General Chemistry*, 5th Edn., Macmillan Publishing Co.: New

- York (1985).
- Morrison, R. T. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
  - Finar, I. L. *Organic Chemistry (Volume 1)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
  - Finar, I. L. *Organic Chemistry (Volume 2)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
  - Nelson, D. L. & Cox, M. M. *Lehninger's Principles of Biochemistry 7<sup>th</sup> Ed.*, W. H. Freeman.
  - Berg, J. M., Tymoczko, J. L. & Stryer, L. *Biochemistry 7<sup>th</sup> Ed.*, W. H. Freeman