SEMESTER - IV

Course IV (INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY) 60hrs (4 h / w)

Course outcomes:

At the end of the course, the student will be able to;

1. To learn about the laws of absorption of light energy by molecules and the subsequent photochemicalreactions.
2. To understand the concept of quantum efficiency and mechanisms of photochemical reactions.

UNIT -I

Organometallic Compounds **8h**

Definition and classification of organometallic

Compounds on the basis of bond type, Concept of hapticity of organic ligands. Metal carbonyls: 18electronrule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation of mono and binuclear carbonyls of 3d series. P-acceptor behaviour of carbon monoxide. Synergic effects (VB approach) - (MO diagram of CO can be referred to for synergic effect to IR frequencies).

UNIT – II

Carbohydrates **8h**

Occurrence, classification and the its biological importance, Monosaccharides: Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani-Fischer synthesis and Ruff degradation; Disaccharides– Elementary treatment of maltose, lactose and sucrose. Polysaccharides–Elementary treatment of starch.

UNIT- III

Amino acidsandproteins **6h**

Introduction: Definition of Amino acids, classification of Amino acids into alpha, beta, and gamma amino acids. Natural and essential amino acids - definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples - Glycine, Alanine, valine and leucine) by following methods: a) from halogenated carboxylic acid b) Gabriel Phthalimide synthesis c) strecker's synthesis.

Physical properties: Zwitter ion structure - salt like character - solubility, melting points, amphoteric character, definition of isoelectric point.

Chemical properties: General reactions due to amino and carboxyl groups - lactams from gamma and delta amino acids by heating- peptide bond (amide linkage). Structure and nomenclature of peptides and proteins.

HeterocyclicCompounds 7h

Introduction and definition: Simple five membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole - Aromatic character – Preparation from 1, 4, -dicarbonyl compounds, Paul-Knorr synthesis.

Properties: Acidic character of pyrrole - electrophilic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions - Diels Alder reaction in furan.

Pyridine – Structure - Basicity - Aromaticity- Comparison with pyrrole- one method of preparation and properties - Reactivity towards Nucleophilic substitution reaction.

UNIT- IV

Nitrogen Containing Functional Groups

Preparation, properties and important reactions of nitro compounds, amines and diazonium salts.

1. Nitrohydrocarbons 3h

Nomenclature and classification-nitro hydrocarbons, structure -Tautomerism of nitroalkanes leading to aci and keto form, Preparation of Nitroalkanes, reactivity -halogenation, reaction with HONO (Nitrous acid), Nef reaction and Mannich reaction leading to Micheal addition and reduction.

2.Amines: 11h

Introduction, classification, chirality in amines (pyramidal inversion), importance and general methods of preparation.Properties: Physical properties, Basicity of amines: Effect of substituent, solvent and steric effects.

Distinction between Primary, Secondary and tertiary amines using Hinsberg's method and nitrous acid. Discussion of the following reactions with emphasis on the mechanistic pathway: Gabriel Phthalimide synthesis, Hoffmann- Bromamide reaction, Carbylamine reaction, Mannichreaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction and Cope elimination.

Diazonium Salts: Preparation and Synthetic applications of diazonium salts including preparation of arenes, haloarenes, phenols, cyano and nitro compounds. Coupling reactions

of diazonium salts (preparation of azo dyes).

UNIT- V

Photochemistry 5h

Difference between thermal and photochemical processes, Laws of photochemistry- Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield- Photochemical reaction mechanism- hydrogen- chlorine and hydrogen- bromine reaction. Qualitative description of fluorescence, phosphorescence, Jablonski diagram, Photosensitized reactions- energy transfer processes (simple example).

Thermodynamics 12 h

The first law of thermodynamics-statement, definition of internal energy and enthalpy, Heat capacities and their relationship, Joule-Thomson effect- coefficient, Calculation of work for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes, State function. Temperature dependence of enthalpy of formation- Kirchoff s equation, Second law of thermodynamics Different Statements of the law, Carnot cycle and its efficiency, Carnot theorem, Concept of entropy, entropy as a state function, entropy changes in reversible and irreversible processes. Entropy changes in spontaneous and equilibrium processes. Third law of thermodynamics, Nernst heat theorem, Spontaneous and non- spontaneous processes, Helmholtz and Gibbs energies-Criteria forspontaneity.

Co-curricular activities and Assessment Methods Continuous Evaluation: Monitoring the progress of student’s learning Class Tests, Worksheets and Quizzes Presentations, Projects and Assignments and Group Discussions:Enhances critical thinking skills and personality Semester-end Examination: critical indicator of student’s learning and teaching methods adopted by teachers throughout the semester.

List of Reference Books

1. Concise coordination chemistry by Gopalan andRamalingam
2. Coordination Chemistry by Basalo andJohnson
3. Organic Chemistry by G.Mareloudan, PurdueUniv
4. Text book of physical chemistry by SGlasstone
6. Concise Inorganic Chemistry byJ.D.Lee
7. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu andMadan
8. A Text Book of Organic Chemistry by Bahl andArunbahl
9. A Text Book of Organic chemistry by I L FinarVolI
10. A Text Book of Organic chemistry by I L FinarVolII
11. Advanced physical chemistry by GurudeepRaj

LABORATORYCOURSE-IV 30hrs (2 h /w)
Practical Course-IV OrganicQualitativeanalysis 50 M
(At the end of Semester- IV)

Course outcomes:

At the end of the course, the student will be able to;

1. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory.
2. Determine melting and boiling points of organiccompounds
3. Understand the applicationofconceptsofdifferentorganicreactionsstudiedintheorypart of organicchemistry.

OrganicQualitativeanalysis 50 M

Analysis of an organic compound through systematic qualitative procedure for functional group identification including the determination of melting point and boiling point with suitable derivatives.

Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids, Aromatic primary amines, amides and simple sugars

MODEL PAPER

SECOND YEAR B.Sc., DEGREE EXAMINATION

SEMESTER-IV

CHEMISTRY COURSE -IV: INORGANIC, ORGANIC & PHYSICALCHEMISTRY

Time: 3 hours Maximum Marks: 75

PART-A 5 X 5 = 25Marks

Answer any **FIVE** of the following questions. Each carries **FIVE** marks

1. Describe the 18 electron rule of mono nuclear and polynuclear metal carbonyls with suitableexamples.
2. What are epimers and anomers. Giveexamples.
3. Discuss about iso electric point and zwitterion.
4. Discuss the Paul-Knorr synthesis of five membered heterocycliccompounds.
5. Explain Tautomerism shown by nitroalkanes
6. Discuss the basic nature ofamines.
7. Write the differences between thermal and photochemicalreactions.
8. Derive heat capacities and derive $C_p - C_v = R$

PART-B 5 X 10 = 50Marks

Answer **ALL** the questions. Each carries **TEN** marks

9 (a). What are organometallic compounds? Discuss their Classification on the basis of type of bonds withexamples.

(or)

(b). Discuss the general methods of preparations of mono & bi-nuclear carbonyls of 3dseries.

10 (a). Discuss the constitution, configuration and ring size of glucose. Draw the Haworth and Conformational structure ofglucose.

(or)

(b). (i) Explain Ruff's degradation.
(ii) Explain Kiliani- Fischer synthesis.

11.(a). What are amino acids? Write any three general methods of preparation of amino acids.

(or)

(b). Discuss the aromatic character of Furan, Thiophene andPyrrole.

12.(a). Write the mechanism for thefollowing.
(i) Nefreaction (ii) Mannichreaction

(or)

(b).(i) Explain Hinsberg separation of amines.
(ii) Discuss any three synthetic applications of diazoniumsalts.

13.(a). What is quantum yield? Explain the photochemical combination of Hydrogen-Chlorine and Hydrogen -Bromine.

(or)

(b).Define entropy. Describe entropy changes in the reversible and irreversible process.

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