

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM
IV SEMESTER CHEMISTRY Time: 4hrs/week
CH 4202(3) (INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY)
Max. Marks: 100

20-21 admitted batch-"20AH" SYLLABUS
SEMESTER - IV Course IV

COURSE OBJECTIVES: The objective of the course is to

- provide the concepts of nomenclature, classification, synthesis, properties and uses of main group organometallics.
- Describe the synthesis, properties and synthetic applications of various organic compounds.
- provide the concepts of laws of Photochemistry and photo processes.
- enable students to critically examine and apply Gibb's Phase Rule Equation and reduced phase rule equation to one and two component heterogeneous equilibria

COURSE OUTCOMES: By the end of the course student will be able to

- Determine and evaluate quantum efficiency and mechanisms of photochemical reactions.
 - Adopt and apply general methodology reactions and industrial applications of nitro compounds, amines and benzene diazonium chloride
 - Compare the Aromaticity and Electrophilic substitution reactions of Pyrrole, furan, thiophene and Pyridine
 - determine the structure of Glucose and fructose and interpret the synthetic procedures for inter conversions of five membered monosaccharide to six membered ones and vice versa
 - Deduce and quantify the work done by a system under isothermal, adiabatic, reversible and irreversible conditions.
 - Correlate the functioning of cooling devices to the inversion temperature of the coolant gas and iso enthalpic nature of the process
 - Predict process feasibility, extent and also determine the efficiency of a heat engine
 - Explain theories involved in bonding in metals, describe conductors, semi conductors and insulators which helps in building their career in battery industry.
 - Explain EAN rule, classification, structures and shapes of metal carbonyls which help in the basis of medicinal uses.
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COURSE:

UNIT - I Organometallic Compounds 8h

Definition and classification of organometallic Compounds on the basis of bond type, Concept of hapticity of organic ligands. Metalcarbonyls: 18 electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation of mono and binuclear carbonyls of 3d series. π -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 their 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 acids and proteins 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.

Heterocyclic Compounds

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 nitrocompounds, amines and diazonium salts.

1.Nitro hydrocarbons

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 Michael 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, Mannich reaction, 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- Kirch off 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 for spontaneity.

Co-curricular activities and Assessment Methods Continuous Evaluation : Monitoring the progress of student's learning Class Tests, Work sheets 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 and Ramalingam
2. Coordination Chemistry by Basalo and Johnson
3. Organic Chemistry by G.Mareloudan, Purdue Univ
4. Text book of physical chemistry by S Glasstone
6. Concise Inorganic Chemistry by J.D.Lee
7. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
8. A Text Book of Organic Chemistry by Bahl and Arunbahl

9. A Text Book of Organic chemistry by I L Finar Vol I
10. A Text Book of Organic chemistry by I L Finar Vol II
11. Advanced physical chemistry by Gurudeep Raj