

ADIKAVI NANNAYA UNIVERSITY
RAJAMAHENDRAVARAM
CBCS / Semester System
(W.e.f. 2016-17 Admitted Batch)
I Semester Syllabus
CHEMISTRY

Paper I - Inorganic & Organic Chemistry 60hrs (4h/w)

INORGANIC CHEMISTRY 30 hrs (2h / w)

UNIT –I

p-block elements –I 15h

Group-13: Synthesis and structure of diborane and higher boranes
(B_4H_{10} and B_5H_9), boron-nitrogen compounds ($B_3N_3H_6$ and BN) and carboranes
Group - 14: Preparation and applications of silanes, silicones and graphitic compounds.
Group - 15: Preparation and reactions of hydrazine, hydroxylamine and Phosphazenes.

UNIT-II

1. p-block elements -II 8h

Group - 16: Classifications of oxides based on (i) Chemical behaviour and
(ii) Oxygen content, Oxyacids of sulphur (structures only).
Group-17: Inter halogen compounds, pseudo halogens and comparison with halogens.

2. Organometallic Chemistry 7h

Definition - classification of Organometallic compounds - nomenclature, preparation, properties and applications of alkyls of Li and Mg.

ORGANIC CHEMISTRY 30hrs (2h /w)

UNIT-III

Structural theory in Organic Chemistry 10 h

Types of bond fission and organic reagents (Electrophilic, Nucleophilic, and free radical reagents including neutral molecules like H_2O , NH_3 & $AlCl_3$).

Bond polarization: Factors influencing the polarization of covalent bonds, electro negativity - inductive effect. Application of inductive effect (a) Basicity of amines (b) Acidity of carboxylic acids (c) Stability of carbonium ions. Resonance or Mesomeric effect, application to (a) acidity of phenol, and (b) acidity of carboxylic acids. Hyper conjugation and its application to stability of carbonium ions, Free radicals and alkenes, carbanions, carbenes and nitrenes.

Types of Organic reactions : Addition - electrophilic, nucleophilic and free radical. Substitution - electrophilic, nucleophilic and free radical. Elimination- Examples.

UNIT-IV

1. Acyclic Hydrocarbons

6 h

Alkenes - Preparation of alkenes. Properties: Addition of hydrogen - heat of hydrogenation and stability of alkenes. Addition of halogen and its mechanism. Addition of HX, Markonikov's rule, addition of H₂O, HOX, H₂SO₄ with mechanism and addition of HBr in the presence of peroxide (anti - Markonikov's addition). Dienes - Types of dienes, reactions of conjugated dienes - 1,2 and 1,4 addition of HBr to 1,3 - butadiene and Diel's - Alder reaction.

Alkynes - Preparation by dehydrohalogenation of dihalides, dehalogenation of tetrahalides, Properties; Acidity of acetylenic hydrogen (formation of Metal acetylides). Preparation of higher acetylenes, Metal ammonia reductions, Physical properties. Chemical reactivity - electrophilic addition of X₂, HX, H₂O (Tautomerism), Oxidation with KMnO₄, OsO₄, reduction and Polymerisation reaction of acetylene.

2. Alicyclic hydrocarbons (Cycloalkanes)

4 h

Nomenclature, Preparation by Freund's method, Wislicenus method. Properties - reactivity of cyclopropane and cyclobutane by comparing with alkanes, Stability of cycloalkanes - Baeyer's strain theory, Sachse and Mohr predictions and Pitzer's strain theory. Conformational structures of cyclobutane, cyclopentane, cyclohexane.

UNIT-V

Benzene and its reactivity

10h

Concept of resonance, resonance energy. Heat of hydrogenation, heat of combustion of Benzene, mention of C-C bond lengths and orbital picture of Benzene. Concept of aromaticity - aromaticity (definition), Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation)

Reactions - General mechanism of electrophilic substitution, mechanism of nitration, Friedel Craft's alkylation and acylation. Orientation of aromatic substitution - Definition of ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like NO₂ and Phenolic). Orientation of (i) Amino, methoxy and methyl groups (ii) Carboxy, nitro, nitrile, carbonyl and sulphonic acid groups (iii) Halogens
(Explanation by taking minimum of one example from each type)

List of Reference Books

1. Inorganic Chemistry by J.E.Huheey
2. Basic Inorganic Chemistry by Cotton and Wilkinson
3. A textbook of qualitative inorganic analysis by A.I. Vogel
4. Organic Chemistry by Morrison and Boyd
5. A Text Book of Organic chemistry by I L Finar Vol I
6. Concise Inorganic Chemistry by J.D.Lee
7. A Text Book of Organic Chemistry by B.S. Bahl and Arun Bahl

LABORATORY COURSE-I
Practical-I Simple Salt Analysis
(At the end of Semester-I)

30 hrs (2 h / w)

Qualitative Inorganic Analysis

50 Marks

Analysis of simple salt containing one anion and cation from the following

Anions: Carbonate, Sulphate, Chloride, Bromide, Acetate, Nitrate, Borate, Phosphate.

Cations: Lead, Copper, Iron, Aluminum, Zinc, Manganese, Nickel, Calcium, Strontium, Barium, Potassium and Ammonium.

ADIKAVI NANNAYA UNIVERSITY: RAJAMAHENDRAVARAM
CBCS/ SEMESTER SYSTEM
II SEMESTER: B.Sc. CHEMISTRY

(FOR 2016-17 ADMITTED BATCH)

Paper II (Physical & General Chemistry) 60 hrs. (4h/w)

PHYSICAL CHEMISTRY 30 hrs (2h / w)

UNIT-I

Solid-state

10h

Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. The law of symmetry. Definition of lattice point, space lattice, unit cell. Bravais lattices and crystal systems. X-ray diffraction and crystal structure. Bragg's law. Defects in crystals. Stoichiometric and non-stoichiometric defects.

UNIT-II

1.Gaseous state

6 h

Compression factors, deviation of real gases from ideal behavior. Vander Waal's equation of state. P-V Isotherms of real gases, Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. The Vander Waal's equation and the critical state. Law of corresponding states. Relationship between critical constants and Vander Waal's constants. Joule Thomson effect.

2.Liquid state

4 h

Structural differences between solids, liquids and gases. Liquid crystals, the mesomorphic state. Classification of liquid crystals into Smectic and Nematic. Differences between liquid crystal and solid/liquid. Application of liquid crystals as LCD devices.

UNIT-III

Solutions

10h

Liquid-liquid - ideal solutions, Raoult's law. Ideally dilute solutions, Henry's law. Non-ideal solutions. Vapour pressure - composition and vapour pressure- temperature curves. Azeotropes-HCl-H₂O, ethanol-water systems and fractional distillation. Partially miscible liquids-phenol-water, trimethylamine-water, nicotine-water systems. Effect of impurity on consolute temperature. Immiscible liquids and steam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

GENERAL CHEMISTRY

30 hrs (2h / w)

UNIT-IV

I.Surface chemistry

8 h

Definition of colloids. Solids in liquids(sols), preparation, purification, properties - kinetic, optical, electrical. Stability of colloids, Hardy-Schulze law, protective colloid.

Liquids in liquids (emulsions) preparation, properties, uses. Liquids in solids (gels) preparation, uses.

Adsorption: Physical adsorption, chemisorption. Freundlich, Langmuir adsorption isotherms. Applications of adsorption

2. Chemical Bonding

7h

Valence bond theory, hybridization, VB theory as applied to ClF_3 , $\text{Ni}(\text{CO})_4$, Molecular orbital theory - LCAO method, construction of M.O. diagrams for homo-nuclear and hetero-nuclear diatomic molecules (N_2 , O_2 , CO and NO).

UNIT-V

Stereochemistry of carbon compounds

15 h

Molecular representations- Wedge, Fischer, Newman and Saw-Horse formulae.

Optical isomerism: Optical activity- wave nature of light, plane polarised light, optical rotation and specific rotation.

Chiral molecules- definition and criteria (Symmetry elements)- Definition of enantiomers and diastereomers – Explanation of optical isomerism with examples Glyceraldehyde, Lactic acid, Alanine, Tartaric acid, 2,3-dibromopentane.

D,L and R,S configuration methods and E,Z- configuration with examples.

List of Reference Books

1. Principles of physical chemistry by Prutton and Marron
2. Solid State Chemistry and its applications by Anthony R. West
3. Text book of physical chemistry by K L Kapoor
4. Text book of physical chemistry by S Glasstone
5. Stereochemistry of Organic compounds by E L Eliel
6. Advanced Organic Chemistry by F A Carey and R J Sundberg
7. Stereochemistry by P.S.Kalsi
8. Stereochemistry of Organic compounds by D. Nasipuri
9. Advanced physical chemistry by Bahl and Tuli
10. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan

LABORATORY COURSE -II

30 hrs (2 h / w)

Practical-II Analysis of Mixture Salt
(At the end of Semester-II)

Qualitative inorganic analysis

Analysis of mixture salt containing two anions and two cations (From two different groups) from the following:

Anions: Carbonate, sulphate, chloride, bromide, acetate, nitrate, borate, phosphate.

Cations: Lead, copper, iron, aluminum, zinc, manganese, calcium, strontium, barium, potassium and ammonium.

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CBCS / Semester System
(W.e.f. 2015-16 Admitted Batch)
III Semester Syllabus

CHEMISTRY

Paper III - INORGANIC & ORGANIC CHEMISTRY 60 hrs (4 h / w)

INORGANIC CHEMISTRY

30 hrs (2h / w)

UNIT –I

1. Chemistry of d-block elements:

9h

Characteristics of d-block elements with special reference to electronic configuration, variable valence, magnetic properties, catalytic properties and ability to form complexes. Stability of various oxidation states.

2. Theories of bonding in metals:

6h

Metallic properties and its limitations, Valence bond theory, Free electron theory, Explanation of thermal and electrical conductivity of metals, limitations, Band theory, formation of bands, explanation of conductors, semiconductors and insulators.

UNIT – II

1. Metal carbonyls :

7h

EAN rule, classification of metal carbonyls, structures and shapes of metal carbonyls of V, Cr, Mn, Fe, Co and Ni.

2. Chemistry of f-block elements:

8h

Chemistry of lanthanides - electronic structure, oxidation states, lanthanide contraction, consequences of lanthanide contraction, magnetic properties. Chemistry of actinides - electronic configuration, oxidation states, actinide contraction, comparison of lanthanides and actinides, separation of lanthanides by ion exchange method and solvent extraction method.

ORGANIC CHEMISTRY

30 h (2h/w)

UNIT – III

1. Halogen compounds

5 h

Nomenclature and classification of alkyl (into primary, secondary, tertiary), aryl, aryl alkyl, allyl, vinyl, benzyl halides.

Nucleophilic aliphatic substitution reaction- classification into SN^1 and SN^2 – reaction mechanism with examples – Ethyl chloride, t-butyl chloride and optically active alkyl halide 2-bromobutane.

2. Hydroxy compounds

5 h

Nomenclature and classification of hydroxy compounds.

Alcohols: Preparation with hydroboration reaction, Grignard synthesis of alcohols.

Phenols: Preparation i) from diazonium salt, ii) from aryl sulphonates, iii) from cumene. Physical properties- Hydrogen bonding (intermolecular and intramolecular).

Effect of hydrogen bonding on boiling point and solubility in water.

Identification of alcohols by oxidation with KMnO_4 , Ceric ammonium nitrate, Luca's reagent and phenols by reaction with FeCl_3 .

Chemical properties:

a) Dehydration of alcohols.

b) Oxidation of alcohols by CrO_3 , KMnO_4 .

c) Special reaction of phenols: Bromination, Kolbe-Schmidt reaction, Riemer-Tiemann reaction, Fries rearrangement, azocoupling, Pinacol-Pinacolone rearrangement.

UNIT-IV

Carbonyl compounds

10 h

Nomenclature of aliphatic and aromatic carbonyl compounds, structure of the carbonyl group. Synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties: Reactivity of carbonyl group in aldehydes and ketones.

Nucleophilic addition reaction with a) NaHSO_3 , b) HCN , c) RMgX , d) NH_2OH , e) PhNHNH_2 , f) 2,4 DNPH, g) Alcohols-formation of hemiacetal and acetal. Base catalysed reactions: a) Aldol, b) Cannizzaro's reaction, c) Perkin reaction, d) Benzoin condensation, e) Haloform reaction, f) Knoevenagel reaction. Oxidation of aldehydes- Baeyer-Villiger oxidation of ketones. Reduction: Clemmensen reduction, Wolf-Kishner reduction, MPV reduction, reduction with LiAlH_4 and NaBH_4 . Analysis of aldehydes and ketones with a) 2,4-DNPH test, b) Tollen's test, c) Fehling test, d) Schiff's test e) Haloform test (with equation)

UNIT-V

1. Carboxylic acids and derivatives

6 h

Nomenclature, classification and structure of carboxylic acids. Methods of preparation by a) Hydrolysis of nitriles, amides b) Hydrolysis of esters by acids and bases with mechanism c) Carbonation of Grignard reagents. Special methods of preparation of aromatic acids by a) Oxidation of side chain. b) Hydrolysis by benzotrichlorides. c) Kolbe reaction. Physical properties: Hydrogen bonding, dimeric association, acidity-strength of acids with examples of trimethyl acetic acid and trichloroacetic acid. Relative differences in the acidities of aromatic and aliphatic acids. Chemical properties: Reactions involving H, OH and COOH groups- salt formation, anhydride formation, acid chloride formation, amide formation and esterification (mechanism). Degradation of carboxylic acids by Huns-Diecker reaction, decarboxylation by Schimdt reaction, Arndt-Eistert synthesis, halogenation by Hell- Volhard- Zelinsky reaction.

2. Active methylene compounds

4 h

Acetoacetic ester: keto-enol tautomerism, preparation by Claisen condensation, Acid hydrolysis and ketonic hydrolysis. Preparation of a) monocarboxylic acids. b) Dicarboxylic acids. c) Reaction with urea

Malonic ester: preparation from acetic acid. Synthetic applications: Preparation of a) monocarboxylic acids (propionic acid and n-butyric acid). b) Dicarboxylic acids (succinic acid and adipic acid) c) α,β -unsaturated carboxylic acids (crotonic acid). d) Reaction with urea.

List of Reference Books

1. Selected topics in inorganic chemistry by W.D.Malik, G..D.Tuli,R.D.Madan
2. Inorganic Chemistry J E Huheey, E A Keiter and R L Keiter
3. A Text Book of Organic Chemistry by B.S. Bahl and Arun Bahl
4. A Text Book of Organic chemistry by Vol I by I.L. Finar Vol I
5. Organic chemistry by Bruice
6. Organic chemistry by Clayden
7. Advanced Inorganic chemistry by Gurudeep Raj
8. Basic Inorganic Chemistry by Cotton and Wilkinson
9. Concise Inorganic Chemistry by J.D.Lee

**Practical -III: Titrimetric Analysis and Organic Functional Group Reactions
(At the end of Semester-III) 50 Marks**

Titrimetric analysis

1. Determination of Fe (II) using KMnO_4 with oxalic acid as primary standard.
2. Determination of Cu(II) using $\text{Na}_2\text{S}_2\text{O}_3$ with $\text{K}_2\text{Cr}_2\text{O}_7$ as primary standard.

Organic Functional Group Reactions

3. Reactions of the following functional groups present in organic compounds:
(at least four) Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids and Amides

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IV SEMESTER : B.Sc CHEMISTRY
W.E.FROM 2015-16 ADMITTED BACH

Paper IV (SPECTROSCOPY & PHYSICAL CHEMISTRY)

60 hrs (4 h / w)

SPECTROSCOPY

30 hrs (2h / w)

UNIT-I

6h

General features of absorption - Beer-Lambert's law and its limitations, transmittance, Absorbance, and molar absorptivity. Single and double beam spectrophotometers. Application of Beer-Lambert law for quantitative analysis of 1. Chromium in $K_2Cr_2O_7$
2. Manganese in Manganous sulphate

Electronic spectroscopy:

8h

Interaction of electromagnetic radiation with molecules and types of molecular spectra. Energy levels of molecular orbitals (σ , π , n). Selection rules for electronic spectra. Types of electronic transitions in molecules effect of conjugation. Concept of chromophore and auxochrome.

UNIT-II

Infra red spectroscopy

8h

Different Regions in Infrared radiations. Modes of vibrations in diatomic and polyatomic molecules. Characteristic absorption bands of various functional groups. Interpretation of spectra-Alkanes, Aromatic, Alcohols carbonyls, and amines with one example to each.

Proton magnetic resonance spectroscopy (1H -NMR)

8h

Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals - spin-spin coupling, coupling constants. Applications of NMR with suitable examples - ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate, toluene and acetophenone.

PHYSICAL CHEMISTRY

30 hrs (2h / w)

UNIT-III

Dilute solutions

10h

Colligative properties. Raoult's law, relative lowering of vapour pressure, its relation to molecular weight of non-volatile solute. Elevation of boiling point and depression of freezing point. Derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods of determination. Osmosis, osmotic pressure, experimental determination. Theory of dilute solutions. Determination

of molecular weight of non-volatile solute from osmotic pressure. Abnormal Colligative properties- Van't Hoff factor.

UNIT-IV

Electrochemistry-I

10h

Specific conductance, equivalent conductance. Variation of equivalent conductance with dilution. Migration of ions, Kohlrausch's law. Arrhenius theory of electrolyte dissociation and its limitations. Ostwald's dilution law. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Definition of transport number, determination by Hittorfs method. Application of conductivity measurements- conductometric titrations.

UNIT-V

1. Electrochemistry-II

4h

Single electrode potential, sign convention, Reversible and irreversible cells Nernst Equation- Reference electrode, Standard Hydrogen electrode, calomel electrode, Indicator electrode, metal – metal ion electrode, Inert electrode, Determination of EMF of cell, Applications of EMF measurements - Potentiometric titrations.

2.Phase rule

6h

Concept of phase, components, degrees of freedom. Thermodynamic Derivation of Gibbs phase rule. Phase equilibrium of one component system - water system. Phase equilibrium of two- component system, solid-liquid equilibrium. Simple eutectic diagram of Pb-Ag system, simple eutectic diagram, desilverisation of lead., NaCl-Water system, Freezing mixtures.

List of Reference Books

1. Spectroscopy by William Kemp
2. Spectroscopy by Pavia
3. Organic Spectroscopy by J. R. Dyer
4. Modern Electrochemistry by J.O. M. Bockris and A.K.N.Reddy
5. Advanced Physical Chemistry by Atkins
6. Introduction to Electrochemistry by S. Glasstone
7. Elementary organic spectroscopy by Y.R. Sharma
8. Spectroscopy by P.S.Kalsi

LABORATORY COURSE – IV
Practical Paper - IV Physical Chemistry and IR Spectral Analysis
(at the end of semester IV)

30 hrs (2 h / W)

Physical Chemistry

25M

1. Critical Solution Temperature- Phenol-Water system
2. Effect of NaCl on critical solution temperature (Phenol-Water system)
3. Determination of concentration of HCl conductometrically using standard NaOH solution.
4. Determination of concentration of acetic acid conductometrically using standard NaOH Solution.

IR Spectral Analysis

25 M

5. IR Spectral Analysis of the following functional groups with examples
 - a) Hydroxyl groups
 - b) Carbonyl groups
 - c) Amino groups
 - d) Aromatic groups

ADIKAVI NANNAYA UNIVERSITY
CBCS SEMESTER PATTERN
CHEMISTRY
w.e.f. 2015-16 admitted batch
SEMESTER-V

Paper - V (INORGANIC, ORGANIC & PHYSICAL CHEMISTRY)
45 hrs (3 h / w)

INORGANIC CHEMISTRY

UNIT – I

Coordination Chemistry:

8h

IUPAC nomenclature - bonding theories - Review of Werner's theory and Sidgwick's concept of coordination - Valence bond theory - geometries of coordination numbers 4-tetrahedral and square planar and 6-octahedral and its limitations, crystal field theory - splitting of d-orbitals in octahedral, tetrahedral and square-planar complexes - low spin and high spin complexes - factors affecting crystal-field splitting energy, merits and demerits of crystal-field theory. Isomerism in coordination compounds - structural isomerism and stereo isomerism, stereochemistry of complexes with 4 and 6 coordination numbers.

UNIT-II

1. Spectral and magnetic properties of metal complexes:

4h

Types of magnetic behavior, spin-only formula, calculation of magnetic moments, experimental determination of magnetic susceptibility-Gouymethod.

2. Stability of metal complexes:

3h

Thermodynamic stability and kinetic stability, factors affecting the stability of metal complexes, chelate effect, determination of composition of complex by Job's method and mole ratio method.

ORGANIC CHEMISTRY

UNIT- III

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 Micheal addition and reduction.

UNIT – IV

Nitrogen compounds:

12h

Amines (Aliphatic and Aromatic): Nomenclature, Classification into 1°, 2°, 3° Amines and Quarternary ammonium compounds. Preparative methods –

1. Ammonolysis of alkyl halides 2. Gabriel synthesis 3. Hoffman's bromamide reaction (mechanism).

Reduction of Amides and Schmidt reaction. Physical properties and basic character - Comparative basic strength of Ammonia, methyl amine, dimethyl amine, trimethyl amine and aniline - comparative basic strength of aniline, N-methylaniline and N,N-dimethyl aniline (in aqueous and non-aqueous medium), steric effects and substituent effects. Chemical properties: a) Alkylation b) Acylation c) Carbylamine reaction d) Hinsberg separation e) Reaction with Nitrous acid of 1°, 2°, 3° (Aliphatic and aromatic amines). Electrophilic substitution of Aromatic amines – Bromination and Nitration. Oxidation of aryl and Tertiary amines, Diazotization.

PHYSICAL CHEMISTRY

UNIT- V

Thermodynamics

15h

The first law of thermodynamics-statement, definition of internal energy and enthalpy. Heat capacities and their relationship. Joule-Thomson effect- coefficient. Calculation of w , 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.

List of Reference Books

1. Concise coordination chemistry by Gopalan and Ramalingam
2. Coordination Chemistry by Basalo and Johnson
3. Organic Chemistry by G.Mare loudan, Purdue Univ
4. Advanced Physical Chemistry by
5. 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 Arun bahl
9. A Text Book of Organic chemistry by I L Finar Vol I
10. Advanced physical chemistry by Gurudeep Raj

SEMESTER-V

Paper - VI (INORGANIC, ORGANIC & PHYSICAL CHEMISTRY)

45 hrs (3 h / w)

INORGANIC CHEMISTRY

UNIT-I

1. Reactivity of metal complexes: 4h

Labile and inert complexes, ligand substitution reactions - SN^1 and SN^2 , substitution reactions of square planar complexes - Trans effect and applications of trans effect.

2. Bioinorganic chemistry: 4h

Essential elements, biological significance of Na, K, Mg, Ca, Fe, Co, Ni, Cu, Zn and Cl⁻. Metalloporphyrins – Structure and functions of hemoglobin, Myoglobin and Chlorophyll.

ORGANIC CHEMISTRY

UNIT- II

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-III

Carbohydrates 8h

Monosaccharides: (+) Glucose (aldo hexose) - Evidence for cyclic structure of glucose (some negative aldehydes tests and mutarotation) - Proof for the ring size (methylation, hydrolysis and oxidation reactions) - Pyranose structure (Haworth formula and chair conformational formula).

(-) Fructose (ketohexose) - Evidence of 2 - ketohexose structure (formation of pentaacetate, formation of cyanohydrin its hydrolysis and reduction by HI). Cyclic structure for fructose (Furanose structure and Haworth formula) - osazone formation from glucose and fructose – Definition of anomers with examples.

Interconversion of Monosaccharides: Aldopentose to Aldohexose (Arabinose to D- Glucose, D-Mannose) (Kiliani - Fischer method). Epimers, Epimerisation - Lobry de bruyn van Ekenstein rearrangement. Aldohexose to Aldopentose (D-Glucose to D- Arabinose) by Ruff degradation. Aldohexose to Ketohexose

[(+)] Glucose to (-) Fructose] and Ketohexose to Aldohexose (Fructose to Glucose)

UNIT- IV

Amino acids and proteins

7h

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) Malonic ester 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.

PHYSICAL CHEMISTRY

UNIT-V

1. Chemical kinetics

8h

Rate of reaction - Definition of order and molecularity. Derivation of rate constants for first, second, third and zero order reactions and examples. Derivation for time half change. Methods to determine the order of reactions. Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy.

2. 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, hydrogen- bromine reaction. Qualitative description of fluorescence, phosphorescence, Photosensitized reactions- energy transfer processes (simple example)

List of Reference Books

1. Concise coordination chemistry by Gopalan and Ramalingam
2. Coordination Chemistry by Basalo and Johnson
3. Organic Chemistry by G.Mare loudan, Purdue Univ
4. Advanced Physical Chemistry by Atkins
5. Text book of physical chemistry by S Glasstone
7. Instrumentation and Techniques by Chatwal and Anand
8. Essentials of nano chemistry by pradeep
9. A Textbook of Physical Chemistry by Puri and Sharma
10. Advanced physical chemistry by Gurudeep Raj

LABORATORY COURSE – V
Practical Paper – V Organic Chemistry
(at the end of semester V)

30 hrs (2 h / W)

Organic Qualitative Analysis:

50M

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.

LABORATORY COURSE – VI
Practical Paper – VI Physical Chemistry
(at the end of semester V)

30 hrs (2 h/W)

1. Determination of rate constant for acid catalyzed ester hydrolysis.
2. Determination of molecular status and partition coefficient of benzoic acid in Benzene and water.
3. Determination of Surface tension of liquid
4. Determination of Viscosity of liquid.
5. Adsorption of acetic acid on animal charcoal, verification of Freundlich isotherm.

MODEL PAPER

THREE YEAR B.Sc. DEGREE EXAMINATION
FINAL YEAR EXAMINATIONS
SEMESTER V

Paper - V : INORGANIC, ORGANIC & PHYSICAL CHEMISTRY

Time: 3 hours

Maximum Marks: 75

PART- A

Answer any FIVE of the following questions. క్రింది వానిలో ఏదీని ఐదు ప్రశ్నలకు సమాధానము నిమ్ము.

Each carries FIVE marks. ప్రతి దానికి ఐదు మార్కులు. 5 x 5 = 25 Marks

1. Explain the EAN rule. Give any two complexes which don't obey this rule.
EAN నియమమును వివరించుము. ఈ నియమమును పాటించని రెండు సంక్లిష్టాలను తెల్పుము.
2. Briefly explain the crystal field theory. స్వల్ప క్షేత్ర సిద్ధాంతమును గూర్చి క్లుప్తంగా వివరించుము.
3. Differentiate the thermodynamic stability and kinetic stability of complexes.
సంక్లిష్టాల యొక్క ఉష్ణగతిక స్థిరత్వము మరియు గతి స్థిరత్వములను బేదించుము.
4. Nef reaction. నెఫ్ చర్య.
5. Explain the basicity of amines. ఎమీన్ల కారత్వమును గూర్చి వివరించుము.
6. Write notes on Diazotization. డయాజోనికరణము గూర్చి వ్యాఖ్య వ్రాయుము.
7. State and explain Joule-Thomson effect. జౌల్-థామ్సన్ ఫలితమును తెల్పి, వివరించుము.
8. Write about Entropy. ఎంట్రోపీ గూర్చి వ్రాయుము.

PART- B

Answer ALL the questions. అన్ని ప్రశ్నలకు సమాధానము నిమ్ము.

Each carries TEN marks. ప్రతి దానికి పది మార్కులు. 5 x 10 = 50 Marks

9. a) Write the postulates of Werner's co-ordination theory.
వెర్నర్ సమన్వయ సిద్ధాంతములోని ముఖ్యాంశాలను వ్రాయుము.
(OR)
b) Explain the formation of $[\text{Fe}(\text{CN})_6]^{4-}$ and $[\text{Fe}(\text{CN})_6]^{3-}$ on the basis of valence bond theory. వేలన్స్ బంధ సిద్ధాంతము ఆధారంగా $[\text{Fe}(\text{CN})_6]^{4-}$ మరియు $[\text{Fe}(\text{CN})_6]^{3-}$ ఏర్పడుటను వివరించుము.
10. a) How do you determine the magnetic susceptibility of metal complexes using Guoy balance method?
గాయ్ తుల పద్ధతి ద్వారా లోహ సంక్లిష్టాల అయస్కాంత వక్రతను ప్రయోగపూర్వకముగా ఎట్లు నిర్ణయించెదవు?
(OR)
b) Explain the factors that affect the stability of complexes.

సంశ్లేషణల స్థిరత్వమును ప్రభావితం చేయు అంశాలను గూర్చి వివరించుము.

11. a) Write the methods of preparation of nitroalkanes.

నైట్రో ఆల్కేన్ల తయారీ పద్ధతులను గూర్చి వ్రాయుము.

(OR)

b) Explain about the Mannich reaction and Micheal addition reaction.

మానిచ్ చర్య మరియు మైఖేల్ సంకలన చర్యను గూర్చి వివరించుము.

12. a) How amines are prepared from Gabriel synthesis and Hoffmann bromamide method?

గాబ్రెయిల్ సంశ్లేషణ మరియు హోఫ్ మన్ బ్రోమైడ్ పద్ధతుల ద్వారా ఎమీన్లను ఎట్లు తయారు చేయుదురు?

(OR)

b) Write any four electrophilic substitution reactions of aromatic amines.

ఆరోమాటిక్ ఎమీన్ల యొక్క ఏవేని నాలుగు ఎలక్ట్రోఫిలిక్ ప్రతిక్షేపణ చర్యలను వ్రాయుము.

13. a) Derive Kirkoff's equation. కిర్కొఫ్ సమీకరణమును ఉత్పాదించుము.

(OR)

b) Describe the Carnot cycle. కార్నాట్ చక్రమును వర్ణించుము.



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MODEL PAPER
THREE YEAR B.Sc. DEGREE EXAMINATION
FINAL YEAR EXAMINATIONS
SEMESTER V
Paper – VI : INORGANIC, ORGANIC & PHYSICAL CHEMISTRY

Time: 3 hours

Maximum Marks: 75

PART- A

Answer any **FIVE** of the following questions. క్రింది వానిలో ఏదేని ఐదు ప్రశ్నలకు సమాధానము నిమ్ము.

Each carries **FIVE** marks. ప్రతి దానికి ఐదు మార్కులు.

5 x 5 = 25 Marks

1. Define labile and inert complexes with suitable examples.
అస్థిరత మరియు జడ సంక్లిష్టాలను తగిన ఉదాహరణలతో నిర్వచించుము.
2. Explain the biological significance of sodium and potassium.
సోడియం మరియు పొటాషియం ల యొక్క జీవ ప్రాముఖ్యతను వివరించుము.
3. Discuss about zero order reactions. శూన్య క్రమాంక చర్యలను గూర్చి చర్చించుము.
4. Write the effect of temperature on the rate of a reaction.
చర్య రేటుపై ఉష్ణోగ్రత ప్రభావమును గూర్చి వ్రాయుము.
5. What are photosensitized reactions? Give one example.
కాంతి స్పందన చర్యలు అనగానేమి? ఒక ఉదాహరణ నిమ్ము.
6. Explain the nature of pyrrole and pyridine.
పిరిడిన్ మరియు పిరోల్ ల యొక్క స్వభావాలను వివరించుము.
7. Kiliani - Fischer method. కిలియాన్ - ఫిషర్ పద్ధతి.
8. Write notes on Zwitter ion. జిప్టర్ అయాన్ గూర్చి వ్యాఖ్య వ్రాయుము.

PART- B

Answer **ALL** the questions. అన్ని ప్రశ్నలకు సమాధానము నిమ్ము.

Each carries **TEN** marks. ప్రతి దానికి పది మార్కులు.

5 x 10 = 50 Marks

9. a) Describe the substitution reactions of metal complexes.
లోహ సంక్లిష్టాల ప్రతిక్షేపణ చర్యలను వర్ణించుము.
(OR)
b) Write the structure and functions of haemoglobin.
హెమోగ్లోబిన్ యొక్క నిర్మాణము మరియు విధులను వ్రాయుము.
10. a) Give in detail the various methods of determining the order of a chemical reaction.
ఒక చర్య యొక్క క్రమాంకమును కనుగొనుటకు గల వేర్వేరు పద్ధతులను తెల్పుము.

(OR)

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b) Explain the photochemical reaction mechanisms of hydrogen – chlorine and hydrogen – bromine reactions. హైడ్రోజన్ - క్లోరిన్ మరియు హైడ్రోజన్ - బ్రోమిన్ చర్యల యొక్క కాంతి రసాయన చర్య విధానమును వివరింపుము.

11. a) What are heterocyclic compounds? Discuss the aromatic character of pyrrole, furan and thiophene. విజాతీయ వలయ సమ్మేళనాలు అనగానేమి? పిర్రోల్, ఫ్యూరాన్ మరియు థయోఫీన్ యొక్క ఆరోమాటిక్ స్వభావమును గూర్చి చర్చించుము.

(OR)

b) Illustrate the substitution reactions of pyridine. పిరిడిన్ యొక్క ప్రతిక్షేపణ చర్యలను సోదాహరణముగా తెల్పుము.

12. a) Discuss the cyclic structure of glucose. గ్లూకోజ్ యొక్క వలయ నిర్మాణమును చర్చించుము.

(OR)

b) i) What are epimers? Give example. ఎపిమర్లు అనగా నేమి? ఉదాహరణ నిమ్ము.

ii) Write about the formation of glucosazone. గ్లూకోసజోన్ ఏర్పడుటను గూర్చి వ్రాయుము.

13. a) Give any three methods of preparation of alanine. ఎలనీన్ తయారుచేయుటకు ఏవేని మూడు పద్ధతులను తెల్పుము.

(OR)

b) Describe the structure of proteins. ప్రోటీన్ నిర్మాణమును వర్ణించుము.


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SYLLABUS FOR VI SEMESTER
III B.Sc. CHEMISTRY ELECTIVE – VII B

No. of h/w : 3

ENVIRONMENTAL CHEMISTRY

UNIT-I

Introduction

9 h

Concept of Environmental chemistry - Scope and importance of environment in now a days – Nomenclature of environmental chemistry – Segments of environment - Natural resources – Renewable Resources – Solar and biomass energy and Non-renewable resources – Thermal power and atomic energy – Reactions of atmospheric oxygen and Hydrological cycle.

UNIT-II

Air Pollution

9 h

Definition – Sources of air pollution – Classification of air pollution – Acid rain – Photochemical smog – Green house effect – Formation and depletion of ozone – Bhopal gas disaster – Controlling methods of air pollution.

UNIT-III

Water pollution

9 h

Unique physical and chemical properties of water – water quality and criteria for finding of water quality – Dissolved oxygen – BOD, COD, Suspended solids, total dissolved solids, alkalinity – Hardness of water – Methods to convert temporary hard water into soft water – Methods to convert permanent hard water into soft water – eutrophication and its effects – principal wastage treatment – Industrial waste water treatment.

UNIT-IV

Chemical Toxicology

9 h

Toxic chemicals in the environment – effects of toxic chemicals – cyanide and its toxic effects – pesticides and its biochemical effects – toxicity of lead, mercury, arsenic and cadmium.

UNIT-V

Ecosystem and biodiversity

9 h

Ecosystem: Concepts – structure – Functions and types of ecosystem – Abiotic and biotic components – Energy flow and Energy dynamics of ecosystem – Food chains – Food web – Tropic levels – Biogeochemical cycles (carbon, nitrogen and phosphorus)

Biodiversity: Definition – level and types of biodiversity – concept - significance – magnitude and distribution of biodiversity – trends - biogeographical classification of India – biodiversity at national, global and regional level.

REFERENCE BOOKS

1. Fundamentals of Ecology by M.C.Dash
2. A Text book of Environmental chemistry by W. Moore and F.A. Moore
3. Environmental Chemistry by Samir K. Banerji

CHEMISTRY LABORATORY COURSE – VII-B
(at the end of semester VI)

30 hrs (2 h / w)

50 Marks

1. Determination of carbonate and bicarbonate in water samples (acidity and alkalinity)
2. Determination of hardness of water using EDTA
 - a) Permanent hardness
 - b) Temporary hardness
3. Determination of Acidity
4. Determination of Alkalinity
5. Determination of chlorides in water samples