

S.K.S.D. Mahila kalasala U.G & P.G. (Autonomous), Tanuku.

(Affiliated to Adikavi Nannaya University, Rajamahendravaram)

B.Sc. – I SEMESTER

Subject : CHEMISTRY SYLLABUS

Paper I - Inorganic & Organic Chemistry

INORGANIC CHEMISTRY

UNIT –I

p-block elements –I

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)

Group - 14: Preparation and applications of silanes and silicones.

Group - 15: Preparation and reactions of hydrazine, hydroxylamine.

Characteristics of S-Block elements (**Additional Input**)

UNIT-II

1. p-block elements -II

Group - 16: Classifications of oxides based on (i) Chemical behaviour and

(ii) Oxygen content.

Group-17: Inter halogen compounds and pseudo halogens.

2. Organometallic Chemistry

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

ORGANIC CHEMISTRY

UNIT-III

Structural theory in Organic Chemistry

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.

Stereo chemistry of addition reactions (Cis&Trans) (**Additional Input**)

UNIT-IV

1. Acyclic Hydrocarbons

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)

Nomenclature, Preparation by Freunds 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

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)

1,3 diaxial interactions (Disubstituted cyclo hexane) **(Additional Input)**

List of Reference Books:

1. Inorganic chemistry by J.E.Huheey.
2. Basic Inorganic Chemistry by Cotton and Wilkinson
3. A text book of qualitative inorganic analysis by A.I.Vogel.
4. Organic chemistry by Morrisson and Boyd

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B.Sc. – I SEMESTER

LABORATORY COURSE-I

Practical-I Simple Salt Analysis

Qualitative inorganic analysis

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.

** Students activities like Seminars, Assignments, Field work, Study projects, models etc, are part of Curriculum for all units in all papers.

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B.Sc. – II SEMESTER

Subject : CHEMISTRY SYLLABUS

Paper II (Physical & General Chemistry)

PHYSICAL CHEMISTRY

UNIT-I

Solidstate

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

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

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

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.

Joul-Thomson effect applications, liquefaction of gases – Linde's method (**Additional Input**)

GENERAL CHEMISTRY

UNIT-IV

1. Surface chemistry

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

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

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.

optical isomers of Monosaccharide, optical activity determination (**Additional Input**)

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

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B.Sc. – II SEMESTER

LABORATORY COURSE -II

Practical-II Analysis of Mixture Salt

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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B.Sc. – III SEMESTER

Subject : CHEMISTRY SYLLABUS

Paper III (INORGANIC & ORGANIC CHEMISTRY)

INORGANIC CHEMISTRY

UNIT - I

1. Chemistry of d-block elements:

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:

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

3. Metal carbonyls :

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

4. Chemistry of f-block elements:

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.

introduction to metallocenes, Molecular Orbital treatment for Ferrocene (**Additional Input**)

ORGANIC CHEMISTRY

UNIT - III

1. Halogen compounds

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

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, Reimer-Tiemann reaction, Fries rearrangement, azocoupling, Pinacol-Pinacolone rearrangement.

Mechanism of Cumene reaction. **(Additional Input)**

UNIT-IV

Carbonyl compounds

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)

crossed Aldol and internal aldol condensation, internal Claisen condensation.

(Additional Input)

UNIT-V

1. Carboxylic acids and derivatives

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 Hunsdiecker reaction, decarboxylation by Schmidt reaction, Arndt-Eistert synthesis, halogenation by Hell- Volhard- Zelinsky reaction.

2. Active methylene compounds

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 Bahl and Arun bahl
4. A Text Book of Organic chemistry 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

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B.Sc. – III SEMESTER

LABORATORY COURSE -III

Practical Paper-III Titrimetric analysis and Organic Functional Group Reactions

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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B.Sc. – IV SEMESTER

Subject : CHEMISTRY SYLLABUS

Paper IV (SPECTROSCOPY & PHYSICAL CHEMISTRY)

SPECTROSCOPY

UNIT-I

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:

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

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)

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. **C^{13} NMR (Additional Input)**

PHYSICAL CHEMISTRY

UNIT-III

Dilute solutions

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

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 Hittorf's method. Application of conductivity measurements- conductometric titrations.

UNIT-V

1. Electrochemistry-II

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

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

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B.Sc. – IVSEMESTER
LABORATORY COURSE – IV
Practical Paper - IV Physical Chemisry and IR Spectral Analysis

Physical Chemistry

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

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

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

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w.e.f. 2015-16 admitted batch

SEMESTER-V

Paper - V (INORGANIC, ORGANIC & PHYSICAL CHEMISTRY)

UNIT - I

Coordination Chemistry:

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.

Spectral and magnetic properties of metal complexes:

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

Stability of metal complexes:

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.

Nitro hydrocarbons:

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.

HSAB principle (Additional Input)

UNIT - II

Nitrogen compounds :

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.

Carbon Carbon single bond formation (Additional Input)

UNIT- III

Thermodynamics

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

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Department of Chemistry
w.e.f. 2015-16 admitted batch
SEMESTER-V
LABORATORY COURSE – V
Practical Paper – V Organic Chemistry

Organic Qualitative Analysis:

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.

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:

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.

Metal clusters (Additional Input)

ORGANIC CHEMISTRY

UNIT- II

Heterocyclic Compounds

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.

Carbon Carbon double bond formation (Additional Input)

UNIT-III

Carbohydrates

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 (keto hexose) - Evidence of 2 - keto hexose 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

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

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

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

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LABORATORY COURSE – VI

Practical Paper – VI Physical Chemistry

(at the end of semester V)

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.

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III B.Sc., - Chemistry (ELECTIVE – VII B)

SYLLABUS FOR VI SEMESTER (w.e.f.2017-18)

ENVIRONMENTAL CHEMISTRY

UNIT-I

Introduction

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

UNIT-II

Air Pollution

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

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

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

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

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Department of Chemistry

VI Semester

SYLLABUS FOR VI SEMESTER (w.e.f.2017-18)

ENVIRONMENTAL CHEMISTRY

CHEMISTRY LABORATORY COURSE – VII-B

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

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SYLLABUS FOR VI SEMESTER
III B.Sc. CHEMISTRY CLUSTER ELECTIVE – VIII-B-1
(w.e.f.2017-18)

FUEL CHEMISTRY AND BATTERIES

UNIT –I

Review of energy sources (renewable and non-renewable) – classification of fuels and their calorific value. Coal: Uses of Coal (fuel and non fuel) in various industries, its composition, carbonization of coal - coal gas, producer gas and water gas – composition and uses – fractionation of coal tar – uses of coal tar based chemicals, requisites of a good metallurgical coke, coal gasification (Hydro gasification and catalytic gasification) coal liquefaction and solvent refining.

UNIT-II

Petroleum and petrol chemical industry:

Composition of crude petroleum, refining and different types of petroleum products and their applications.

UNIT-III

Fractional distillation(principle and process), cracking(Thermal and catalytic cracking). Reforming petroleum and non petroleum fuels (LPG, CNG, LNG, bio-gas), fuels derived from biomass, fuel from waste, synthetic fuels (gaseous and liquids), clear fuels, petro chemicals: vinyl acetate, propylene oxide, isoprene, butadiene, toluene and its derivative xylene.

UNIT-IV

Lubricants

Classification of lubricants, lubricating oils (conducting and non-conducting), solid and semi solid lubricants, synthetic lubricants. Properties of lubricants (viscosity index, cloud point, pore point) and their determination.

UNIT-V

Batteries

Primary and secondary batteries, battery components and their role, Characteristics of Battery. Working of following batteries: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.

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SYLLABUS FOR VI SEMESTER
III B.Sc. CHEMISTRY CLUSTER ELECTIVE – VIII-B-2
(w.e.f.2017-18)

INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE

UNIT - I

Recapitulation of s- and p-Block Elements

Periodicity in s- and p-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electronegativity (Pauling, Mulliken and Alfred - Rochow scales). Allotropy in C, S, and P. Oxidation states with reference to elements in unusual and rare oxidation states like carbides and nitrides), inert pair effect, diagonal relationship and anomalous behaviour of first member of each group.

UNIT – II

Silicate Industries

Glass: Glassy state and its properties, classification(silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.

Ceramics: Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, superconducting and semiconducting oxides, fullerenes, carbon nanotubes and carbon fibre.

Cements: Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.

UNIT – III

Fertilizers:

Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphate, polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate.

UNIT – IV

Surface Coatings:

Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, additives, Metallic coatings (electrolytic and electroless), metal spraying and anodizing.

UNIT – V

Alloys:

Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels.

Chemical explosives:

Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants.

REFERENCE BOOKS

1. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.
2. R. M. Felder, R. W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.
3. W. D. Kingery, H. K. Bowen, D. R. Uhlmann: Introduction to Ceramics, Wiley Publishers, New Delhi.
4. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.

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**SYLLABUS FOR VI SEMESTER
III B.Sc.CHEMISTRY CLUSTER ELECTIVE PAPER – VIII-B-3
(w.e.f.2017-18)**

ANALYSIS OF APPLIED INDUSTRIAL PRODUCTS

UNIT-I

Analysis of soaps: moisture and volatile matter, combined alkali, total fatty matter, free alkali, total fatty acid, sodium silicate and chlorides.

Analysis of paints : Vehicle and pigments, Barium Sulphate, total lead, lead chromate, iron pigments, zinc chromate.

UNIT- II

Analysis of oils: saponification value, iodine value, acid value, ester value, bromine value, acetyl value.

Analysis of industrial solvents like benzene, acetone, methanol and acetic acid, Determination of methoxyl and N-methyl groups.

UNIT-III

Analysis of fertilizers: urea, NPK fertilizer, super phosphate.

Analysis of DDT, BHC, endrin, endosulfone, malathion, parathion.

Analysis of starch, sugars, cellulose and paper.

UNIT -IV

Gas analysis: carbon dioxide, carbon monoxide, oxygen, hydrogen, saturated hydro carbons, unsaturated hydrocarbons, nitrogen, octane number, cetane number.

Analysis of Fuel gases like: water gas, producer gas, kerosene (oil) gas.

Ultimate analysis :carbon, hydrogen, nitrogen, oxygen, phosphorus and sulfur.

UNIT - V

Analysis of Complex materials:

Analysis of cement- loss on ignition, insoluble residue, total silica, sesquioxides, lime, magnesia, ferric oxide, sulphuric anhydride.

Analysis of glasses - Determination of silica, sulphur, barium, arsenic, antimony, total R_2O_3 , calcium, magnesium, total alkalies, aluminium, chloride, fluoride.

REFERENCE BOOKS

1. F.J.Welcher - Standard methods of analysis.
2. A.I.Vogel - A text book of quantitative Inorganic analysis - ELBS.
3. S.H.H.Willard and H.Deal - Advanced quantitative analysis - Van Nostrand Co.
4. F.D.Snell & F.M.Biffen - Commercial methods of analysis - D.B.Taraporavala & sons.
5. J.J.Elving and I.M.Kolthoff - Chemical analysis - A series of monographs on analytical chemistry and its applications - Inter Science Vol I to VII.
6. G.Z.Weig - Analytical methods for pesticides, plant growth regulators and food additives - Vols I to VII.
7. S.L.Chopra & J.S.Kanwar - Analytical Agricultural Chemistry - Kalyani Publishers.
8. R.M.Upadhyay and N.L. Sharma - Manual of soil, plant, water and fertilizer analysis - Kalyani Publishers.