

**VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY,
BALLARI**

SYLLABUS

Department of Studies in CHEMISTRY

BACHELOR OF SCIENCE

(I to VI Semester)

With effect from 2016-17

**BACHELOR OF SCIENCE IN CHEMISTRY
COURSE OF VSK UNIVERSITY**

FIRST SEMESTER

Code : **CHT-101**
Contact Hours :54
Credit Points :

Univ Code :101
Work load : 4 hours per week

Evaluation: Continuous Internal Assessment - 20 marks
Semester and Examination - 80 marks

PAPER-1

UNIT-I: INORGANIC CHEMISTRY-1

18 Hours

Atomic structure

06 hours

Wave-mechanical model- Schrodinger wave equation (no derivation), explanation of the various terms, application of Schrodinger wave equation to H-atom & physical significance of ψ & ψ^2 . Main conditions which ψ must satisfy to give meaningful solution (Eigen function). Quantum numbers n, l, m & s, radial and angular wave functions and probability distribution curves, shapes of s, p & d orbitals. Pauli exclusion principle. Hund's rule of maximum multiplicity, Aufbau principle & (n+l) rule. Energy level diagram, electronic configurations of elements.

Periodic properties

06 hours

Atomic & ionic radii, ionization energy, electron affinity and electronegativity – definition, methods of determination or evaluation, trends in periodic table and application in predicting and explaining the chemical behavior. Effective nuclear charge and Slater rules

Chemical bonding-1

06 hours

Definition, types of chemical bonds, Ionic bond-formation, factors favoring the formation of ionic bond, Characteristics of ionic compounds, radius ratio rule. structure of ionic crystals: MX (ZnS) & MX₂(TiO₂), lattice energy, Born-Haber's cycle, Born-Landé equation (no derivation), consequences of lattice energy, Polarization of ions (Fajan's rules).

UNIT-II:ORGANIC CHEMISTRY-1**18 Hours****Structure and bonding in organic molecules****06 hours**

Causes of bond formation, types of bonds: ionic, covalent and coordinate – definition with examples. Bond length, bond angle, bond energy and bond order – definition with examples. Hybridization in carbon – definition. Explanation of sp^3 , sp^2 , sp hybridizations by taking methane, ethylene and acetylene molecules respectively, sigma and pi bonds-definition & examples.

Organic reactions and their mechanism**06 Hours**

Types of organic reactions: Substitution, addition, elimination, rearrangement, hydrolysis, oxidation, reduction, reactions – definition with examples.

Types of bond cleavage: Homolytic & heterolytic fission – definition with examples.

Types of reagents: Electrophiles and nucleophiles – definition with examples.

Reactive intermediates: Carbonium ions, carbanions – definition, methods of generation and stability. Free radicals and carbenes – definition with examples.

Types of reaction mechanisms (Ionic and free radical mechanisms).

Stereochemistry of organic reactions**06 Hours**

Concept of isomerism and types. Optical isomerism, Optical activity, chiral carbon, and molecular dissymmetry. Elements of symmetry: plane of symmetry, and center of symmetry. Optical isomerism in tartaric acid. Enantiomers, diastereomers, meso compound, racemic mixture – meaning & examples.

Geometrical isomerism: definition with examples (maleic & fumaric acids) E-Z nomenclature with examples

Conformation isomers: Definition with examples. Conformational analysis of ethane.

UNIT-III: PHYSICAL CHEMISTRY-1**18 Hours****Gaseous state****08 hours**

Critical phenomenon, PV-isotherms of real gases, continuity of states, the isotherms of carbon dioxide, relation between critical constants and Vanderwaal's constants. The law of corresponding states and reduced equation of states. Molecular velocities; root mean square velocity, average velocity and most probable velocity. Qualitative discussion of Maxwell and Boltzmann's distribution of molecular velocities, collision number and mean free path.

Physical properties of liquids**05 Hours**

Surface tension and its determination by using stalagmometer. Viscosity and its determination by using Ostwald's viscometer. Effect of temperature on viscosity and surface tension. Refractive index, specific & molar refractivities. Additive and constitutive properties. Application of parachor and molar refractivity in elucidating the structure of benzene and quinone.

Solid state**05 Hours**

Difference between crystalline and amorphous solids. Laws of crystallography (definition & explanation). Symmetry elements. Crystal lattice and unit cell, Bravais lattice, Miller indices. Derivation of Bragg's equation.

Code : **CHP-101**
Contact Hours :84
Credit Points :

Univ Code :101
Work load : 4 hours per week

Evaluation: Continuous Internal Assessment - 10 marks
Semester and Examination - 40 marks (30 marks for examination,
05 marks for Practical record and 05 marks for viva-voce)

LABORATORY COURSE-1

84 Hours

Titrimetric estimations

- **Two practical durations should be used for instructions on theory & principles of titrimetric estimations and demonstration of any one estimation.**
- **Minimum 18 experiments are to be given for estimation.**

The following estimations are to be given.

1. Preparation of standard sodium carbonate solution, standardization of HCl and estimation of sodium hydroxide solution.
2. Estimation of sodium hydroxide and sodium carbonate in a mixture of the two.
3. Estimation of oxalic acid and sulphuric acid in a mixture of the two using standard potassium permanganate and standard sodium hydroxide solution.
4. Preparation of standard oxalic solution, standardization of potassium permanganate and estimation of Fe in Mohr's salt.
5. Estimation of calcium content in lime stone as calcium oxalate by standardized potassium permanganate solution.
6. Estimation of ferrous & ferric iron in a mixture of the two by dichromate method.
7. Preparation of standard potassium dichromate solution, standardization of sodium thiosulphate solution and estimation of copper in copper sulphate.
8. Preparation of standard ferrous ammonium sulphate, standardization of potassium dichromate solution and estimation of Fe in FeCl_3 .
9. Estimation of hardness of water by EDTA method.
10. Estimation of Zn in Zinc sulphate solution by EDTA method.
11. Determination of alkali content in antacid tablet
12. Estimation of phenol/aniline by bromination method.
13. Estimation of water soluble carboxylic acid-titration method.
14. Estimation of glucose by titrimetry method.
15. Estimation of vitamin C by titrimetry method.
16. Estimation of amino acid.
17. Estimation of aldehyde and ketone.
18. Determination of percentage of hydroxyl groups by acetylation methods.
19. Estimation of amines by acetylation methods.
20. Determination of saponification value of an oil or fat.
21. Determination of dissolved oxygen (DO) in water sample.

Spectrophotometric estimations

22. Estimation of carbohydrate by spectrophotometric method
23. Estimation of aminoacids using ninhydrin method
24. Estimation of protein by Biuret method

SECOND SEMESTER

Code : **CHT-201**
Contact Hours :54
Credit Points :

Univ Code :201
Work load : 4 hours per week

Evaluation: Continuous Internal Assessment - 10 marks
Semester and Examination - 40 marks

PAPER-2

UNIT-I: INORGANIC CHEMISTRY-2

18 Hours

S-block elements

05 hours

Comparative study of alkali & alkaline earth metals with respect to

Physical properties: density, melting points & boiling points, flame coloration.
Solubility of ionic compounds in relation to lattice energy and hydration energy.
complexation tendencies of alkali metals. Characteristics of oxides and basicity of hydroxides.

P-block elements

05 Hours

Some compounds of p-block elements: Halides of boron, relative strength of BF_3 , BCl_3 & BBr_3 as Lewis acids, diborane-preparation, structure & bonding.

Halogens: Size of atoms & ions, ionization energy, electronegativity, oxidation states and oxidizing power. Types of interhalogen compounds-preparation and structure of ICl_3 , IF_5 & IF_7 .

Noble gases: structure & bonding in XeF_6 and XeO_3 , Clathrates.

Chemical bonding -2

08 Hours

Valence bond theory: postulates, Concept of resonance, hybridization involving s, p & d atomic orbitals, Limitations of valence bond theory. VSEPR theory, structure of simple molecules like BF_3 , NH_3 , PCl_5 & ClF_3 .

Molecular orbital theory (LCAO method), bonding and antibonding molecular orbitals, sigma & pi bonds. s-s, s-p, p-p, combination of orbitals, order of molecular orbital energy level configuration, bond order, molecular orbital energy level diagram for homonuclear H_2 , He_2 , N_2 & O_2 molecules.

Weak interactions: H-bonding and Van Der Waal's interactions.

UNIT-II: ORGANIC CHEMISTRY-2

18 Hours

Alkanes and cycloalkanes

06 hours

Alkanes – Introduction, chain isomerism in alkanes up to C_5 . General methods of synthesis of alkanes by Wurtz reaction, Kolbe reaction and Corey-House reaction. Free radical mechanism of halogenations (chlorination of methane may be taken as example).

Cycloalkanes – Definition with examples. Methods of synthesis of cycloalkanes (any two methods). Chemical properties. Bayer's strain theory – Salient features, angle of strain and its calculations, Limitations. Sachse-Mohr theory of strainless rings.

Alkenes, Dienes and Alkynes

06 hours

Alkenes: Synthesis by dehydration of alcohols, dehydrohalogenation of alkyl halides and dehydrogenation of vicinal dihalides. Chemical reactions – Addition of hydrogen, halogens, and hydrogen halides. Markovnikov's rule and peroxide effect with mechanism.

Dienes: definition of isolated, conjugated and cumulated dienes with examples. Diels-Alder reaction. Preparation & chemical reactions of 1,3-butadiene

Alkynes: synthesis of alkynes by dehydrohalogenation of vicinal dihalides and dehalogenation of tetrahalides. Acidity of alkynes and formation of metal acetylides.

Arenes and aromaticity

06 hours

Arenes: Nomenclature of benzene derivatives. Modern concept of structure of benzene (MOT). Resonance energy. Directive orientation effect of substituents in monosubstituted benzene. Types of groups with examples. Ortho-para orientation (phenol) and meta orientation (nitrobenzene). Explanation with resonance structures. Aromaticity – Definition and criteria. Huckel's rule with examples.

UNIT-III: PHYSICAL CHEMISTRY-2

18 Hours

Liquid state

06 hours

Inter molecular forces, structure of liquids (a qualitative description) structural differences between solids, liquids and gases.

Liquid crystals: Differences between liquid crystals, solid and liquid structure. Properties of nematic and cholestric phases. Applications of liquid crystals.

Chemical kinetics

08 hours

Revision of the concepts – the rate, order and molecularity of reaction and half life period. Second order reaction with examples. Derivation of specific rate constant of a second order reaction when $a = b$ and $a \neq b$. Methods of determination of order of a reaction – differential, half life and graphical method.

Theory of reaction rates – qualitative treatment of collision theory of bimolecular reactions. Theory of unimolecular reactions. Lindemann's hypothesis and steady state principle. An elementary account of transition state theory, activated complex its relation with thermodynamic functions (ΔG^* , ΔH^* and ΔS^*). Derivation of rate constant of a bimolecular reaction based on transition state theory. Parallel reactions with examples, consecutive reactions with examples. Numerical problems on second order reactions.

Colloids

04 hours

Origin of charge on colloidal particle – electrical double layer, zeta potential. Electrophoresis & electro osmosis. Applications of colloids.

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LABORATORY COURSE-2

84 Hours

Organic qualitative analysis of single compound with preparation of derivative.

Note

- **In the beginning two practical durations may be used for instructions & demonstration of single compound analysis with preparation of derivative.**
- **Instructions should include explanation of basis of scheme of analysis and each test with its use. For elements test and functional groups test chemical equations are to be given.**
- **Minimum 18 compounds are to be given for analysis.**
- **At least three compounds should be given from each group.**
- The following compounds may be given for analysis
 - Acids: Benzoic, Salicylic, succinic, cinnamic & pthalic acid.
 - Phenols: α -naphthol, β -naphthol, p-cresol and o-cresol.
 - Bases: Aniline, p-Toluidine.
 - Neutrals: Urea, Nitrobenzene, m-Dinitrobenzene, naphthalene, Chlorobezene, Bromobenzene, Benzaldehyde, Acetone, Acetophenone & Biphenyl.

DEPARTMENT OF CHEMISTRY CHEMISTRY IN DAILY LIFE (OPEN ELECTIVE)

56 Hours

UNIT-I

Dairy Products: Composition of milk and milk products. Analysis of fat content, minerals in milk and butter. Estimation of added water in milk. Beverages: Analysis of caffeine in coffee and tea, detection of chicory in coffee, chloral hydrate in toddy, estimation of methyl alcohol in alcoholic beverages.

Food additives, adulterants and contaminants- Food preservatives like benzoates, propionates, sorbates, disulphites. Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose and sodium cyclamate. Flavours: Vanillin, alkyl esters (fruit flavours) and monosodium glutamate.

Artificial food colorants: Coal tar dyes and non-permitted colours and metallic salts. Analysis of pesticide residues in food. 14 h

UNIT II

Air Pollution: Air pollutants, prevention and control, Green house gases and acid rain. Ozone hole and CFC's. Photochemical smog and PAN. Catalytic converters for mobile sources. Bhopal gas tragedy.

Hydrologic cycle, sources, criteria and standards of water quality-safe drinking water. Public health significance and measurement of water quality parameters- (Colour, turbidity, total solids, acidity, alkalinity, hardness, sulphate, fluoride, phosphate, nitrite, nitrate, BOD and COD). Water purification for drinking and industrial purposes.

Toxic chemicals in the environment. Detergents- pollution aspects, eutrophication. Pesticides and insecticides-pollution aspects. Heavy metal pollution. Solid pollutants- treatment and disposal. Treatment of industrial liquid wastes. Sewage and industrial effluent treatment. 14h

UNIT-III

Vitamins: Classification and Nomenclature. Sources, deficiency diseases and structures of Vitamin A1, Vitamin B1, Vitamin C, Vitamin D, Vitamin E & Vitamin K1.

Oils and fats: Composition of edible oils, detection of purity, rancidity of fats and oil. Tests for adulterants like argemone oil and mineral oils.

Soaps & Detergents: Definition, classification composition and uses 14h

UNIT IV

Corrosion: Types and prevention, corrosion failure and analysis Chemical energy system and limitations, principles and applications of primary & secondary batteries and fuel cell. Basics of solar energy, future energy storage.

Polymers : Types and classification of polymers. Source and general characteristics of natural and synthetic polymers. Typical examples of polymers used as plastics, in textiles, in electronic and automobile components, in the medical and aerospace materials. Problems of plastic waste management. Strategies for the development of environment friendly polymers. 14h

References

1. B. K. Sharma: introduction to Industrial Chemistry, Goel Publishing, Meerut (1998)
2. Medicinal Chemistry by Ashtoush Kar.
3. Drugs and Pharmaceutical Sciences Series, Marcel Dekker, Vol. II, INC, New York
4. Analysis of Foods – H.E. Cox: 13. Chemical Analysis of Foods – H.E.Cox and Pearson.

5. Foods: Facts and Principles. N. Shakuntala Many and S. Swamy, 4th ed. New Age International (1998)
6. Physical Chemistry – P I Atkins and J. de Paula – 7 th Ed. 2002, Oxford University Press.
7. Handbook on Fertilizer Technology by Swaminathan and Goswamy, 6th ed. 2001, FAI.
8. Organic Chemistry by I. L. Finar, Vol. 1 & 2. 9. Polymer Science and Technology, J. R. Fried (Prentice Hall).

THIRD SEMESTER

Code : **CHT-301**
Contact Hours :54
Credit Points :

Univ Code :301
Work load : 4 hours per week

Evaluation: Continuous Internal Assessment - 20 marks
Semester and Examination - 80 marks

PAPER-3

UNIT-I:INORGANIC CHEMISTRY-3

18 Hours

d-block elements

08 hours

Introduction and definition, position in the periodic table, occurrence.

Chemistry of the elements of first transition series: electron configuration, ionic radii, ionization energy, density, melting point, oxidation states & their stability, magnetic properties, color of compounds and catalytic properties.

Chemistry of the elements of second & third transition series: comparative treatment of 4d & 5d series elements with their 3d analogues in respect of electron configurations, ionic radii, oxidation states, magnetic behavior, color and catalytic properties.

Chemistry of lanthanides & Actinides

05 hours

Lanthanides: Electronic configurations, ionic radii & lanthanide contraction, spectral, magnetic properties, oxidation states, basic character. Separation of lanthanides by ion exchange method.

Actinides: Introduction, electronic configurations, ionic size, oxidation states, color & spectra, magnetic properties, formation of complexes, comparison with lanthanides.

Acids & bases

06 hours

Bronsted – Lowry concept, conjugate acids & bases, relative strength of acids & bases, leveling solvents. Solvent system concept, solvolytic behavior & limitations. Lux-Flood concept & Limitations. Lewis concept, success & limitations. Usanovich concept.

Hard & soft acids & bases, Pearson's HSAB principle, acid-base strength and hardness. & softness, symbiosis, Electronegativity & hardness and softness

Theories of hardness & softness.

UNIT-II: ORGANIC CHEMISTRY-3

18 Hours

Organic halogen compounds

06 hours

Alkyl halides, alkenyl halides & acyl halides-definition with examples.

Alkyl halides: Classification with examples. Mechanism of SN^1 and SN^2 reactions by taking hydrolysis of tertiary butyl bromide and methyl bromide as examples. E^1 and E^2 reactions of alkyl halides with mechanism.

Aryl halides: Methods of formation, Nucleophilic displacement reactions with NaOH, NH_3 and KCN. Wurtz-Fitting reaction and Ullmann reaction (C_6H_5Cl)

Alcohols

03 hours

Classification with examples. Monohydric alcohols-classification with examples. Isomerism in monohydric alcohols up to C_5 . Methods of preparation of monohydric alcohols by hydrolysis of alkyl halides, hydroboration-oxidation of alkenes and reduction of aldehydes and ketones.

Distinguishing tests for primary, secondary and tertiary alcohols by Lucas test and dichromate test. Mechanism of pinacol-pinacolone rearrangement.

Phenols

03 hours

Classification with examples, manufacture of phenol by Cumene and Dow process. Acidity of phenol. Effect of substituents on acidity. Mechanism of Reimer-Tiemann and Kolbe reactions. Gattermann reaction and Fries rearrangement (mechanism not expected).

Carboxylic acids and acid derivatives

06 hours

Carboxylic acids: Introduction, Classification into aliphatic & aromatic acids with examples. Methods of preparation of aliphatic monocarboxylic acids from alcohols, cyanides, esters and Grignard reagent. Acidity of carboxylic acids. Effect of substituents on acidity. Reactions of acids (salt formation, formation of acid halides, esters and amides) Hell-Volhard-Zelinsky (HVZ) reaction.

Acid derivatives: Definition with examples of different acid derivatives of acids. Preparation and reactions of acid chloride (acetyl chloride) and acid amides (acetamide may be taken as example).

UNIT-III: PHYSICAL CHEMISTRY-3

18 Hours

Quantum mechanics

06 hours

Black body radiation, Planck's radiation law, photoelectric effect, Compton effect, De-Broglie hypothesis, Heisenberg's uncertainty principle, Derivation of Schrodinger's fundamental wave equation. Significance of wave equation, Eigen values, postulates of quantum mechanics.

Thermodynamics

07 hours

Limitations of first law of thermodynamics. Need for second law, spontaneous process, Statements of the second law of thermodynamics, Carnot cycle and its efficiency, Carnot theorem, concept of entropy, entropy as a state function. Physical significance of entropy, Free energy – Gibb's & Helmholtz free energies. Derivation of Gibb's-Helmholtz equation. ΔG as a criteria for spontaneity & equilibrium

Third law of thermodynamics: Nernst heat theorem, Statement of third law and concept of residual entropies.

Adsorption

03 hours

Langmuir's adsorption isotherm their significance, BET equation (no derivation). Application of BET equation in the determination of surface area of adsorbent.

Distribution law

02 hours

Statement, modification of the law when the solute undergoes association and dissociation in one of the solvents.

Code : **CHP-301**
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Credit Points :

Univ Code :301
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Semester and Examination - 40 marks (30 marks for examination,
05 marks for Practical record and 05 marks for viva-voce)

LABORATORY COURSE-3

84 Hours

Inorganic semimicro qualitative analysis of binary mixture

- **Systematic semimicro qualitative analysis of mixture of two simple inorganic salts (containing two basic radicals and two acidic radicals).**
- **Minimum 18 mixtures should be given for analysis.**
 - **In the beginning two practical durations may be used for instructions and demonstration of semi micro qualitative analysis of binary mixture.**
 - **Instructions should cover the explanation of basic principles of scheme of qualitative analysis: Solubility, solubility product principle, common ion effect, complex formation etc. and various reaction equations for acidic radicals tests, basic radicals group precipitations, group analyses and cause of flame coloration.**

The following radicals may be given for analysis with suitable combination

- **Acidic radicals:** CO_3^{2-} , Cl^- , Br^- , I^- , NO_3^- , SO_4^{2-} , BO_3^{3-} , acetate & oxalate
- **Basic radicals:** NH_4^+ , Cu^{2+} , Bi^{3+} , Al^{3+} , Fe^{3+} , Cr^{3+} , Mn^{2+} , Zn^{2+} , Ni^{2+} , Co^{2+} , Ba^{2+} , Sr^{2+} , Ca^{2+} , Mg^{2+} , K^+ , Na^+ & Li^+ .

Note: i. only one basic radical in a group should be given in a mixture.

- ii. Mixture of Cl^- & I^- , Cl^- & Br^- , NO_3^- & Br^- , NO_3^- & I^- , should be avoided.
 SO_4^{2-} with Ba^{2+} , Ca^{2+} & Sr^{2+} should be avoided.

FOURTH SEMESTER

Code : **CHT-401**
Contact Hours :54
Credit Points :

Univ Code :401
Work load : 4 hours per week

Evaluation: Continuous Internal Assessment - 20 marks
Semester and Examination - 80 marks

PAPER-4

UNIT-I:INORGANIC CHEMISTRY

18 Hours

Coordination compounds

07 hours

Introduction, nomenclature of coordination compounds. Werner's theory of complexes, experimental evidences in support of Werner's theory.

Classification of ligands: monodentate, bidentate & polydentate ligands with examples, ambidentate ligands, macrocyclic ligands, chelating ligands & chelates.

Coordination number & geometry of complexes,

Isomerism in coordination compounds - structural isomerism and stereoisomerism in coordination number 4 & 6.

Stability of complexes, factors affecting the stability of complexes.

Metal-Ligand bonding in complexes

06 hours

Sidgwick's electronic interpretation of coordination, Effective atomic number (EAN) rule
Limitations of Sidgwick's theory

Valence bond theory (VBT) or Pauling's theory of coordination: postulates, VBT applied to octahedral complexes with example, VBT applied to tetrahedral complexes with example, VBT applied to square planar complexes with example, Limitations of VBT

Crystal field theory (CFT): Salient features, CFT applied to octahedral complexes and tetrahedral complexes.

Crystal field stabilization energy (Δ or $10 Dq$), Factors affecting crystal field stabilization energy. Spectrochemical series, Measurement of crystal field stabilization energy (Δ or $10 Dq$)

Oxidation – Reduction

05 hours

Redox potentials, standard redox potentials, use of redox potential data, redox cycle. Redox stability in water- reduction of water, oxidation of water, disproportionation & comproportionation. Diagrammatic representation of potential data – Latimer diagrams, Frost diagrams, Pourbaix diagrams.

UNIT-II: ORGANIC CHEMISTRY-4

18 Hours

Ethers and Epoxides

03 hours

Ethers: Definition, nomenclature, methods of preparation by dehydration of alcohols, heating alkyl halides with Ag_2O and Williamson's ether synthesis. Reactions of ethers (halogenations, auto-oxidation, reactions with dilute H_2SO_4 , PCl_5 , HX)

Epoxides: Definition, synthesis of epoxides (ethylene oxide may be taken as example), ring opening reactions of ethylene oxide.

Aldehydes and ketones

06 hours

Preparation of aldehydes and ketones by alcohols, gem dihalides and alkynes (acetaldehyde and acetone may be taken as examples). Mechanism of nucleophilic addition reactions (with HCN and NaHCO_3) and condensation reactions (NH_2OH , NH_2NH_2 and $\text{C}_6\text{H}_5\text{NHNH}_2$) of aldehydes and ketones (acetaldehyde and acetone may be taken as examples). Mechanism of aldol condensation (in acetaldehyde). Mechanism of Cannizzaro and Perkin's reactions (in benzaldehyde). Mannich reaction and Wolf-Kishner reduction (mechanism not expected).

Organic compounds of nitrogen

09 hours

Reduction reactions of nitrobenzene in acid, alkaline and neutral medium

Amines: Definition, classification with examples of aliphatic and aromatic amines. Methods of preparation of primary aliphatic amine (methylamine) by alkyl halides, alcohols and Gabriel's method. Distinguishing tests between primary, secondary and tertiary amines by nitrous acid, basic character of amines. Comparison of basic character in the following group of amines (a) CH_3NH_2 , $(\text{CH}_3)_2\text{NH}$ and $(\text{CH}_3)_3\text{N}$ (b) $\text{C}_6\text{H}_5\text{NH}_2$, $\text{C}_6\text{H}_5\text{NHCH}_3$ and $\text{C}_6\text{H}_5\text{N}(\text{CH}_3)_2$ (c) aniline, p-nitroaniline and p-Toluidine.

Introduction of diazonium salts. Preparation and applications of benzene diazonium chloride. Diazo coupling reactions.

UNIT-III: PHYSICAL CHEMISTRY

18 Hours

Liquid mixtures

06 hours

Different types of solutions with examples. Binary mixtures of completely miscible liquids, Raoult's law, Ideal and non-ideal solutions (based on Raoult's law). Positive and negative deviations from Raoult's law with examples. Vapor pressure – composition and boiling point – composition diagrams for above types. Principle of fractional distillation, azeotropic mixtures. Partially miscible liquids – Critical solution temperature, (phenol-water, triethylamine-water & nicotine-water systems)

Phase equilibria

06 hours

Statement and meaning of terms – phase, component and degree of freedom. Derivation of Gibb's phase rule. Phase equilibria for one component system (water), phase equilibria for two component system (Lead-silver). Solid-liquid equilibria, KI-water system, Freezing mixtures. Solid solution- compound formation Mg-Zn and $\text{FeCl}_3\text{-H}_2\text{O}$ systems.

Colligative properties

06 hours

Concept of vapor pressure. Relative lowering of vapor pressure of solvent. Calculation of molecular mass from relative lowering of vapor pressure.

Elevation in boiling point and its relationship with relative lowering of vapor pressure (to be derived from Clapeyron-Clausius equation). Ebullioscopic constant of solvent, relationship between molar mass and elevation in boiling point. Determination of molar mass of a solute by Land Berger's method.

Depression in freezing point and its relationship to the lowering of vapor pressure, cryoscopic constant of the solvent, relation between depression in freezing point and molecular mass of the solute (to be derived from Clapeyron-Clausius equation). Relation between K_f , m , ΔH and freezing point of solvent.

Abnormal colligative properties, VantHoff's factor, numerical problems.

Code : **CHP-401**

Contact Hours :84

Credit Points :

Evaluation: Continuous Internal Assessment - 10 marks

Semester and Examination - 40 marks (30 marks for examination, 05 marks for Practical record and 05 marks for viva-voce)

Univ Code :401

Work load : 4 hours per week

LABORATORY COURSE-4

84 Hours

1. Physical non-instrumental

- **In the beginning two practical durations may be used for instructions and demonstration. Instructions should cover theory and principle of each experiment.**
 - **Minimum 16 experiments are to be given for practical exercise.**
1. Determine the viscosity of a given liquid using Ostwald's viscometer (determine the density of the liquid).
 2. Determine the viscosity of the two given liquids using Ostwald's viscometer (densities are given).
 3. Determine the percentage composition of given liquid mixture (glycerol and water) using Ostwald's viscometer.
 4. Determine the specific rate constant of hydrolysis of methyl acetate by HCl at room temperature.
 5. Compare the strength of HCl and H₂SO₄ in the hydrolysis of ethyl acetate (K for one acid is given)
 6. Determine the activation energy in the hydrolysis of methyl acetate (K value for one temperature is given)
 7. Determine the heat of neutralization of strong acid and strong base.
 8. Determine the critical solution temperature of phenol-water system.
 9. Determine the percentage of NaCl solution using solubility of phenol in water.
 10. Determine the molecular weight of non-volatile solute by ebullioscopic method.
 11. Investigate the reaction between hydrogen peroxide and hydrogen iodide.
 12. Determine the surface tension of a given liquid using stalagmometer and determine the density of liquid.
 13. Determine the surface tension of two given liquids using stalagmometer and calculate the parachor (densities of liquids are given)
 14. Determination of percentage composition of liquid mixture (ethyl alcohol and water) by surface tension method).
 15. Determine the specific rate constant of second order reaction between KI and K₂S₂O₈.
 16. Study of adsorption of acetic acid on activated charcoal.
 17. Determination of partition coefficient of benzoic acid between water and benzene.
 18. Determination of partition coefficient of I₂ between CCl₄ and H₂O.
 19. Determine the equilibrium constant of $KI + I_2 \leftrightarrow KI_3$ by distribution law method.
 20. Determine the specific rate constant of saponification of ethyl acetate by NaOH.
 21. Determination of the molecular weight of non-volatile solute by Rast's method.

22. Studies on a 'clock reaction'. Determination of the activation energy of the bromide bromate reaction.
23. Determination of order of hydrolysis of ethyl acetate by NaOH.
24. Determination of transition temperature of CaCl_2 by thermometric method.

FIFTH SEMESTER

Code : **CHT-501**
 Contact Hours :45
 Credit Points :

Univ Code :501
 Work load : 4 hours per week

Evaluation: Continuous Internal Assessment - 20 marks
 Semester and Examination - 80 marks

PAPER-5.1

UNIT-I:INORGANIC CHEMISTRY-5

15 Hours

Magnetic properties of complexes

05 hours

Origin magnetic behavior, types of magnetic behavior-diamagnetism, paramagnetism, ferromagnetism & antiferromagnetism, magnetic moment of complex ions, spin-only formula, L-S coupling, correlation of μ_s & μ_{eff} values, orbital contribution to magnetic moments, temperature independent paramagnetism(TIP), magnetic properties of octahedral and tetrahedral complexes based on crystal field theory. Measurement of magnetic susceptibility and magnetic moment by Guoy method.

Electronic spectra of transition metal complexes

05 hours

Types of electronic transitions, selection rules for electronic transitions, spectroscopic ground states, spectrochemical series, Orgel energy level diagram for d^1 & d^9 states. Discussion of electronic spectrum of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ complex ion, charge transfer spectra.

Inorganic chains, rings, cages and clusters

05 hours

Silicates – Occurrence, classification and structures.
 Intercalation compounds of graphite with alkali metals – properties and structure.
 Sulfur nitrides – Preparation, properties and structure of S_4N_4 ,
 Borazines & cyclophosphazenes $(\text{NPCl}_2)_3$ & $(\text{NPCl}_2)_4$ – preparation, properties and structure.
 Carboranes – preparation & structure of $\text{C}_2\text{B}_{10}\text{H}_{12}$

UNIT-II: ORGANIC CHEMISTRY-5

15 Hours

Spectroscopy

09 hours

Introduction and types of spectroscopic methods, advantages of spectroscopic methods, general principles of spectroscopy, basic components of spectrophotometer.
 Salient features and applications of Infra red (IR) spectroscopy.

Nuclear magnetic resonance (NMR) spectroscopy: Principle and instrumentation of NMR spectroscopy, salient features and applications. Meaning of the terms equivalent and non-equivalent protons, chemical shift, down-field shift, spin-spin coupling and (n+1) rule in NMR spectra.

Organo-sulphur compounds

03 hours

Thiols: Nomenclature, methods of preparations and chemical reactions of thiols (ethane thiols may be taken as examples).

Thioethers: Nomenclature, methods of preparation and chemical reactions of thioethers (diethyl sulphide may be taken as example).

Amino acids

03 hours

Introduction, classification and structure of amino acids. Synthesis of α -amino acids (from acids, Strecker & Gabriel's phthalimide method). Acid-base behavior and isoelectric point of amino acid.

UNIT-III: PHYSICAL CHEMISTRY-5

15 Hours

Photochemistry

09 hours

Photochemical and thermochemical reactions, definition, examples, differences.

Laws of photochemistry: Grothus – Draper's law, Lambert's law, Beer's law, Absorption coefficient, extinction coefficient and their significance. Molar absorption coefficient, molar extinction coefficient and their significance. Einstein's law of photochemical equivalence. (problems based on only Einstein's law).

Quantum yield: high and low quantum yield, reasons for the deviation. Primary and secondary processes.

Mechanism of the following photochemical processes

(a) Decomposition of HI

(b) Combination of H_2 & Br_2

(c) Combination of H_2 & Cl_2

Chemiluminescence, fluorescence, phosphorescence, photo inhibition & photo sensitization with examples.

Physical properties & molecular structure

06 hours

Dipole moment, polarization, induced polarization, orientation polarization, Clausius-Mosotti equation (no derivation) and its importance, comparison of bond polarity taking examples of hydro acids of halogens, deciding the shapes of CO_2 , H_2O , BF_3 and CCl_4 .

Code : **CHP-501**
Contact Hours :45
Credit Points :

Univ Code :501
Work load : 4 hours per week

Evaluation: Continuous Internal Assessment - 10 marks
Semester and Examination - 40 marks (30 marks for examination,
05 marks for Practical record and 05 marks for viva-voce)

LABORATORY COURSE-5

45 Hours

Organic mixture separation and analysis of single compound

- Separation of mixture containing two solid compounds. Analysis of any one compound with preparation of derivative.
- Minimum 11 mixtures are to be given for analysis
- In the beginning two practical durations may be used for instructions and demonstration one mixture separation and analysis, Instructions should cover the basis of separation and reactions of elements tests and functional group tests.
- The mixtures may be A+N, P+N and B+N combinations.
Acids: Benzoic, Salicylic, Cinnamic and Pthalic acid.
Phenols: α -naphthol, β -naphthol and resorcinol.
Bases: p-Toluidine, o-Toluidine, m-Toluidine,
Neutrals: Naphthalene, Diphenyl, m-Dinitrobenzene. Acetanilide.

FIFTH SEMESTER

Code : **CHT-502:**
Contact Hours :45
Credit Points :

Univ Code :502
Work load : 4 hours per week

Evaluation: Continuous Internal Assessment - 20 marks
Semester and Examination - 80 marks

PAPER-5.2

UNIT-I:INORGANIC CHEMISTRY-6

15 Hours

Analytical chemistry

05 hours

Errors & evaluations: Definition & terms, mean & median, precision, standard deviation, relative standard deviation. Accuracy, absolute error & relative error.

Types of errors-Determinate (systematic) & Indeterminate (Random) errors. Sources of errors and effects upon analytical results. Methods of reporting analytical data. Significant figures & computations, reporting analytical data. Sampling of solids, liquids and gases.

Non-aqueous solvents

5hours

Solvent properties, classification of solvents, general properties.

dielectric constant, electrical conductance, viscosity, proton affinity.

Protonic solvent: Liquid ammonia as a solvent - Physical data, solubility in liquid NH₃, Auto-ionization of liquid ammonia, reactions in liquid ammonia.

Aprotic solvent: Liquid sulfur dioxide as a solvent - Physical data, solubility in liquid SO₂, chemical reactions in liquid SO₂.

Nuclear chemistry

05 hours

Structure of nucleus, nuclear models (shell model). Nuclear stability based on N/P ratio.

Mass defect binding energy. Radioactive displacement law, radioactive equilibrium.

Artificial radioactivity – Units of radioactivity.

Nuclear fission & nuclear fusion.

UNIT-II: ORGANIC CHEMISTRY-6

15 Hours

Organic synthesis via Enolates

03 hours

Reactive methylene compounds – Introduction. Acidity of α -H atoms in ethyl acetoacetate. Synthesis of ethyl acetoacetate (mechanism of Claisen condensation). Keto-enol tautomerism in ethylacetoacetate. Synthetic applications of ethyl acetoacetate.

Carbohydrates

04 hours

Introductio and classification, mechanism of osazone formation. Interconversion of glucose into fructose and vice-versa, chain lengthening in aldoses (Killiani-Fischer synthesis). Chain shortening in aldoses (Ruff degradation) Epimerization and

mutarotation. Elucidation of open-chain structure of D-glucose. Cyclic structures of glucose (Fischer & Haworth representations).

Oils, fats, soaps and detergents

04 hours

Oils & fats – composition of oils & fats. Determination of saponification number and iodine number of oils & fats.

Soaps – Introduction, manufacture of soap by hydrolyser process (modern continuous process)

Synthetic detergents (syndets) – Introduction, synthesis of sodium lauryl sulfate and sodium dodecyl benzene sulfonate. Cleaning action of soaps.

Synthetic polymers

02 hours

Definition, classification with examples. Synthesis and uses of teflon, nylon and terylene. Thermoplastic & thermosetting polymers.

Synthetic dyes

02 hours

Introduction, Classification of dyes based on structure, chromophore & auxochrome theory of color & constitution. Synthesis of methyl orange, Bismarck brown & malachite green.

UNIT-III: PHYSICAL CHEMISTRY

15 Hours

Electrochemistry

12 hours

Revision of conduction in metals and electrolyte solutions, specific conductance, molar conductance, equivalent conductance, variation of equivalent conductance and specific conductance with dilution. Cell constant, determination of equivalent conductance, ionic conductance, ionic mobility, Kohlrausch's law and its applications. Transport number by Hittorf's method. (non-attackable electrodes).

Debye-Huckel-Onsager equation for strong electrolytes (elementary treatment only). Numerical problems.

Application of conductance measurements

(a) Solubility and solubility product of sparingly soluble salt.

(b) Degree of dissociation of weak electrolytes

(c) Conductance titrations (acid-base) and precipitation titration and advantage of these.

Polymers

03 hours

Degree of polymerization, number average and mass average molecular weights. Determination of molecular weight of polymers by viscosity method. Influence of molecular weight on mechanical properties of polymers.

Code : **CHP-502**

Contact Hours :45

Credit Points :

Univ Code :502

Work load : 4 hours per week

Evaluation: Continuous Internal Assessment - 10 marks
Semester and Examination - 40 marks (30 marks for examination,
05 marks for Practical record and 05 marks for viva-voce)

LABORATORY COURSE – 6

Physical chemistry instrumental experiments part-I

45 hours

- **In the beginning two practical durations may be used for instructions and demonstration. Instructions should cover theory and principle of each experiment.**
 - **Minimum 11 experiments are to be given for practical exercise.**
1. Conductometric titration of strong acid (HCl) against strong base (NaOH).
 2. Conductometric titration of weak acid (acetic acid) against strong base (NaOH).
 3. Conductometric titration of mixture of acids against strong base.
 4. Determination of amount of Cu^{2+} in CuSO_4 solution and verify Beer-Lambert's law.
 5. Estimation of HCl by titrating with standard NaOH potentiometrically.
 6. Estimate the amount of iron in ferrous ammonium sulphate by titrating with standard $\text{K}_2\text{Cr}_2\text{O}_7$ solution potentiometrically.
 7. Determine the specific and molecular refractivities of two given liquids by Abbey's refractometer. And determine the densities of two given liquids.
 8. Determine the specific rotation of cane-sugar solution using polarimeter.
 9. Conductometric precipitation titration of NaCl against AgNO_3 .
 10. Preparation of buffer solutions and determination of their pH using pH meter.
 11. Estimation of vitamin C by UV spectrophotometer.
 12. Potentiometric titration of acetic acid with NaOH and determination of dissociation constant of acetic acid using quinhydrone electrode.

SIXTH SEMESTER

Code : **CHT-601**
Contact Hours :45
Credit Points :

Univ Code :601
Work load : 4 hours per week

Evaluation: Continuous Internal Assessment - 20 marks
Semester and Examination - 80 marks

PAPER - 6.1

UNIT-I:INORGANIC CHEMISTRY-7

15 Hours

Industrial chemistry

06 hours

- (a) Cement - Definition & composition of Portland cement, manufacture of Portland cement by dry process, setting of cement, types of Portland cement & other types of cement. Cement Industries in India. 02 hours
- (b) Glass – Definition & composition, physical properties, chemical properties, characteristics, manufacture of glass by pot furnace method. Types of glasses. 02 hours
- (c) Paints & pigments – Constituents of paints, formulation of paints. Types of pigments, White lead: Manufacture, physical properties & uses. Setting of paint. 02 hours

Environmental chemistry

05 hours

Types & sources of air pollution. Determination of particulates, SO_x, NO_x & CO_x
Water pollution – Different types of water pollutants. Ground water pollution, surface water pollution and marine water pollution. Impacts of water pollution on environment, COD, BOD. Control of water pollution. Industrial effluents – their effects & treatment, sewage water treatment. Water & air quality standards (ISI & WHO)

Inorganic polymers

04 hours

General characteristics of Inorganic polymers. Types of Inorganic polymers, Silicones – preparation, general properties, types and applications. Polyphosphazenes.

UNIT-II: ORGANIC CHEMISTRY-7

15 Hours

Study of natural products-Alkaloids & Terpenes

06 hours

Alkaloids: Introduction, classification with examples. Elucidation of structure of nicotine and synthesis. Structural formula and uses of quinine and atropine.
Terpenes: Introduction, classification, isoprene rule. Elucidation of structure of citral and synthesis. Structural formula and uses of menthol and camphor.

Enzymes, hormones and vitamins

06 hours

Enzymes: Classification, characteristic properties of enzymes, mechanism of enzymatic action (Lock and Key theory and template hypothesis) & Coenzymes.

Hormones: Introduction, classification with examples, hormone secreting glands (in human beings). Synthesis and importance of adrenaline. Biological importance of thyroxin, insulin.

Vitamins: Introduction, classification with examples. Synthesis of vitamin C. Biological importance of vitamin A, B₁, B₂, C and D.

Peptides and proteins

03 hours

Peptides: Classification, peptide linkage, synthesis of a dipeptide glycylalanine.

Proteins: Classification of proteins based on molecular shape and composition. Primary and secondary structure of proteins (α -helix and β -sheet structures).

UNIT-III:PHYSICAL CHEMISTRY-7

15 Hours

Spectroscopy

Electromagnetic radiations, regions of the spectrum, basic features of different spectrometers. Statement of Born-oppenheimer approximation, degree of freedom.

Rotational spectrum

Diatomic molecules, energy levels of a rigid rotator (semi classical principle), spacing of spectral lines, selection rule, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution), determination of bond length, qualitative description of non-rigid rotator, isotopic effect, problems.

Vibrational spectrum

IR spectrum – Energy levels of simple harmonic oscillator, selection rule, pure vibrational spectrum, intensity determination of force constant, qualitative relation of force constant and bond energy. Zero point energy. Effect of anharmonicity and isotope on the spectrum. Idea of vibrational frequencies of different functional groups – problems.

Raman spectrum

Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.

Code : **CHP-601:**
Contact Hours :45
Credit Points :

Univ Code :601
Work load : 4 hours per week

Evaluation: Continuous Internal Assessment - 10 marks
Semester and Examination - 40 marks (30 marks for examination,
05 marks for Practical record and 05 marks for viva-voce)

LABORATORY COURSE-7

45 Hours

Inorganic quantitative analysis

- Theory of individual estimation & calculation of conversion factor is to be explained.
- Minimum 11 experiments are to be given for estimation.

Following experiments are to be given.

1. Estimation of Fe as Fe_2O_3 in ferrous ammonium sulphate
2. Estimation of barium as barium sulphate in barium chloride solution.
3. Estimation of sulphate as barium sulphate in ammonium sulphate.
4. Estimation of Ni as Ni-DMG in Ni-ammonium sulphate solution.
5. Estimation of copper as cuprous thiocyanate.
6. Estimation of magnesium as magnesium oxinate in magnesium sulphate solution.
7. Estimation of chloride as silver chloride in sodium chloride.
8. Estimation of aluminium as aluminium oxide in aluminium sulphate.
9. Estimation of copper as copper oxide.
10. Analysis of stainless steel
11. Analysis of lime stone (SiO_2 by gravimetry & Ca by titrimetry).
12. Gravimetric analysis of Cu-Ni alloy.

Code : **CHT-602**
Contact Hours :45
Credit Points :

Univ Code :602
Work load : 4 hours per week

Evaluation: Continuous Internal Assessment - 20 marks
Semester and Examination - 80 marks

PAPER - 6.2

UNIT-I:INORGANIC CHEMISTRY-8

15 Hours

Organo metallic chemistry

05 hours

Classification & nomenclature of organometallic Compounds, EAN (16 & 18 electron) rule, General methods of preparation. Organo-lithium & Organo-Aluminium compounds. Grignard reagent.

Ferrocene - preparation, properties & structure, Metal-Olefinic complexes- structure & bonding, Metal carbonyls - preparation, structure & bonding in metal carbonyls, Catalytic property of organometallic compounds, Ziegler-Natta catalysis.

Bio-Inorganic chemistry

05 hours

Macro elements, micro elements (Trace elements)- Essential trace elements, non-essential trace elements.

Metalloporphyrins, heme proteins. Myoglobin & hemoglobin-structure & functions, oxygenation.

Metalloenzymes: Heme containing enzymes - carbonic anhydrase, carboxy peptidase, peroxidase, cytochrome.

Materials chemistry

05 hours

Introduction, classification of materials.

Multi-phase materials: ferrous & non-ferrous alloys, Fe-C phase transformation in ferrous alloys.

Composites: particle reinforced, fiber reinforced & structural composites.

Nano materials: Introduction about nanoscience & nanotechnology and applications.

UNIT-II:ORGANIC CHEMISTRY-8

15 Hours

Heterocyclic compounds

05 hours

Definition and classification. Two methods of synthesis of furan, pyrrole, thiophene and pyridine. Molecular orbital picture and aromaticity of furan and pyridine. Electrophilic substitution reactions of pyrrole.

Food analysis

05 hours

Reasons for food analysis. Analysis of moisture in vegetable oils & spices. Analysis of ash in honey. Analysis of crude fibers in spices and condiments. Food adulteration, common adulterants in food. Contamination of food stuffs. Common micro-organisms of food stuffs. Pesticide analysis in food products by TLC technique.

medicinal chemistry

05 hours

Introduction to chemotherapy. Different types of drugs with examples (Analgesics, antiseptics, antimalarials, antibiotics, tranquilizers). Synthesis and uses of aspirin, paracetamol and sulphanylamide.

Antibiotics: Definition, examples and importance. Synthesis of antipyrine and chloramines-T. Pesticides – types with examples. Synthesis and uses of gammexane.

UNIT-III: PHYSICAL CHEMISTRY-8

15 Hours

E.M.F

12 hours

Electrolytic and Galvanic cells, reversible and irreversible cells. Types of reversible electrodes, metal-metal ion electrode, metal-metal insoluble salt electrode, amalgam electrode, gas electrode and redox electrode. Electrode reaction in Daniel cell, sign convention of electrode potential (reduction potential is to be applied). EMF of the cell and its measurement. Standard electrode potential, Nernst equation for electrode potential (to be derived). Reference electrodes-calomel electrode. Weston standard cell, polarization, over voltage and hydrogen over voltage. Problems on the electrode potential and E.M.F of the cell. Concentration cells-with and without transference, liquid-junction potential.

Application of E.M.F measurements: (1) Determination of pH of a solution using quinhydrone and glass electrode. (2) Potentiometric titrations: Acid-base and redox titrations.

Electrochemical energy sources

03 hours

Primary cell (dry cell), secondary cell (Ni-Cd cell), Fuel cells. Construction and working of hydrogen-oxygen fuel cell and its importance.

Code : **CHP-602**
Contact Hours :45
Credit Points :

Univ Code :602
Work load : 4 hours per week

Evaluation: Continuous Internal Assessment - 10 marks
Semester and Examination - 40 marks (30 marks for examination,
05 marks for Practical record and 05 marks for viva-voce)

LABORATORY COURSE-8

45 Hours

Physical chemistry Instrumental experiments-II

- **In the beginning two practical durations may be used for instructions and demonstration. Instructions should cover theory and principles of each experiment.**
- **Minimum 11 experiments should be given for practical exercises.**
 1. Determination of equivalent conductance at infinite dilution of strong electrolyte.
 2. Determination of degree of dissociation of weak electrolyte.
 3. Determination of dissociation constant of weak electrolyte.
 4. Determination of solubility & solubility product of a sparingly soluble salt (BaSO_4 , AgCl , AgBr) by conductometric method.
 5. Estimation of Fe by colourimetry.
 6. Determination of percentage composition of liquid mixture by graph method using Abbey's refractometer.
 7. Percentage composition by formula method using Abbey's refractometer.
 8. Determination of pH of an unknown solution using quinhydrone or glass electrode by potentiometer.
 9. Determination of ionic product of water by E.M.F method at 25°C .
 10. Determine the pH of various mixtures of sodium acetate and acetic acid in aqueous solution and hence determine the dissociation constant of acetic acid.
 11. Conductometric determination of the kinetic order of saponification of ethyl acetate by NaOH .
 12. Determination of equivalent conductance of weak electrolyte at infinite dilution following Kohlrausch's law.

References

INORGANIC CHEMISTRY

S.No.	Title & edition	Author/s	Year of publicn.	Publisher
1	Concise Inorganic Chemistry Fifth edition	J.D.Lee	1998	ELBS with Chapman & Hall
2	Basic Inorganic Chemistry Fourth edition	F.A.Cotton, G.Wilkinson		Wiley Eastern
3	Inorganic Chemistry Fourth edition	Shriver, Atkins & C.H.Longford		Oxford University press
4	Principles of Inorganic Chemistry As per UGC curriculum	Puri. Sharma.Kalia	2010-11	Milestone publishers & Distributors, Delhi.
5	Theoretical principles of Inorganic Chemistry	G.S.Manku	1990	TATA McGraw Hill Publishing company Ltd. New Delhi.
6	Chemistry for Degree students. For First year	Dr.R.L.Madan	2011	S.Chand & company P.Ltd. New Delhi.
7	Chemistry for Degree students. For Second year	Dr.R.L.Madan	2011	S.Chand & company P.Ltd. New Delhi.
8	Chemistry for Degree students. For Third year	Dr.R.L.Madan	2011	S.Chand & company P.Ltd. New Delhi.
9	Comprehensive Inorganic Chemistry for B.Sc.I year	Dr.Sulekh Chandra	2004	New Age International (P) Ltd.
10	Advanced Inorganic Chemistry. Vol-I, 23 rd Edition	Gurdep Raj	1997-98	Goel Publishing House, Meerut.
11	Text book of Inorganic Chemistry, second revised edition	K.N.Upadhyaya	1990	Vikas Publishing House Pvt. Ltd.
12	Analytical chemistry	Alka Gupta		
13	Quantitative Inorganic Analysis	A.I.Vogel		
14	Callister's Material Science & Engineering	Adapted by R.Balasubramanian		Wiley India (P) Ltd.
15	Industrial Chemistry	B.K.Sharma		
16	Environmental chemistry	Asim K.Das		
Other useful Inorganic chemistry books				
15	Inorganic Chemistry	G.L.Miessler and D.A.Tarr		Prentice Hall
16	Inorganic chemistry	A.G.Sharpe		ELBS
17	Concepts and Models of Inorganic Chemistry, second editoin	Douglas, McDaniel & Alexander	1983	Vikas Publishing House Pvt. Ltd.

ORGANIC CHEMISTRY

1	A Text book of organic chemistry	Arun Bahl and B.S.Bahl		
2	Advance organic chemistry	Arun Bahl and B.S.Bahl		
3	A Text book of organic chemistry	K.S.Tewari and N.K.Vishnoi		
4	Reaction Mechanism and Reagents in organic chemistry	Gurdeep R.Chatwal		
5	Organic chemistry by	Morrison and Boyd		
6	Organic chemistry	L.G.Wade		
7	Organic chemistry Vol I, II, & III	Mukherji, Singh & Kapoor		
8	Organic chemistry	I.L.Finar		
9	Analytical chemistry	B.K.Sharma		
10	Organic chemistry	P.S.Kalsi		
11	Organic chemistry	Clayden		Oxford University press
12	A guide book to mechanism in organic chemistry	Peter sykes		
13	Environmental chemistry with green chemistry	Asim. K.Das		
14	Organic spectroscopy	William Kemp		
15	Stereochemistry	P.S.Kalasi		
16	Stereochemistry	Elil		
17	Environmental chemistry	A.K.De		
18	Organic chemistry	Bruice		
19	Organic reaction mechanisms	Nasipuri		
20	Organic reaction mechanisms	P.S.Kalasi		

PHYSICAL CHEMISTRY

1	Physical chemistry 7 th edition	P.W.Atkins & Julio dePaula	2002	Oxford University press
2	Elements of physical chemistry 3 rd edition	Peter Atkins	2000	Oxford University press
3	Physical chemistry-A molecular approach	Donald A, Macquarie & John D.Simon	2001	Viva Low priced student edition
4	Introduction to physical chemistry 3 rd edition	Mark Ladd	1999	Cambridge Low Priced edition
5	Text book of physical chemistry	S.Glasstone	1982	Mcmilan India Ltd.
6	Principles of physical chemistry	B.R. Puri, L.R.Sharma & M.S.Pathania	1987	S.L.N.Chand & Co.
7	Text Book of Physical Chemistry	P.L.Soni	1993	S.Chand & Co.
8	Physical chemistry	Alberty R.A. & Silbey	1992	R.J.John Wiley & Sons
9	Physical chemistry	G.M.Barrow	1986	McGraw Hills
10	Physical chemistry 3 rd edition	Gilbert W.Castilian	1985	Narosa Publishing House
11	Text book of polymer Science	BilMeyer. Jr	1984	John Wiley & Sons
12	Basic Physical Chemistry	Walter J.Moore	1972	Prentice Hall
13	Physical chemistry	Gurdeep raj		Goel Publications

1	Vogel's Text book of qualitative chemical analysis	J.Basset, R.C.Denney, G.H.Jaffrey and J. Mendham	1986	ELBS
2	Inorganic semi micro qualitative analysis	v.v.Ramanujam	1974	National pub.Co.
3	Practical Inorganic chemistry	G.Marr, B.W.Rackett, Von Nostrand, Reinhold	1972	
4	Laboratory manual of Organic Chemistry	Day, Sitaraman and Govindachari	1998	
5	Text book of practical organic chemistry	A.I.Vogel	1996	
6	A Hand book of organic Analysis	Calrke and Hayes	1964	
7	Findlay's Practical physical chemistry	Levitt,	1968	Longman's London
8	Experiments in physical chemistry	Shoe maker & Garland	1986	McGraw Hill Int. edn.
9	An Introductioin to Practical Biochemistry	David Plummer	1992	McGraw Hill Pub. Co.
10	Introduction to practical Biochemistry	S.K.Sawlmey & Ranadhir Singh	2000	Narosa Pub. House
11	Advanceed Practical Chemistry	Jagadamba Singh, R.K.P.Singh etc.	2008	Pragathi Pub. Meerut
12	Advanced Experimental chemistry I, II, III	J.N.Gurtu & R.Kapoor	1986	S.Chand & Company Ltd.

This is going to be the question paper pattern for all the semesters

MODEL QUESTION PAPER

B.Sc. First semester Degree examination

CHEMISTRY

Paper I

Time: 3 Hours

Max. marks:80

Instructions: 1) Section A is compulsory.

2) Candidate has to answer any two questions from the remaining sections.

SECTION-A

1. Answer **any ten** questions (10 x 2 = 20)

- a.
- b.
- c.
- d.
- e.
- f.
- g.
- h.
- i.
- j.
- k.
- l.

Answer any two from each section.

SECTION – B

2x10 = 20

- | | | |
|----|-----|------------|
| 2 | (a) | 05 or 06 M |
| | (b) | 05 or 04M |
| 3 | (a) | 05 or 06 M |
| | (b) | 05 or 04M |
| 4. | (a) | 03 M |
| | (b) | 03M |
| | (c) | 04 M |

SECTION – C

2x10 = 20

- | | | |
|---|-----|------------|
| 5 | (a) | 05 or 06 M |
| | (b) | 05 or 04M |
| 6 | (a) | 05 or 06 M |
| | (b) | 05 or 04M |
| 7 | (a) | 03 M |

(b)
(c)

SECTION – D

03M
04 M
2X10=20

8 (a)
(b)

05 or 06 M
05 or 04M

9 (a)
(b)

05 or 06 M
05 or 04M

10 (a)
(b)
(c)

03 M
03M
04 M
