VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY, BALLARI

SYLLABUS

Department of Studies in CHEMISTRY

BACHELOR OF SCIENCE

(I to VI Semester)

With effect from 2015-16

BACHELOR OF SCIENCE IN CHEMISTRY

COURSE OF VSK UNIVERSITY

FIRST SEMESTER

Code : **CHT-101** Univ Code :101
Contact Hours :54 Work load : 4 hours per week
Credit Points :

Evaluation: Continuous Internal Assessment - 30 marks
Semester and Examination - 70 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) & MX_2(TiO_2), lattice energy, Born-Haber's cycle, Born-Lande 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: Hemolytic & 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** Univ Code :101

Contact Hours :84 Work load : 4 hours per week

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)

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. Estmation 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** Univ Code :201
Contact Hours :54 Work load : 4 hours per week
Credit Points :

Evaluation: Continuous Internal Assessment - 30 marks
Semester and Examination - 70 marks

PAPER-2

UNIT-I: INORGANIC CHEMISTRY-2 **18 Hours**
S-block elements **05 hours**

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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.

THIRD SEMESTER

Code : **CHT-301** Univ Code :301
Contact Hours :54 Work load : 4 hours per week
Credit Points :

Evaluation: Continuous Internal Assessment - 30 marks
Semester and Examination - 70 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.

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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-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).**
- **Miniumum 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** Univ Code :401
Contact Hours :54 Work load : 4 hours per week
Credit Points :

Evaluation: Continuous Internal Assessment - 30 marks
Semester and Examination - 70 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. Diagramatic representation of potential data – Latimer diagrams, Frost diagrams, Porbaux 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 $C_6H_5NHNH_2$) of aldehydes and ketones (acetaldehyde and acetone may be taken as examples). Mechanism of aldol condensation (in acetaldehyde). Mechanism of Cannizaro and Perkin's reactions (in benzaldehyde). Mannich reactionand 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 , $(CH_3)_2NH$ and $(CH_3)_3N$ (b) $C_6H_5NH_2$, $C_6H_5NHCH_3$ and $C_6H_5N(CH_3)_2$ (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, azeoptropic 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 $FeCl_3$-H_2O 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 of vapor pressure (to be derived from Clapeyron-Clausius equation). Ebulioscopic 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** Univ Code :401
Contact Hours :84 Work load : 4 hours per week
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)

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 H_2SO_4 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 $K_2S_2O_8$.
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 I_2 between CCl_4 and H_2O.
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** Univ Code :501
Contact Hours :45 Work load : 4 hours per week
Credit Points :

Evaluation: Continuous Internal Assessment - 30 marks
Semester and Examination - 70 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 $[Ti(H_2O)_6]^{3+}$ 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 $(NPCl_2)_3$ & $(NPCl_2)_4$ – preparation, properties and structure.
Carboranes – preparation & structure of $C_2B_{10}H_{12}$

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 pthalimide 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

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

Physical properties & molecular structure **06 hours**

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

Code : **CHP-501** Univ Code :501
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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:** Univ Code :502
Contact Hours :45 Work load : 4 hours per week
Credit Points :

Evaluation: Continuous Internal Assessment - 30 marks
Semester and Examination - 70 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 NH_3, Auto-ionization of liquid ammonia, reactions in liquid ammonia.

Aprotic solvent: Liquid sulfur dioxide as a solvent - Physical data, solubility in liquid SO_2, chemical reactions in liquid SO_2.

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 & oxochrome 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-Onsagar equation for strong electrolytes (elementary treatment only). Numerical problems.

Application of conductance measurements

(a) Solubility and solubility product o 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 polmers.

Code : **CHP-502** Univ Code :502
Contact Hours :45 Work load : 4 hours per week
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)

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 $K_2Cr_2O_7$ 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** Univ Code :601
Contact Hours :45 Work load : 4 hours per week
Credit Points :

Evaluation: Continuous Internal Assessment - 30 marks
Semester and Examination - 70 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. Strucutural 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, B_1, B_2, 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 anhormonic motion 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:** Univ Code :601
Contact Hours :45 Work load : 4 hours per week
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)

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. Estimationof 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.

SIXTH SEMESTER

Code : **CHT-602** Univ Code :602
Contact Hours :45 Work load : 4 hours per week
Credit Points :

Evaluation: Continuous Internal Assessment - 30 marks
Semester and Examination - 70 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, hemeproteins. 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 sulphanilamide.

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** Univ Code :602
Contact Hours :45 Work load : 4 hours per week
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)

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 excercises.**

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 waterby E.M.F method at 25^0C.
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 curriculam	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 Chemmistry. Vol-I, 23rd Edition	Gurddep Raj	1997-98	Goel Publshing 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 7th edition	P.W.Atkins & Julio dePaula	2002	Oxford University press
2	Elements of physical chemistry 3rd 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 3rd 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 3rd 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 1 = 10)

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)	03M
	(c)	04 M
	SECTION – D	2X10=20
8	(a)	05 or 06 M
	(b)	05 or 04M
9	(a)	05 or 06 M
	(b)	05 or 04M
10	(a)	03 M
	(b)	03M
	(c)	04 M

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