S.A.S MENT DEGREE COLLEGE
NARA , WEST GODAVARI DISTRICT-534406
(AFFILIA IKAVI NANNAYA UNIVERSITY, RAJAMAHENDRAVARAM)
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ESTD 1972

PROGRAMMEOUTCOMESOFCOURSESOFFERED

Thelearningoutcomesoftheundergraduateprogrammesofferedatthiscollegereflectdisciplinary knowledge, generic skills and competencies applicable in different academicfieldsofstudy.

Uponcompletionoftheprogrammes:

1. B.A.
2. B.Com.
3. B.Sc.LifeSciences
4. B.Sc.Physicalsciences

PO1: CRITICAL THINKING: Students develop the trait of critical thinkingandideaseffectivelyinwritingandorally.Theyalsodescribeand definecriticalconcepts in theirdiscipline.

PO2: EFFECTIVE COMMUNICATION: Acquire ability to express thoughts and ideas effectively inwriting and orally. They will be able to communicative the ideas in lucid manner. They also willbe able to use socially accepted language either in regional language, national language Hindi orinEnglish.

PO3: SCIENTIFIC ATTITUDE: They develop scientific attitude towards the issues. Hence, theyanalyzethecriticalthingsforgettingsolutiontotheproblemstheyencounterintheirprofession orreallifesituations.

PO4:EFFECTIVECITIZENSHIP:Demonstrateempatheticsocialconcernandequitycenterednational development and the ability to act with an informed awareness of issues andparticipateinciviclifethroughvolunteering.

PO5: ETHICAL VALUES: Imbibe ethical values that are already part of our culture and relatethemtotheirprofessions.Theystronglyadheretotheprinciplesandetiquetteslaiddownin oursocial behaviour.

PO6:SOCIALBEHAVIOUR:Theymaintainhealthy relationshipswithothersforbetteroutcomeoftherequiredresultsintheir particulararea of profession.

PO7:**TEAMWORK**:Theycanunderstandthevalueofteamwork.Theyalsoworkwithgoodacquire dsoftskillsforthebettermentoftheir professionalism.

PO8:LIFELONGLEARNING:Acquirethe abilitytoengageinindependentandlife-longlearninginthebroadestcontexts.

Department of chemistry

VISION

To provide a resilient foundation that enables profound understanding and learning of chemistry. The study of Chemistry is to understand scientific reasoning and analytical problem solving with a molecular perspective.

MODEL

The capacity to learn is a gift; the ability to learn is a skill; the willingness to learn is a choice – Brian Herbert.

MISSION

To create an opportunity in reaching the excellence in learning the discipline of chemistry in its very depths and being able to effectively apply the same knowledge to contemporary problems. To integrate industrial training with curricula.

Program specific outcomes(MPC&BZC)

S.No	CHEMISTRY
PSO-1	Beversatileinclassicallaboratorytechniques, useinstrumentalmethods for analysisaswellassynthesisandfollowstandardizedproceduresand regulationsinhandlinganddisposalofchemicals.
PSO-2.	Demonstrate,solveandanunderstandingofmajor conceptsinall disciplines ofchemistry
PSO-3.	Solvetheproblemandalso think methodically,independentlyanddraw alogical conclusion
PSO-4.	Employcriticalthinkingandthescientificknowledgetodesign, carryout,recordandanalyzethe resultsofchemicalreactions
PSO-5	Createanawarenessoftheimpactofchemistryonthe environment,society,and developmentoutsidethescientificcommunity
PSO-6	Findoutthegreenrouteforchemicalreactionforsustainabledevelopment
PSO-7	Toinculcatethescientifictemperamentinthestudentsandoutsidethe scientificcommunity
PSO-8	Usemoderntechniques,decentequipmentandChemistrysoftware

COURSEOUTCOMESOFCHEMISTRY

Semester I

ChemistryCourse IInorganic and Physical Chemistry

At the end of the course, the student will be able to;

S.NO	Course Outcomes	Mapping with POs	Cognitive level
CO 1	Understand the basic concepts of p-block elements,preparations and structures	PO 1,2,3,4	L 1,2,3,5
CO 2	Apply the difference between solid, liquid and gases in terms of intermolecular interactions, solutions , colligative properties	PO 1,2,3,4,7	L 1,2,3,4
CO 3	Explain the concepts of theories of bonding,Different properties of d block and f-block elements	PO 1,2,3,4	L 1,2,4,6

Mapping of COs to POs: Alignment on a 3 point scale from weak to strong

COs	POs							
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	2	3	3	3	1	2	1
CO 2	3	3	2	3	1	1	1	1
CO 3	3	3	3	3	1	1	2	1

B.Sc. Semester – I Credits: 4 Course: 1 Inorganic and Physical Chemistry Hrs/Wk: 4

UNIT I:

INORGANIC CHEMISTRY :

Chemistry of p-block elements Group 13:

Preparation & structure of Diborane, Borazine

Group 14: Preparation, classification and uses of silicones

Group 15: Preparation & structures of Phosphonitrilic halides {(PNCl2)n where n=3, 4

Group 16: Oxides and Oxoacids of Sulphur (structures only)

Group 17: Pseudohalogens, Structures of Interhalogen compounds.

UNIT II: 1.

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

2. Chemistry of f-block elements:

Chemistry of lanthanides - electronic structure, oxidation states, lanthanide

contraction, consequences of lanthanide contraction, magnetic properties. Chemistry of actinides - electronic configuration, oxidation states, actinide contraction, comparison of lanthanides and actinides.

3. Theories of bonding in metals: Valence bond theory and Free electron theory, explanation of thermal and electrical conductivity of metals based on these theories, Band theory- formation of bands, explanation of conductors, semiconductors and insulators.

UNIT III:

PHYSICAL CHEMISTRY

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

UNIT IV:

1. Gaseous state van der Waal's equation of state. Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. Relationship between critical constants and vander Waal's constants. Lawof corresponding states. Joule-Thomson effect. Inversion temperature.
2. .Liquid state

   Liquid crystals, mesomorphic state. Differences between liquid crystal and solid/liquid. Classification of liquid crystals into Smectic and Nematic. Application of liquid crystals as LCD devices.

   UNIT V:

   SOLUTIONS, IONIC EQUILIBRIUM & DILUTE SOLUTIONS

   1. Solutions Azeotropes- HCl-H2O system and ethanol-water system. Partially miscible liquids-phenol- water system. Critical solution temperature (CST), Effect of impurity on consulate temperature. Immiscible liquids and steam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law. 2. Ionic equilibrium Ionic product, common ion effect, solubility and solubility product. Calculations based on solubility product. 3. Dilute solutions Colligative properties- RLVP, Osmotic pressure, Elevation in boing point and depression in freezing point. Experimental methods for the determination of molar mass of a non-volatile solute using osmotic pressure, Elevation in boiling point and depression in freezing point. Abnormal colligative properties. Van't Hoff factor.

Semester II

ChemistryCourse: IIOrganic & General Chemistry

At the end of the course, the student will be able to

S.NO	Course Outcomes	Mapping with POs	Cognitive level
CO 1	Understand and explain the differential behavior of organic compounds based on fundamental concepts learnt	PO 1,2,4.7	L 1,2,3,5
CO 2	Comprehend Chemical bonding ,VBT,MO theory,HSAB application	PO 1,2,3,4,7	L 1,3,4,5
CO 3	Learn and identify stereochemistry ,isomerisms,separation of racemic mixture	PO 1,2,3,4,5,7	L 1,2,3,6

Mapping of COs to POs: Alignment on a 3 point scale from weak to strong

COs	POs							
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	1	3	1	2	3	1
CO 2	2	3	1	3	1	1	3	1
CO 3	3	3	2	3	1	3	2	1

B.Sc. Semester – II Credits: 4

Course: 2 Organic & General Chemistry Hrs/Wk: 4

UNIT I:

ORGANIC CHEMISTRY

Recapitulation of Basics of Organic Chemistry Carbon-Carbon sigma bonds (Alkanes and Cycloalkanes) General methods of preparation of alkanes- Wurtz and Wurtz-Fittig reaction, Corey House synthesis, physical and chemical properties of alkanes, Isomerism and its effect on properties, Free radical substitutions; Halogenations, concept of relative reactivity v/s selectivity. Conformational analysis of alkanes (Conformations, relative stability and energy diagrams of Ethane, Propane and butane) General molecular formulae of cycloalkanes and relative stability, Baeyer strain theory, Cyclohexane conformations with energy diagram, Conformations of monosubstituted cyclohexane.

UNIT II:

Carbon-Carbon pi Bonds(Alkenes and Alkynes) General methods of preparation, physical and chemical properties. Mechanism of E1, E2, E1 cb reactions, Saytzeff and Hofmann eliminations, Electrophilic Additions ,mechanism (Markovnikov/Anti Markovnikov addition) with suitable examples,, syn and anti-addition; additionofH2,X2, HX. Oxymercuration, demercuration, hydroboration-oxidation, ozonolysis, hydroxylation, Diels Alderreaction,1,2- and1,4-addition reactions in conjugated dienes. Reactions of alkynes; acidity, electrophilic and nucleophilic additions, hydration to form carbonyl compounds, Alkylation of terminal alkynes.

UNIT III:

Benzene and its reactivity Concept of aromaticity, Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation) Reactions - General

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

UNIT IV:

GENERAL CHEMISTRY

1. Surface chemistry and chemical bonding Surface chemistry Colloids- Coagulation of colloids- Hardy-Schulze rule. Stability of colloids, Protection of Colloids, Gold number. Adsorption-Physical and chemical adsorption, Langmuir adsorption isotherm, applications of adsorption.
2. Chemical Bonding Valence bond theory, hybridization, VB theory as applied to ClF3,Ni(CO)4, Molecular orbital theory -LCAO method, construction of M.O. diagrams for homo-nuclear and hetero-nuclear diatomic molecules(N2,O2,CO and NO). 3. HSAB Pearson's concept, HSAB principle & its importance, bonding in Hard-Hard and Soft-Soft combinations. UNIT V:
3. Stereochemistry of carbon compounds Molecular representations- Wedge, Fischer, Newman and Saw-Horse formulae. Optical isomerism: Optical activity- wave nature of light, plane polarised light, optical rotation and specific rotation. Chiral molecules- definition and criteria (Symmetry elements)- Definition of enantiomers and diastereomers – Explanation of optical isomerism with examples- Glyceraldehyde, Lactic acid, Alanine, Tartaric acid, 2,3-dibromopentane. D,L, R,S and E,Z- configuration with examples. Definition of Racemic mixture – Resolution of racemic mixtures (any 3 techniques) Co-curricular activities and Assessment Methods Continuous Evaluation: Monitoring the progress of student's learning Class Tests, Worksheets and Quizzes Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality Semester-end Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

Semester III

Chemistry Course: IIIOrganic chemistry & Spectroscopy

At the end of the course, the student will be able to

S.NO	Course Outcomes	Mapping with POs	Cognitive level
CO 1	Understand preparation, properties and reactions of haloalkanes, haloarenes and oxygen containing functional groups.	PO 1,2	L 1,2,3,5
CO 2	Use the synthetic chemistry learnt in this course to do functional group transformations.	PO 1,2,4,	L 1,2,3,5
CO 3	To propose plausible mechanisms for any relevant reaction, master principles of spectroscopy	PO 1,2,4,8	L 1,2,4,5

Mapping of COs to POs: Alignment on a 3 point scale from weak to strong

COs	POs							
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	1	1	3	1	2	1
CO 2	3	2	1	3	1	2	1	1
CO 3	3	3	1	3	1	1	3	3

B.Sc. Semester – III Credits: 4**Course: 3 Organic chemistry & Spectroscopy**Hrs/Wk: 4 UNIT I:

ORGANIC CHEMISTRY

Chemistry of Halogenated Hydrocarbons:

Alkyl Halides:

Methods of preparation and properties, nucleophilic substitution reactions– SN1, SN2 and SNi mechanisms with stereo chemical aspects and effect of solvent etc.; nucleophilic substitution vs. elimination, Williamson's synthesis.

Aryl Halides:

Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution; SN Ar, Benzyne mechanism. Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

Alcohols & Phenols Alcohols:
preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouvet Blanc Reduction; Oxidation Of Diols By Periodic Acid AndleadTetraacetate,Pinacol- Pinacolone Rearrangement; Phenols: Preparation And Properties; Acidity And Factors Affecting It, Ring substitution reactions, Reimer–Tiemann and Kolbe's–Schmidt Reactions, Fries and Claisen Rearrangement with mechanism;
UNIT II:
Carbonyl Compounds: Structure, reactivity, preparation and properties; Nucleophilic Addition, Nucleophilic Addition-elimination reactions with ammonia derivatives Mechanisms of Aldol and Benzoin Condensation, Claisan-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann Haloform Reaction And Baeyer Villiger oxidation, α- substitution reactions, oxidations and reductions (Clemmensen, wolf –kishner, with LiAlH4 &NaBH4). Addition Reactions Of α, βunsaturated carbonyl compounds: Michael Addition. Active Methylene

Compounds: Keto-enol tautomerism. Preparation And Synthetic Applications Diethyl malonate and ethyl acetoacetate.

UNIT III:

Carboxylic Acids and their Derivatives : General methods of preparation, physical properties and reactions of monocarboxylic acids, effect ofsubstituent acidic strength. Typical reactions of icarboxylic acids, hydroxy acids and unsaturated acids. Preparation And Reactions Of Acid Chlorides, anhydrides, esters and amides; Comparative study of nucleophilic substitution at acyl group-Mechanism of acidic and alkaline hydrolysis of esters, Claisen Condensation, Reformatsky reactions and Curtius Rearrangement Reactions involving H, OH and COOH groups-salt formation, anhydride formation, acid chloride formation, amide formation and esterification (mechanism). Degradation of carboxylic acids by Huns-Diecker reaction, decarboxylation by Schimdt reaction, Arndt- Eistert synthesis, halogenation by Hell- Volhard- Zelinsky reaction.

UNIT IV:

SPECTROSCOPY

Molecular Spectroscopy:

Interactionofelectromagneticradiationwithmoleculesandvarioustypesof spectra; Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution. Vibrational Spectroscopy: Classical Equation Of Vibration, computation of force constant, Harmonic and anharmonic oscillator, Morse Potential curve, vibrational degrees of freedom for polyatomic molecules, modes of vibration. Selection rules for vibrational transitions, Fundamental Frequencies, overtones and hot bands. Electronic spectroscopy: Energy levels of molecular orbitals (σ, π, n). Selection rules for electronic spectra. Types of electronic transitions in molecules, effect of conjugation. Concept of chromophore. bathochromic and hypsochromic shifts. Beer-Lambert's law and its limitations. Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals - spin-spin coupling, coupling constants. Applications of NMR with suitable examples - ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate, toluene and acetophenone.

UNIT V:

Application of Spectroscopy to Simple Organic Molecules Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Application of electronic spectroscopy and Woodward rules for calculating λmax of conjugated dienes and α,β – unsaturated compounds. Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions).

Semester IV

Chemistry**Course: IVInorganic, Organic and Physical Chemistry**

At the end of the course, the student will be able to

S.NO	Course Outcomes	Mapping with POs	Cognitive level
CO 1	To learn about Organometallic compounds ,preparations and properties	PO 1,2,3,4	L 1,2,4,5
CO 2	Learn about carbohydrates, Amines, Heterocyclic compounds structures ,preparation and properties	PO 1,2,5	L 1,2,4,6
CO 3	To learn about the laws of absorption of light energy by molecules and subsequent photochemical reactions, Explore molecular spectroscopy	PO 1,2,3,4,7	L 1,2,4,5

Mapping of COs to POs: Alignment on a 3 point scale from weak to strong

COs	POs							
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	1	2	3	1	1	2
CO 2	3	3	1	1	3	2	3	1
CO 3	3	2	3	1	1	1	3	1

B.Sc. **Semester – IV** Credits: 4 **Course: 4 Inorganic, Organic and Physical Chemistry** Hrs/Wk: 4

UNIT I:

Organo metallic Compounds: Definition and classification of organometallic compounds on the basis of bond type, Concept of hapticity of organic ligands. Metal Carbonyls:18electronrule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation of mono and binuclear carbonyls of 3d series. P-acceptor behaviour of carbon monoxide. Synergic effects (VB approach) - (MO diagram of CO can be referred to for synergic effect to IR frequencies).

UNIT II:

Carbohydrates: Occurrence, classification and their biological importance, Monosaccharides: Constitution and absolute configuration glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth Projection And Conformational Structures ;Interconversions of aldoses and ketoses; Kiliani-Fischer synthesis and Ruff degradation; Disaccharides– Elementary Treatment Of Maltose, lactose and sucrose. Polysaccharides–Elementary Treatment Of starch.

UNIT III:

Amino acids and proteins:

Introduction: Definition of Amino acids, classification of Amino acids into alpha, beta, and gamma amino acids. Natural and essential amino acids - definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples - Glycine, Alanine, valine and leucine) by following methods: a) from halogenated carboxylic acid b) Gabriel Phthalimide synthesis c) strecker's synthesis. Physical properties: Zwitter ion structure - salt like character - solubility, melting points, amphoteric character, definition of isoelectric point. Chemical properties: General reactions due to amino and carboxyl groups - lactams from gamma and delta amino acids by heating- peptide bond (amide linkage). Structure and nomenclature of peptides and proteins.

Heterocyclic Compounds:

Introduction and definition: Simple five membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole - Aromatic character – Preparation from 1, 4, - dicarbonyl compounds, Paul-Knorr synthesis. Properties: Acidic character of pyrrole - electrophilic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions - Diels Alder reaction in furan. Pyridine – Structure - Basicity - Aromaticity- Comparison with pyrrole- one method of preparation and properties - Reactivity towards Nucleophilic substitution reaction.

UNIT IV:

Nitrogen Containing Functional Groups: Preparation, properties and important reactions of nitro compounds, amines and diazonium salts. 1. Nitro hydrocarbons Nomenclature and classification-nitro hydrocarbons, structure -Tautomerism of nitroalkanes leading to aci and keto form, Preparation of Nitroalkanes, reactivity -halogenation, reaction with HONO (Nitrous acid), Nef reaction and Mannich reaction leading to Micheal addition and reduction.

2.Amines:

Introduction, classification, chirality in amines (pyramidal inversion), importance and general methods of preparation. Properties : Physical properties, Basicity of amines: Effect of substituent, solvent and steric effects. Distinction between Primary, secondary and tertiary amines using Hinsberg's Method And Nitrous Acid. Discussion of the following reactions with emphasis on the mechanistic pathway: Gabriel Phthalimide synthesis, Hoffmann- Bromamide Reaction,Carbylamine Reaction, Mannich reaction, Hoffmann’s exhaustive methylation, Hofmann-elimination reaction and Cope elimination. Diazonium Salts: Preparation and synthetic applications of diazonium salts including preparation of arenes, haloarenes, phenols, amino and nitro compounds. Coupling Reactions Of Diazonium Salts (preparation of azo dyes).

UNIT V:

Photochemistry: Difference between thermal and photochemical processes, Laws of photochemistry- Grothus- Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield- Photochemical reaction mechanism- hydrogen- chlorine and hydrogen- bromine reaction. Qualitative description of fluorescence, phosphorescence, Jablonski diagram, Photosensitized reactions- energy transfer processes (simple example).

Thermodynamics:

The first law of thermodynamics-statement, definition of internal energy and enthalpy, Heat capacities and their relationship, Joule-Thomson effect- coefficient, Calculation of work for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes, State function. Temperature dependence of enthalpy of formation- Kirchoff s equation, Second law of thermodynamics Different Statements of the law, Carnot cycle and its efficiency, Carnot theorem, Concept of entropy, entropy as a state function, entropy changes in reversible and irreversible processes. Entropy changes in spontaneous and equilibrium processes. Third law of thermodynamics, Nernst heat theorem, Spontaneous and non-spontaneous processes, Helmholtz and Gibbs energies-Criteria for spontaneity.

Semester IV

ChemistryCourse:VInorganic & Physical Chemistry

At the end of the course, the student will be able to;

S.NO	Course Outcomes	Mapping with POs	Cognitive level
CO 1	Understand concepts of complexes ,nomenclature,theories of bonding	PO 1,2,3,4,7	L 1,2,3,4
CO 2	Explain reactions of complexes,Trans effect and factors affecting stability of complexes	PO 1,2,3,4,	L 1,2,4,5
CO 3	Describe Various phase diagrams by phase rule, Electrochemical reactions and Order ,molecularity and Rate constants	PO 1,2,3,4,7	L 1,2,3,6

Mapping of COs to POs: Alignment on a 3 point scale from weak to strong

COs	POs							
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	1	2	3	1	3	1
CO 2	3	3	3	3	1	2	1	1
CO 3	3	2	1	3	1	1	3	2

B.Sc. **Semester – IV** **Credits: 4** Course: 5

Inorganic & Physical Chemistry Hrs/Wk: 4

UNIT I:

Coordination Chemistry:

IUPAC nomenclature of coordination compounds, Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Valence Bond Theory (VBT): Inner and outer orbital complexes. Limitations of VBT, Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry, Factors affecting the magnitude of crystal field splitting energy, Spectrochemical series, Comparison of CFSE for Octahedral and Tetrahedral complexes, Tetragonal distortion of octahedral geometry, Jahn-Teller distortion, square planar coordination.

UNIT II:

1. Inorganic Reaction Mechanism:
2. Introduction to inorganic reaction mechanisms. Concept of reaction pathways, transition state, intermediate and activated complex. Labile and inert complexes, ligand substitution reactions -SN1 and SN2 , Substitution reactions in square planar complexes, Trans-effect, theories of trans effect and its applications

2. Stability of metal complexes:

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

Metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on the distribution of metals, Sodium / K - pump, carbonic anhydrase and carboxypeptidase. Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents

in medicine, Cis-platin as an anticancer drug. Iron and its application in bio-systems, Haemoglobin, Myoglobin. Storage and transfer of iron.

UNIT-III:

PHYSICAL CHEMISTRY

1 .Phase rule:

Concept of phase, components, degrees of freedom. Thermodynamic derivation of Gibbs phase rule. Phase diagram of one component system - water system, Study of Phase diagrams of Simple eutectic systems i) Pb-Ag system, desilverisation of lead ii) NaCl-Water system, Congruent and incongruent melting point- Definition and examples for systems having congruent and incongruent melting point , freezing mixtures.

UNIT IV:

Electrochemistry: Specific conductance, equivalent conductance and molar conductance- Definition and effect of dilution. Cell constant. Strong and weak electrolytes, Kohlrausch's law and its applications, Definition of transport number, determination of transport number by Hittorf's method. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only), Application of conductivity measurements- conduct metric titrations.Electrochemical Cells- Single potential, Types of electrodes with examples: Metal- metal ion, Gas electrode, Inert electrode, Redox electrode, Metal-metal insoluble salt- salt anion. Determination of EMF of a cell, Nernst equation, Applications of EMF measurements - Potentiometric titrations. Fuel cells- Basic concepts, examples and applications

UNIT V:

Chemical Kinetics : The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction, Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).Enzyme catalysis- Specificity,factors affecting enzyme catalysis, Inhibitors and Lock & key model. Michaels- Menten equation- derivation, significance of Michaelis-Menten constant.

Semester V

ChemistryCourse :VIAnalytical Methods in Chemistry-1

At the end of the course, the student will be able to;

S.NO	Course Outcomes	Mapping with POs	Cognitive level
CO 1	Identify the importance of solvent extraction and ion exchange method	PO 1,2,3,4	L 1,2,3,5
CO 2	Acquire knowledge on the basic principles of volumetric analysis and gravimetric analysis.	PO 1,2,,4,7	L 1,2,3,4
CO 3	Demonstrate the usage of common laboratory apparatus used in quantitative analysis	PO 1,2,3,4,5	L 1,2,4,6

Mapping of COs to POs: Alignment on a 3 point scale from weak to strong

COs	POs							
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	2	3	1	3	2	1	3	1
CO 2	3	3	2	3	3	1	1	1
CO 3	3	1	3	3	1	3	3	1

B.Sc.(Hons)–**Semester–V** Course6-B:
Analytical Methods in Chemistry-1
Quantitative analysis-
1. A brief introduction to analytical methods in chemistry 2. Principles of volumetric analysis, concentration terms- Molarity, Molality, Normality, v/v, w/v, ppm and ppb, preparing solutions- Standard solution, primary standards and secondary standards. 2. Description and use of common laboratory apparatus- volumetric flask, burette, pipette, beakers, measuring cylinders.
Unit-2:
Quantitative analysis-2
1. Principles of volumetric analysis: Theories of acid-base (including study of acid-base titration curves), redox, complex metric, iodometric and precipitation titrations-choice of indicators for the saturations.
2. Principles of gravimetric analysis: precipitation, coagulation, peptization, co precipitation, post precipitation, digestion, filtration, and washing of precipitate, drying and ignition. Unit-3: Treatment of analytical data 8hours Types of errors- Relative and absolute, significant figures and its importance, accuracy - methods of expressing accuracy, errors- Determinate and indeterminate and minimization of errors, precision-methods of expressing precision, standard deviation and confidence interval. Unit-4:
separation techniques
1. Solvent Extraction:
Introduction, principle, techniques, factors affecting solvent extraction, Batch extraction, continuous extraction and counter current extraction. Synergism. Application-Determination of Iron (III).

Ion Exchange method: Introduction, action of ion exchange resins, applications.

UNIT-5:

3. Analysis of water 10hours Determination of dissolved solids, total hardness of water, turbidity, alkalinity, Dissolved oxygen, COD, determination of chloride using Mohr's method.

Semester V

Chemistry Course VIIAnalytical Methods in Chemistry-2

Students after successful completion of the course will be able to

S.NO	Course Outcomes	Mapping with POs	Cognitive level
CO 1	Identify the importance of chromatography in the separation and identification of compounds in a mixture	PO 1,2,3,4	L 1,2,3,5
CO 2	Acquire a critical knowledge on various chromatographic techniques.	PO 1,2,3,4,7	L 1,2,3,4
CO 3	Demonstrate skills related to analysis of water using different techniques, spectroscopy and comprehend applications	PO 1,2,3,4	L 1,2,4,6

Mapping of COs to POs: Alignment on a 3 point scale from weak to strong

COs	POs							
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	2	1	3	3	1	3	1
CO 2	3	3	3	2	1	3	3	3
CO 3	3	2	3	3	1	3	3	1

B.Sc**Semester-V** Course7-B:

Analytical Methods in Chemistry-2

Unit-1:

Chromatography-Introduction and classification

Principle, Classification of chromatographic methods, Nature of adsorbents, eluents, Rfvalues, factors affecting Rfvalues.

UNIT-2:

TLC and paper chromatography

1. Thin layer chromatography:

Principle, Experimental procedure, preparation of plates, adsorbents and solvents, development of chromatogram, detection of spots, applications and advantages.

Paper Chromatography:

Principle, Experimental procedure, choice of paper and solvents, various modes of development- ascending, descending, radial and two dimensional, applications

UNIT-3:

Column chromatography

1. Column chromatography:

Principle, classification, Experimental procedure, stationary and mobile phases, development of the Chromatogram, applications. 2. HPLC: Basic principles, instrumentation –block diagram and applications.

UNIT-4:

Spectrophotometry

Principle, Instrumentation:

Single beam and double beam spectrometer, BeerLambert's law- Derivation and deviations from Beer-Lambert's law, applications of BeerLambert's law-Quantitative determination ofFe^{+2}, $Mn^{+2}$and Pb^{+2} .

UNIT-5:

Atomic spectroscopy

Types, atomizer, atomic absorption and emission and applications