



DEPARTMENT OF CHEMISTRY

**Programme outcome, Programme Specific outcome
and
Course outcome**

HOD

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PRINCIPAL



Annai College of Arts & Science

Quality Education for Today & Tomorrow

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Programme Outcome:

PO1. Current tool usage: Understand basic facts and concepts in Chemistry while retaining the exciting aspects of Chemistry so as to develop an interest in the study of chemistry as a discipline.

PO2. Communication: Develop the ability to apply the principles of Chemistry.

PO3. Ethics: Appreciate the achievements in Chemistry and to know the role of Chemistry in nature and in society. To develop problem-solving skills.

PO4. Life-long learning: Familiarized with the emerging areas of Chemistry and their applications in various spheres of Chemical sciences and to apprise the students of its relevance in future studies.

PO5. Individual and teamwork: Develop skills in the proper handling of apparatus and chemicals. To be exposed to the different processes used in industries and their applications.

PO6. Society: To help in understanding the causes of environmental pollution and can open up new methods for environmental pollution control.

Programme Specific Outcome:

PSO1. Gains complete knowledge about all fundamental aspects of all branches of chemistry

PSO2. Understand the basic concepts behind complex chemical structures, reagents in organic syntheses, reactive intermediates, important organic reactions and its mechanisms, naming reactions, molecular rearrangements, stereochemistry, instrumental method of chemical analysis and natural products etc.

PSO3. Identify the importance of various elements present in the periodic table, coordination chemistry and structure of molecules, properties of compounds, structural determination of complexes using theories and instruments, complex metal drugs and catalysts, role of metal ions in biological processes and organometallic chemistry

PSO4. Gathers attention to the physical aspects of atomic structure, quantum chemistry, thermodynamics, reaction pathways with respect to time, various energy

transformations, the significance of electrochemistry, molecular spectroscopy, role of catalysts in reactions, polymer chemistry, materials chemistry, and biophysical chemistry.

PSO5. Learns about the potential uses of analytical industrial chemistry, medicinal chemistry, and environment-oriented chemistry.

PSO6. Apply the various analytical techniques like IR, mass, NMR, NQR, EPR, XRD to structural characterization of unknown compounds.

PSO7. Carry out experiments in the area of organic analysis, estimation, separation, derivative process, inorganic semi microanalysis, preparation, conductometric and potentiometric analysis.

Course Outcomes: Under Graduate Programme in Chemistry

Name of the Course with Subject Code	Course Outcomes
General Chemistry I 16SCCCH1	<p>CO1. Difference between periodic table and periodic properties elements</p> <p>CO2. Classification of elements into s, p, d, and f block elements and explain electronic configuration.</p> <p>CO3. Describe the analytical methods of Qualitative Inorganic Analysis</p> <p>CO4. Explain the Semi microanalysis of simple salts, Volumetric analysis</p> <p>CO5. Describe the Inductive, mesomeric, electromeric effects and hyperconjugation, the structure of organic molecules based on sp³, sp², and sp hybridization</p> <p>CO6. Explain the Alkanes and conformational analysis</p> <p>CO7. Explain the carbocations, carbanions, carbenes, and nitrenes reactive intermediates and methods for reaction mechanisms</p> <p>CO8. Describe the chemistry of cycloalkanes, alkenes, dienes, and alkynes</p> <p>CO9. Describe the Alkynes: Nomenclature, General methods of preparation</p> <p>CO10. Definition and types of Colloids and Describe Macromolecules.</p>
Volumetric Analysis 16SCCCH1P	<p>CO1. Learn the techniques of titrimetric analyses.</p> <p>CO2. Quantitative estimation using the different branches of volumetric Analysis.</p> <p>CO3. Estimate of several cations and anions.</p> <p>CO4. Estimate of total hardness of the water.</p>

<p>General Chemistry II 16SCCCH2</p>	<p>CO1. Explain the chemical bond formation, character and Rules.</p> <p>CO2. Describe the VB theory, MO theory and VSEPR theory of simple inorganic Molecules</p> <p>CO3. General characteristics of s-block elements.</p> <p>CO4. Explain the Metallurgy: Occurrence of metals and Zero group elements</p> <p>CO5. Describe the benzene and benzenoid compounds- Aromaticity, Aromatic electrophilic substitution reactions</p> <p>CO6. Describe the Polynuclear aromatic hydrocarbons and Nomenclature</p> <p>CO7. Explain the Nomenclature of haloalkanes – structure - general preparations of haloalkanes – physical and chemical properties and uses and Stereochemical aspects</p> <p>CO8. Describe the Halobenzene's orientation and reactivity, preparation, and properties</p> <p>CO9. Describe the atomic structure and basic quantum mechanics, Rutherford's and Bohr's model an atom- Bohr's theory.</p> <p>CO10. Explain De-Broglie's hypothesis and Davisson and Germer experiment. Heisenberg's uncertainty principle. Schrodinger wave equation.</p>
<p>General Chemistry III 16SCCCH3</p>	<p>CO1. Describe the characteristics of p-block elements. Comparative study of elements of III A & their compounds.</p> <p>CO2. Extraction methods of Al and Pb - alums, alloys of Al and Explain the Compounds of nitrogen and phosphorous</p> <p>CO3. Preparation, properties, structure, Peracids of sulfur, Thionic acids, sodium thiosulphate</p> <p>CO4. Classification of oxides superoxides and Interhalogen compounds, Pseudohalogens, Oxyacids</p>

	<p>of halogens</p> <p>CO5. Explain symmetry elements, asymmetry and dissymmetry, isomerism, constitutional isomers, stereoisomers, enantiomers, diastereomers, geometrical isomerism</p> <p>CO6. Describe the Nomenclature, correlation of configuration Cahn-Ingold-Prelog rules and Atropisomerism, erythro and threo conventions, stereoselectivity, stereospecificity</p> <p>CO7. Explain Gases Boyle's law, Charles's law and Avagadro's law ideal gas and real gas equation.</p> <p>CO8. Explain Maxwell's distribution of molecular velocities</p> <p>CO9. Describe the Classification of solids, laws of crystallography and Types of crystals</p> <p>CO10. Explain the Semiconductors and Liquid crystals- types and applications</p>
<p>Chemistry In Everyday Life 16SCNME1</p>	<p>CO1. Explain the Characteristics of water and the Purification of water by ion exchange and reverse osmosis methods.</p> <p>CO2. Explain the Water pollution and Eutrophication Discuss primary, the secondary and tertiary structure of proteins</p> <p>CO3. Describe the Heavy metals such as Hg, Cr, Cd, Zn, Cu and metals like Pb, As</p> <p>CO4. Discuss Plant nutrients and Requisites of good fertilizer</p> <p>CO5. Explain the difference between fertilizer and manure</p> <p>CO6. Describe Fungicides, Herbicides, Acaricides, Rodenticides, Repellants, Fumigants</p> <p>CO7. Explain the Food classification and functions and Food additives, coloring, Flavouring agents Anti-oxidants, Emulsifiers</p>

	<p>CO8. Describe the Cosmetics and side effects, Toothpowder and Preparation of phenyl, liquid blue and incense sticks, soap and detergents</p> <p>CO9. classification of dyes based on application.</p> <p>CO10. Explain Polymers, Fibers, Dyes, and Dyeing process</p>
<p>Semi Microanalysis 16SCCCH2P</p>	<p>CO1. Learn the techniques of semi-micro inorganic qualitative analysis.</p> <p>CO2. Analysis of a mixture containing two cations and two anions of which one will be an interfering acid radical.</p> <p>CO3. Cations to be Studied: lead, copper, bismuth, cadmium, iron, aluminium, zinc, manganese, cobalt, nickel, barium, calcium, strontium, magnesium and ammonium.</p> <p>CO4. Anions to be studied: Carbonate, Sulphide, Sulphate, nitrate, chloride, bromide, fluoride, borate, oxalate and phosphate.</p>
<p>General Chemistry IV 16SCCCH4</p>	<p>CO1. Describe the General characteristics of d-block and f-block elements, comparative study of zinc group elements.</p> <p>CO2. Explain the Arrhenius, Lowry – Bronsted, and Lewis concept of acids and bases.</p> <p>CO3. Describe the preparation of Organolithium, organocopper, Organolead, organophosphorus and organoboron, organomagnesium compounds physical and chemical properties uses.</p> <p>CO4. Explain the Nomenclature – industrial source of alcohols – preparation of alcohols and physical-chemical properties – uses</p> <p>CO5. Explain Preparation of phenols including di- and trihydroxy phenols – physical and chemical properties.</p>

	<p>CO6. Describe Preparation of ethers: dehydration of alcohols, Williamson's synthesis – silyl ether. epoxides from peracids - Sharpless asymmetric epoxidation</p> <p>CO7. Explain system and surrounding- isolated, closed and open system- state of the system.</p> <p>CO8. Explain the First law of thermodynamics, Thermochemistry- the relationship between enthalpy.</p> <p>CO9. Describe the Rate of reaction- rate equation, order and molecularity of reaction, Methods of determination of order of reactions</p> <p>CO10. Explain the Effect of temperature on reaction rate- concept of activation energy, energy barrier, Arrhenius equation. Theories of reaction rates- collision theory.</p>
<p>Health Chemistry 16SCNME2</p>	<p>CO1. Definition: Food, Food Pyramid Health-Hygiene-mal, under and over nutrition, causes and remedies, sanitation.</p> <p>CO2. Describe the Drugs Types of drugs depressant, anticonvulsant, narcotics, antipyretics, antibiotics, antiseptics, analgesics, muscle relaxants and cardiovascular and vasodepressants, steroids.</p> <p>CO3. Explain the body fluids Blood volume, groups, coagulation, blood pressure, anemia, blood sugar, hemoglobin. Chemistry of urine.</p> <p>CO4. Describe the Types of enzymes and enzyme action, Characters of hormones action.</p> <p>CO5. Describe the Common diseases - Jaundice, vomiting, fever, night blindness, ulcer, and diabetes.</p>
<p>Inorganic Chemistry – I 16SCCCH5</p>	<p>CO1. Classify of ligands: unidentate, bidentate and polydentate ligands, chelating ligands and chelates.</p> <p>CO2. Describe the Isomerism in coordination compounds and Werner, Sidgwick theories, methods of</p>

	<p>detecting complex formation.</p> <p>CO3. Explain the Theories of coordination compounds, Valence bond theory, valence bond theory, crystal field theory and Jahn – Teller distortion.</p> <p>CO4. Describe the Molecular orbital theory, Molecular orbital diagram, Ligand field theory.</p> <p>CO5. Explain Labile and inert complexes, stability of coordination compounds.</p> <p>CO6. Describe the Unimolecular and biomolecular nucleophilic substitution reactions in octahedral and square planar complexes, trans effect – theories of trans effect and applications.</p> <p>CO7. Explain biologically important coordination compounds.</p> <p>CO8. Metal carbonyls Mono and binuclear carbonyls of Ni, Fe, Cr, Co and Mn – preparation, structure, reactions, bonding and uses and Binary metallic compounds.</p> <p>CO9. Classify -nitrosyl chloride and sodium nitroprusside - preparation, properties and structure</p> <p>CO10. Explain the Dipole moment-determination, application in the study of simple inorganic Molecules</p>
<p>Organic Chemistry I 16SCCCH6</p>	<p>CO1. Describe the Nomenclature, structure of carbonyl compounds and Reduction and oxidation reactions of carbonyl compounds.</p> <p>CO2. Explain the preparation of aromatic carbonyl compounds physical and chemical properties.</p> <p>CO3. Describe the Nomenclature - Acidity of carboxylic acids, dicarboxylic acid - physical and chemical properties</p> <p>CO4. Explain the manufacture of soap and mechanism of cleaning action of soap</p> <p>CO5. Explain Nomenclature - nitro alkanes - alkyl nitrites - differences - aromatic nitro compounds -</p>

	<p>preparation and reduction of nitrobenzene under different conditions, TNT.</p> <p>CO6. Describe the Amines – effect of substituents on basicity of aliphatic and aromatic Amines</p> <p>CO7. Explain the Diazonium compounds - preparation and synthetic applications.</p> <p>CO8. Explain the nomenclature of heterocyclic compounds and Dyes color and constitution.</p> <p>CO9. Describe Oxidation: Osmium tetroxide, Chromyl chloride, Ozone, DDQ, Dioxiranes Lead tetraacetate, selenium dioxide, DMSO either with Ac₂O or oxalyl chloride – Dess-Martin reagent</p> <p>CO10. Explain the Reduction: Catalytic hydrogenation using Wilkinson Catalyst – Reduction with LAH, NaBH₄, tritertiarybutoxy aluminum hydride, NaCNBH₃</p>
<p>Physical Chemistry I 16SCCCH7</p>	<p>CO1. Explain various concepts of photochemistry and group theory.</p> <p>CO2. Photochemical reactions-Comparison between thermal and photochemical reactions</p> <p>CO3. Illustration of group postulates using symmetry operations of H₂O molecule</p> <p>CO4. Discuss Second law of thermodynamics – need for the law- different statements of the law</p> <p>CO5. Explain the Gibb's free energy and Helmholtz free energy variation of A and G with P, V and T- Gibb's – Helmholtz equation and its applications and Systems variable composition- partial molar quantities- chemical potential variation of chemical potential</p> <p>CO6. Describe Equilibrium constant and free energy change- thermodynamic derivation of law and Third law of thermodynamics- Nernst heat theorem.</p> <p>CO7. Explain the Raoult's law, Henry's law, Ideal and non-ideal solutions and partially miscible liquids</p>

	<p>CO8. Describe Determination of molecular masses using colligative properties</p> <p>CO9. Definitions of terms in the phase rule- derivation and application to one component Two-component systems.</p> <p>CO10. Explain Compound formation with congruent melting point Solid Solutions-(Ag-Au)-fractional crystallization.</p>
<p>Analytical Chemistry 16SMBECH1:1</p>	<p>CO1. Describe the Storage and handling of chemicals- corrosion, flammable, explosive, toxic, carcinogenic and poisonous chemicals and Simple first aid procedures for accidents.</p> <p>CO2. Precautions to avoid poisoning-treatment for specific poisons, threshold vapour concentrations-safe limits-laboratory safety measures and Waste disposal-fume disposal-precautions for avoiding accidents.</p> <p>CO3. Explain the Mean-significant numbers, the median-precision, accuracy- confidence limits, standard deviation and Errors-method for improving accuracy-rejection of data-presentation of tabulated data-Scatter diagram</p> <p>CO4. Discuss solvent extraction-chromatography.</p> <p>CO5. Explain Gravimetric analysis - principles-methods of gravimetric analysis and Types of precipitation Thermo analytical techniques – types-TGA principle-Instrumentation – TGA analysis of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$.</p> <p>CO6. Describe Differential thermal analysis-principle-DTA of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$, TGA & DTA.</p> <p>CO7. Explain the Theory of spectrophotometry and colorimetry</p> <p>CO8. Describe Criteria for satisfactory colorimetric estimation advantages of colorimetric estimation, determination of composition of complexes</p> <p>CO9. Definitions of Electro gravimetry theory electro</p>

	<p>gravimetric analysis of Fe and Cu and Electrolytic separation of metals.</p> <p>CO10. Explain Coulometry Principle of coulometric analysis.</p>
<p>Physical Chemistry 16SCCCH3P</p>	<p>CO1. Analysis to learn the fundamentals of conductometric and potentiometric titrations.</p> <p>CO2. The understanding the method of determination of molecular weight, CST, TT and rate constant.</p>
<p>Organic Chemistry II 16SCCCH8</p>	<p>CO1. Describe Carbohydrate - classification, properties of monosaccharides and structure and configuration</p> <p>CO2. Explain the Disaccharides - sucrose, maltose - structure elucidation –a polysaccharide – starch and cellulose.</p> <p>CO3. Describe Amino acids, Zwitter ion isoelectric point - general methods of preparation and reactions of amino acids and Structure of proteins.</p> <p>CO4. Explain the Nucleic acids - elementary treatment of DNA and RNA - Vitamins - classification, Structure.</p> <p>CO5. Explain Preparation of phenols including di and trihydroxy phenols – physical and chemical properties natural products, alkaloids classification, isolation - methods for synthesis of coniine, piperine, nicotine and quinine.</p> <p>CO6. Describe Terpenoids - classification - isoprene, special isoprene rule, methods for synthesis of citral, limonene, menthol, camphor.</p> <p>CO7. Explain the Molecular rearrangements - types of rearrangement.</p> <p>CO8. Explain Benzil - benzilic acid, benzidine, Claisen, Fries, Hofmann. Curtius, Lossen, Beckmann and dienone – phenol rearrangements.</p> <p>CO9. Describe spectroscopy types of electronic transitions – Instrumentation</p> <p>CO10. Explain the chemical shift- factors affecting the chemical shift inductive effect and hydrogen bonding</p>

	TMS, delta scales, splitting of signals, spin-spin coupling, NMR spectrum of EtOH.
Physical Chemistry II 16SCCCH8	<p>CO1. Describe the Conductance in metal and in electrolytic solution- specific conductance and equivalent conductance and Effect of dilution on equivalent conductance and specific conductance.</p> <p>CO2. Transport number and Hittorf's rule. Determination of transport number by Hittorf's method and moving boundary method Application of conductance measurements- determination of degree of dissociation.</p> <p>CO3. Explain Galvanic cells - reversible and irreversible cells. Conventional representation of electrochemical cells</p> <p>CO4. Discuss Potentiometric titrations -Acid-Base titrations- Oxidation-reduction</p> <p>CO5. Catalyst-Definition and Characteristics - Types of catalysis-Homogeneous and heterogeneous.</p> <p>CO6. Describe Adsorption-types-chemical and physical, characteristics of adsorption Theories,</p> <p>CO7. Explain the Different types of isotherms-Freundlich and Langmuir adsorption isotherms</p> <p>CO8. Describe Electromagnetic spectrum- the region of various types of spectra. Microwave Spectroscopy and Infrared spectroscopy- vibrations of diatomic molecules</p> <p>CO9. Definitions of Raman spectroscopy – Rayleigh scattering and Raman scattering. Stokes and anti-stokes lines in Raman spectra.</p> <p>CO10. Explain NMR spectroscopy- nuclear spin and conditions for a molecule to give rise to NMR spectrum theory of NMR spectra.</p>
Nuclear, Industrial Chemistry & Metallic	CO1. Describe the nuclear structure, nuclear model liquid.

<p>State 16SMBE:CH2</p>	<p>CO2. Explain the Isotopes detection, physical and chemical methods of separation and Radioactivity.</p> <p>CO3. Explain the Detection and measurement of radioactivity</p> <p>CO4. Discuss Applications of radioisotopes.</p> <p>CO5. Explain Metallic bond, Packing of atoms in metals and Semiconductors.</p> <p>CO6. Describe Inorganic polymers coordination polymers and Silicates – classification into discrete anions.</p> <p>CO7. Explain the Composition, properties and uses of beryl, asbestos, talc, mica, feldspar and zeolite.</p> <p>CO8. Describe Gaseous fuels, Natural gas, gobar gas, water gas, semi water gas, carburetted water gas, producer gas and liquified petroleum gas</p> <p>CO9. Definitions of Fertilizers, Manufacture of nitrogen, phosphorus, potassium and mixed fertilizers, micro nutrients and their role in plant life.</p> <p>CO10. Explain Glass, Cement, Paints and varnishes Composition, manufacture, types and uses.</p>
<p>Polymer Chemistry 16MBECH3:1</p>	<p>CO1. Explain the Basics of polymers, monomers and polymers and Types of polymerization reactions.</p> <p>CO2. Describe the Basics of rubbers types, vulcanization of rubber- ebonite- uses of rubbers.</p> <p>CO3. Explain the Glass transition temperature (T_g), definition factors affecting T_g. Relationship between T_g and molecular weight.</p> <p>CO4. Discuss the Polymer degradation- thermal, photo and oxidation degradation of polymers</p> <p>CO5. Explain the Polymerization techniques: bulk, solution, emulsion, melt condensation and interfacial polycondensation polymerization.</p> <p>CO6. Describe the Moulding technique: Injection, compression, extrusion, rotational and calendaring</p>

	<p>CO7. Explain the Preparation, properties and uses of the polymers, Polyethylene, polypropylene, polystyrene, PVC, teflon and polymethylmethacrylate, polycarbonate, polyurethanes, polyamides,</p> <p>CO8. Describe the phenol-formaldehyde, urea-formaldehyde resin, epoxy resins, rubber-styrene and neoprene rubbers.</p> <p>CO9. Explain the Biopolymers – biomaterials. Polymers in medical.</p> <p>CO10. Explain the High temperature and fire, resistant polymers. Silicones. conducting polymers, carbon fibers.</p>
<p>Gravimetric & Organic Analysis 16SCCCH4P</p>	<p>CO1. Gravimetric analysis, estimation of lead as lead chromate, estimation of barium as barium chromate, estimation of nickel as nickel DMG complex, estimation calcium as calcium oxalate monohydrate, estimation of barium as barium sulphate.</p> <p>CO2. Organic qualitative analysis and organic preparation, organic analysis of simple organic compounds</p> <p>CO3. Organic preparation, preparation of organic compounds involving the following chemical conversions. oxidation, reduction, hydrolysis, nitration, bromination, diazotization, osazone formation</p> <p>CO4. Determinate boiling /melting points by semimicro method.</p>