

U.G. CHEMISTRY PROGRAMME SPECIFIC OOTCOMES:

(a) Developing knowledge of chemistry through theory and practical.

b) Explaining molecules in terms of nomenclature, stereochemistry, structures, reactivity, and mechanism of the chemical reactions.

(c) Identify chemical formulae, structures and solve numerical problems.

(d) Understanding good laboratory practices and safety. (e) Developing research-oriented skills.

(f) Make aware and handle the sophisticated equipment and advanced instruments.

U.G CHEMISTRY COURSE OUTCOME:

Paper/ Semester	Title	Course Outcome
Chemistry UG (CBCS) Semester		
CC1(Theory & Practical)/ Sem-1	Organic Chemistry	CO-1: To know hybridisation, shapes of molecules and orbital pictures of bonding. CO-2: To know structure and bonding of compounds of carbon and factor that control their reactivity such as Inductive Effect, resonance, hyperconjugation etc. CO-3: To understand MO theory and frontier MOs (FMO). CO-4: To learn the basics concepts of organic chemistry specially on chemical bonding and Physical Properties. CO-5: To know the concept types, reaction, mechanism and examples of elimination, free-radical, nucleophilic substitution and pericyclic reactions. CO-6: To understand about the formation and stability of reaction intermediates and their electrophilic and nucleophilic behaviour. CO-7: Gain basic knowledge of Stereochemistry of organic molecules. CO-8: To learn experimentally about the separation of organic compounds from solid binary mixture by using common laboratory reagents. CO-9: To understand experimentally how to determine the boiling point of organic liquid Compounds. CO-10: To study experimentally the qualitative detection of pure solid and liquid organic compounds.
CC2 (Theory & Practical)	Physical Chemistry-1	Students acquired knowledge on some physical parameter like Pressure, Temperature, Volume, frequency

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Chemistry UG (CBCS) Semester		
<p>CC2 (Theory & Practical Sem-1</p>	<p>Physical Chemistry-1</p>	<p>CO1: Students acquired knowledge on some physical parameter like Pressure, Temperature, Volume, frequency.</p> <p>CO2: Learnt about Collision, binary collision, Collision diameter, distribution of molecular speed of gas molecules. Difference between ideal and real gas and calculation of MPS, Average speed, RMS speed on the basis of Maxwell equation.</p> <p>CO3: They also learned to establish the energy distribution equation from speed distribution equation.</p> <p>CO4: Students are able to express the Vander wall equation of real gas and its virial form. Also, they learned some new terminology like critical temperature, critical pressure, critical volume, virial coefficient etc.</p> <p>CO4: Students are learned about “Flow of heat” and increased their concept by understanding different law of thermodynamics, they also learned some new terminology like Isolated system, close system, adiabatic system, enthalpy, Internal energy,</p> <p>CO5: In thermochemistry part students understood about formation and dissociation of molecules, ions and acquired knowledge by listening about bond energy, Kirchhoff’s equations and how enthalpy effected by changes of pressure.</p> <p>CO6: Students learned about Carnot engine, Concept of entropy, Entropy change of systems and surroundings for various processes and transformations; Entropy and unavailable work.</p> <p>CO7: Students experienced and learned to establish some thermodynamic derivation like Maxwell's relations; Gibbs-Helmholtz equation, Joule-Thomson experiment.</p> <p>CO 8: In Chemical kinetics chapter, Students cleared their concept on rate and order of a chemical reaction, they also learned to determine the order (1st, 2nd, 3rd, zero order) of reaction.</p> <p>CO9: Concept of different kind of reaction like Parallel reaction, consecutive reaction.</p> <p>CO10: Students learn Arrhenius theory, Collision theory, and Lindermann theory of Unimolecular reaction.</p> <p>CO11: Determination of P^H of unknown buffer solution by colormatching method.</p> <p>CO12: Determination of heat of neutralization of a strong acid by a strong base.</p> <p>CO13: Study of kinetics of acid-catalysed hydrolysis of methyl acetate</p> <p>CO14: Study of kinetics of decomposition of H₂O₂.</p> <p>CO15: Determination of heat of solution of oxalic acid from solubility measurement.</p>

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Chemistry UG (CBCS) Semester		
CC3 (Theory & Practical) Sem-II	Inorganic Chemistry-1	CO-1: To know extra nuclear structure of atom. CO-2: To study in detail about modern periodic table, physical and chemical properties of the elements along a group or period, factors influence those properties, relativistic effects and inert pair effect. CO-3: To understand acid-base reactions. CO-4: To know the basic concept of Red-Ox reactions. CO-5: to study the estimation of ions or salts by acid-base titration method and Oxidation –Reduction method.
CC4 (Theory & Practical) Sem-II	Organic Chemistry-2	CO-1: To learn Stereochemistry of chiral compounds arises due to presence of Stereo-axis; concept of prostereoisomerism and of conformations of stereoisomers. CO-2: To understand reaction kinetics, reaction thermodynamics and tautomerism of Organic compounds. CO-3: To learn the concept of organic acids, bases, acid-base equilibria and HSAB principle. CO-4: To learn in detail about the types, mechanism and Stereochemistry of substitution Elimination reactions. CO-5: To learn experimentally how to synthesise, calculate the yield and determine the melting point of pure organic compounds in the laboratory.
CC5 (Theory & Practical)	Physical Chemistry-2	CO-1: Learning the measuring technique of surface tension and viscosity of different fluid, CO-2: Learn the application of electrochemistry, develops the usage of electrode kinetics, electrochemical cell formation and their reactions, conductance and its importance. Application of conductance measurement. CO-3. Learning basic knowledge of thermodynamics. Thermodynamic functions for systems with variable composition. Learning about chemical equilibrium and derivation under thermodynamic condition. CO-4: Learning the spectroscopy and structural property of molecule, moment of inertia, mode of vibration and vibrational energy of a molecule, zero-point energy a harmonic oscillator, Raman scattering, fluorescence and phosphorescence and their mechanism, Operators used in quantum mechanics, matter and wave property of a system, wave function and energy of 1D, 2D, 3D box and hydrogen like system.

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Chemistry UG (CBCS) Semester		
CC5 (Theory & Practical) Sem-III	Physical Chemistry-2 Practical	<p>Learn about viscosity measurement of unknown liquid with respect to water. Partition coefficient determination for the distribution of I₂ between water and CCl₄.</p> <p>Uses of conductivity metre and learn about titration of an acid (strong, weak/ monobasic, dibasic) against base strong</p> <p>Study of saponification reaction conductometrically</p> <p>Experiment 6: Verification of Ostwald's dilution law and determination of K_a of weak acid.</p>
CC6 (Theory & Practical) Sem-III	Inorganic Chemistry-2	<p>CO-1: To learn about the basic concepts and types of chemical bonding, laws, rules and equations for formation of chemical bonds, solubility, hybridization and dipole moment of molecules.</p> <p>CO-2: To study the modern approaches of chemical bonding (Molecular Orbital Theory, Metallic Bonding concept, Role of weak intermolecular forces)</p> <p>CO-3: To understand about the concept of radioactivity and radioactive compounds, nuclear reactions, artificial radioactivity, radio carbon dating, hazards of radiation and safety measures.</p> <p>CO-4: To study the estimation of copper, vitamin C, arsenite and antimony in a mixture, available chlorine in bleaching powder by Iodo-Iodimetry Titration Method.</p> <p>CO-5: To study the estimation of copper in Brass, chromium and manganese in Steel, iron in Cement.</p>
CC7(Theory & Practical)	CC-7(Organic Chemistry-3)	<p>CO-1: To learn in detail about the synthesis, properties, chemical reactions and reaction mechanisms of alkenes and alkynes</p> <p>CO-2: To understand about different types of electrophilic and nucleophilic aromatic substitution reactions, reaction intermediates and their mechanisms.</p> <p>CO-3: To study the properties and reactions of carbonyl compounds and corresponding reaction mechanisms.</p> <p>CO-4: To learn preparations, reactions and corresponding reaction mechanisms of organometallic compounds.</p> <p>CO-5: Helps to know experimentally the qualitative analysis of single solid organic Compounds.</p>
SEC-1 (Theory & Practical)	SEC-1(Pharmaceutical Chemistry)	<p>CO-1: Helps to understand about the drug discovery, design and development of representative drugs of the following classes: Antipyretic, Analgesics, Anti-inflammatory, Anti-bacterial, Antifungal, Antiviral, Antibiotics, Anti-leprosy, Central Nervous System agents, HIV-AIDS related drugs.</p>

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Chemistry UG (CBCS) Semester		
SEC-1 (Theory& practical. SEM-III)	SEC-1(Pharmaceutical Chemistry)	<p>CO-2: To know about aerobic and anaerobic fermentation, importance of Vitamins and Amino acids, synthesis of Penicillin, Cephalosporin, Chloromycetin, Streptomycin and their role as an antibiotic.</p> <p>CO-3: To learn experimentally how to prepare aspirin in the laboratory and how to analyze it.</p> <p>CO-4: To learn experimentally how to prepare magnesium bisilicate in the laboratory.</p>
Sem-IV CC-8(Theory& Practical)	CC-8(Physical Chemistry-3) Practical	<p>Learning about application of Thermodynamics in types of solution, colligative property and determination of molecular mass of solutes using colligative properties.</p> <p>Phase rule and its derivations, learn about three component systems.</p> <p>Aquired knowledge on binary solutions, Electrical Properties of molecules. Application of standard electric potential in different kind of half-cell</p> <p>Schrödinger equation, transformation. Know about quantization of energy. Hartree-Fock method development.</p> <p>Learning about potentiometric titration of Mohr's salt solution. Know about phenol-water phase diagram. pH-metric titration.</p>
Sem-IV CC-9(Theory& Practical)	CC-9 (Inorganic Chemistry-III)	<p>CO-1: To study the general principles of metallurgy.</p> <p>CO-2: To study the chemistry of s and p block elements including noble gases and their compounds in detail.</p> <p>CO-3: To learn about inorganic polymers in detail.</p> <p>CO-4: To study the meaning of various terms involving co-ordination chemistry, Warner's theory for complex formation, structural and stereoisomerism of co-ordination complex.</p> <p>CO-5: To study the estimation of Zn (II), Zn (II) in a Cu (II) and Zn (II) mixture, Ca(II) and Mg (II) in a mixture, Hardness of water by Complexometric Titration Method.</p> <p>CO-6: To follow the preparation methods of [Cu (CH₃CN)₄] PF₆ /ClO₄, Cis and trans K [Cr (C₂O₄)₂ (H₂O)₂], Potassium di aqua dioxalato chromate (III) , Tetrammine carbonato Cobalt (III) ion, Potassium tris (Oxalato) ferrate (III) , Tris-(ethylenediamine) Nickel (II) chloride , [Mn(acac)₃] and [Fe (acac)₃] .</p>

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Chemistry UG (CBCS) Semester		
SEM-IV CC-10 (Theory& practical.	CC-10(Organic Chemistry-IV	<p>CO-1: To understand in detail about the synthesis, separation, properties, identification, chemical reactions and their corresponding mechanism of nitrogen containing compounds.</p> <p>CO-2: Discussion about different kinds of rearrangement reactions.</p> <p>CO-3: Helps to know the logic of organic synthesis</p> <p>CO-4: To study UV-Visible, IR and NMR spectroscopy in detail.</p>
SEM-IV Sec-2 Theory& Practical)	(Pesticide Chemistry)	<p>CO-1: Helps to understand about the preparation, structures, properties, reactions, benefits and adverse effects of pesticide compounds</p> <p>CO-2: Helps to understand how to calculate acidity/alkalinity in a given sample of pesticide formulations as per BIS specifications.</p> <p>CO-3: To learn experimentally how to prepare organophosphates, phosphonates and thiophosphates.</p> <p>CO-4: To study how to prepare inorganic complexes in the laboratory.</p> <p>CO-5: To know how to determine the co-ordination compounds by spectrophotometric method.</p>
	Cosmetic Chemistry	<p>CO-1: Formulate and evaluate various cosmeceutical products.</p> <p>CO-2: Know the key components used in different cosmeceutical products.</p> <p>CO-3: Recognize the role of ingredients and herbs used in cosmeceutical products.</p> <p>CO-4: Know the advanced current technology used for manufacturing the cosmetics at lab scale and industry scale.</p> <p>CO-5: Employable skills and high technical competence for Pharceutical industry</p>
	Fuel Chemistry	<p>Learning about renewable and non-renewable energy sources. Petroleum and non-petroleum fuels. Petrochemicals, Lubricants.</p>

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Chemistry UG (CBCS) Semester		
SEM-V CC-11 (Theory & practical)	CC-11(Inorganic Chemistry-IV)	<p>CO-1: To study the concept of VBT, elementary idea of CFT, OSSE, MO concept, Sigma-Pi bonding in complex, Magnetism and Colour of complexes, Orgel diagram, Selection rules for Spectral studies.</p> <p>CO-2: To study the chemistry of d and f- block elements and their compounds in detail.</p> <p>CO-3: To study the principles and techniques involved in chromatographic separation of Ni (II) and Co (II), Fe (III) and Al (III) by Paper chromatography.</p> <p>CO-4: To learn the Gravimetric estimation of Ni (II) , Al(III) , Cu as CuSCN , chloride .</p> <p>CO-5: To study the measurement of $10 Dq$ and λ_{max} of $[Mn(acac)_3]$ and $[Fe(acac)_3]$ by Spectrophotometry Method.</p>
SEM-V CC12 (Theory & Practical)	CC1-12(Organic Chemistry-V)	<p>CO-1: To learn in detail about the synthesis, properties, chemical reactions and reaction mechanisms of polynuclear hydrocarbons and their derivatives.</p> <p>CO-2: To study the chemical reactions, properties and synthesis of heterocyclic compounds.</p> <p>CO-3: To know in detail about the stereochemistry, properties and chemical reactions of alicyclic compounds.</p> <p>CO-4: To learn the mechanism, stereochemistry and regioselectivity of pericyclic reactions.</p> <p>CO-5: Helps to understand about the classification, structure, properties, reactions and use of carbohydrate molecules.</p> <p>CO-6: Deals with the synthesis, structure, properties, chemical and biological reactions of amino acids, peptides and nucleic acids.</p> <p>CO-7: To learn experimentally how to separate molecules by chromatographic methods</p> <p>CO-8: To study how to analyze the Organic compounds by spectroscopic techniques.</p>

SEM-V DSE-1 (Theory& practical.	DSE-1 (T) Advanced Chemistry	Physical	<p>CO:- -Learning about solid states, type of unit cell, packing efficiency, plane of symmetry of crystal, Bragg's reflection.</p> <p>To understand the differences between statistical thermodynamics and previously learned thermodynamics.</p> <p>Applications to barometric distribution. Maxwell's speed distribution.</p> <p>3rd law of thermodynamics and their consequence, Classification of polymers, Mechanism and kinetics of polymerization.</p>
	Practical		<p>Computer programs based on numerical methods for Programming. Like roots of equations, Numerical differentiation.</p> <p>Application of Gauss-Siedel method in colourimetry.</p> <p>Uses of molecular visualization software.</p>
	DSE-2T Analytical Methods in Chemistry		<p>CO: Learning about Sampling, evaluation of analytical data, errors, accuracy and precision, statistical test of data; F, Q and t test, rejection of data, and confidence intervals.</p> <p>CO: Learned about Origin of spectra, Basic principles of instrumentation, Basic principles of quantitative analysis, Infrared Spectrometry, Classification of electroanalytical methods. Separation techniques like Solvent extraction, Mechanism of extraction, Technique of extraction. chromatography, Role of computers in instrumental methods of analysis.</p>
	Practical		<p>To learn the separation technique by Chromatography (TLC),</p> <p>Analysis of soil:</p> <p>(i) Determination of pH of soil.</p> <p>(ii) Estimation of calcium, magnesium, phosphate.</p>
DSE-2 (Theory & Practical)			

SEM- VI CC-13 (Theory & Practical)	CC-13(T) Inorganic Chemistry-V	<p>CO-1: To study the benefits and role of essential elements and metal ions in biological system, structure bonding and mechanism of Haemoglobin, Hemocyanin, Hemerythrin, electron transport protein Hydrolytic enzymes, mechanism of Photosystem (I, II), effects of toxic metals, role of Pt and Au as drugs and metal dependent diseases.</p> <p>CO-2: To study the definition and classification of Organometallic compounds, preparation, reactions and structures of carbonyls, nitrosyls, cyanides, Zeise 's salt .</p> <p>CO-3: To know about the catalytic role of Organometallic compounds in different types of industrial processes.</p> <p>CO-4: To study the reaction kinetics and mechanism of different type of complexes</p>
	Practical	CO-5: To study experimentally the qualitative detection of known and unknown radicals and insoluble materials in a mixture.
SEM- VI C14T: (Theory & Practical)	CC14 (T) Physical Chemistry-V	<p>CO: 1. To learn about fundamentals and application of Rotational, Vibrational, Raman & NMR Spectroscopy. Principle and applications of ESR.</p> <p>CO:2 Learning Photochemistry calculation of Quantum yields, Photophysical and Photo chemical Process.</p> <p>CO:3. Learned about Surface Chemistry Adsorption, Colloids etc.</p>
	Practical	<p>Learn about Surface tension determination of liquid using stalagmometer.</p> <p>Verification of Beer and Lambert's Law for KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ solution.</p> <p>Determination of pH of unknown buffer, spectrophotometrically.</p>
DSE-3 (Theory & Practical)	Green Chemistry (T)	<p>CO:1 Learning about Green Chemistry Principles, Synthesis, how green Chemistry gives us a sustainable environment</p> <p>CO:2 Future Trends in Green Chemistry</p>

DSE-3 (Theory & Practical)	Practical	<p>Preparation and characterization of nanoparticles of gold using tea leaves</p> <p>Preparation of biodiesel from vegetable/ waste cooking oil</p>
DSE4T: (Theory & Practical)	Polymer Chemistry	<p>CO: To learn classification of polymers. Mechanism and kinetics of copolymerization.</p> <p>Morphology of crystalline polymers</p>