

SUBJECT: CHEMISTRY(B.Sc.)	After completion of the course students will be able to:
PROGRAMME OUTCOMES (COs)	<p>PO1: Understand Organic, Inorganic, and Physical Chemistry concepts.</p> <p>PO2: Apply chemistry to everyday life and explore new scientific and technological fields.</p> <p>PO3: Explain the principles behind chemical techniques used in academics and industry.</p> <p>PO4: Practice safe handling of chemicals in research and laboratories.</p> <p>PO5: Use chemistry to address social, economic, and environmental issues.</p> <p>PO6: Perform qualitative and quantitative analysis using various methods.</p> <p>PO7: Identify sustainable chemical processes for environmental benefit.</p> <p>PO8: Communicate complex theories clearly in writing and speaking.</p> <p>PO9: Conduct experiments, analyze data, and interpret results ethically.</p> <p>PO10: Follow safety and chemical hygiene regulations and practices.</p>
PROGRAMME SPECIFIC OUTCOMES (PSOs) <i>(Students will be able to have)</i>	<p>PSO1: Understand fundamental concepts in Organic, Inorganic, and Physical Chemistry.</p> <p>PSO2: Perform scientific experiments effectively using procedural knowledge.</p> <p>PSO3: Apply scientific concepts in industry, medicine, and research, and understand their significance.</p> <p>PSO4: Work in research labs and related fields, and gain skills for employment in chemicals, pharmaceuticals, food, materials industries, and pass national competitive exams.</p>
COURSE OUTCOMES	
SEMESTER-I	
CORE- Paper-I Inorganic Chemistry-I	<p>CO1: Analyze the behavior of gases and apply different laws to real gases.</p> <p>CO2: Explain the liquid state of matter and interpret the pH scale.</p> <p>CO3: Describe the solid state of matter and examine its related properties.</p> <p>CO4: Define and apply concepts such as buffers and solubility products.</p>
CORE--II	CO1: Describe the behavior of gases and apply different laws to real

Physical Chemistry-I	<p>gases.</p> <p>CO2: Explain the liquid state of matter and interpret the pH scale.</p> <p>CO3: Explain the solid state of matter and analyze its related properties.</p> <p>CO4: Define and apply concepts such as buffers and solubility products.</p>
GE-1 Atomic structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons	<p>CO1: Students will learn how to use Fajan's rules, the Born equation, and Slater's rules to perform specific calculations in chemistry.</p> <p>CO2: Students will gain an understanding of how atoms and molecules are organized and structured.</p> <p>CO3: Students will be able to predict and describe the shapes and arrangements of different molecules.</p> <p>CO4: Students will learn how to create various organic compounds by attaching different functional groups and analyze them.</p> <p>CO5: Students will study how to prepare and understand the properties of various organic compounds.</p>
SEMESTER-II	
CORE-III Organic Chemistry I	<p>CO1: Describe the electronic forces in organic molecules and explain different types of organic reactions. Analyze the stereochemistry of organic molecules, recognize the mechanisms of various reactions, and explain optical activity and geometrical isomerism.</p> <p>CO2: Discuss the preparation and interpret the physical and chemical properties of alkanes, alkenes, and alkynes.</p> <p>CO3: Distinguish between different types of organic reactions and analyze the reactivity of various intermediates.</p> <p>CO4: Apply principles of organic qualitative analysis to identify organic compounds in the CHO system and determine the melting point of pure samples.</p> <p>CO5: Perform chromatographic separation of organic molecules using TLC and paper chromatography techniques.</p>
CORE--IV Physical Chemistry II	<p>CO1: Define thermodynamic terms and laws; calculate energy changes and heat capacities, and predict conditions for thermodynamic equilibrium and reaction spontaneity.</p>

	<p>CO2:Recognize thermodynamic conditions for one-component and two-component systems.</p> <p>CO3:Describe the quantitative treatment of the principle of chemical equilibrium.</p> <p>CO4:Explain colligative properties of different solutions.</p> <p>CO5:Determine the heat capacity of a calorimeter;calculate integral enthalpies of various salts and measure the enthalpy of neutralization of an acid-base mixture.</p>
<p>GE-2 Chemical Energetics, Equilibria & Functional Organic Chemistry</p>	<p>CO1:Calculations related to both ideal and real gases, and use thermodynamic principles to predict chemical equilibrium and the spontaneity of reactions.</p> <p>CO2:Apply their understanding of colloids and gels in practical contexts.</p> <p>CO3:Know in-depth knowledge of the properties and behaviors of solid and liquid states of matter.</p> <p>CO4: Synthesize various organic compounds, including alkyl halides, aryl halides, alcohols, and phenols.</p> <p>CO5:Describe the fundamental concepts of organic chemistry related to compounds such as carboxylic acids, ethers, and esters.</p>
SEMESTER-III	
<p>CORE--V Inorganic Chemistry-II</p>	<p>CO1:Classify different metallurgical operations and describe the HSAB principle.</p> <p>CO2:Compare the structure and bonding in boranes, carboranes, metal clusters, polyamides, and pseudo halogens.</p> <p>CO3:Describe the inert pair effect, different hydrides, and the anomalous behavior of s- and p-block elements.</p> <p>CO4:Compare compounds formed by noble gases and explain different types of inorganic Polymers like silicones and silicates.</p> <p>CO5:Prepare various inorganic compounds, estimate the amount of chlorine in bleaching powder, and standardize the amount of copper in a given solution.</p>
CORE--VI	CO1:Describe the preparation and properties of halogenated

Organic Chemistry-II	<p>hydrocarbons.</p> <p>CO2: Explain various methods for preparing alcohols, aldehydes, ketones, and carboxylic acids, and predict the stereo chemical outcomes of organic reactions based on reaction mechanisms.</p> <p>CO3: Propose mechanisms for named and rearrangement reactions, and select appropriate organic reagents for functional group interconversions.</p> <p>CO4: Perform acetylation, benzylation, bromination, and nitration reactions using conventional methods.</p> <p>CO5: Prepare derivatives using green methods and purify them through recrystallization.</p>
CORE--VII Physical Chemistry-III	<p>CO1: Explain phase equilibrium and interpret phase diagrams.</p> <p>CO2: Describe binary solutions and derive various laws related to them.</p> <p>CO3: Derive rate equations from mechanistic data.</p> <p>CO4: Comprehend the applications and actions of catalysts, and analyze surface phenomena.</p> <p>CO5: Analyze adsorption isotherms and determine distribution coefficients between solvent systems, and calculate reaction kinetics.</p>
GE-III Chemistry Of S- And P- Block Elements, States Of Matter & Chemical Kinetics	<p>CO1: Gain an understanding of the basic principles of metallurgy and the concepts of acids and bases.</p> <p>CO2: Acquire in-depth knowledge about the properties and behaviors of s-block and p-block elements.</p> <p>CO3: Design and conduct experiments to measure the rate of chemical reactions.</p> <p>CO4: Measure the viscosity and surface tension of liquids.</p> <p>CO5: Explore and comprehend the principles of solid-state chemistry.</p>
Semester- IV	
CORE--VIII Inorganic Chemistry-III	<p>CO1: Describe the theory of coordination chemistry, including valence bond theory (inner and outer orbital complexes), the electro neutrality principle, and back bonding.</p> <p>CO2: Evaluate the stability of various oxidation states and</p>

	<p>interpret.m.f. using Latimer and Frost diagrams.</p> <p>CO3:Examine the chemistry of Ti, V, Cr, Mn, Fe, and Co in various oxidation states, excluding their metallurgy.</p> <p>CO4:Discuss the use of chelating agents in medicine.</p> <p>CO5:Examine the role of iron in biological systems, including the functions of haemoglobin and myoglobin.</p>
<p>CORE--IX Organic Chemistry-III</p>	<p>CO1:Explain different nitrogen-containing compounds and the significance.</p> <p>CO2:Elucidate the structure and chemistry of natural products, including terpenes and alkaloids.</p> <p>CO3:Describe the chemistry of heterocyclic compounds and write the mechanisms involved in the reactions of nitrogen-containing compounds.</p> <p>CO4:Apply principles of organic qualitative analysis to identify organic molecules containing extra elements such as nitrogen, sulphur, and halogens.</p> <p>CO5:Identify various nitrogen-containing compounds and prepare derivatives of these compounds for conformation.</p>
<p>CORE--X Physical Chemistry-IV</p>	<p>CO1:Define theories of conductivity, the laws of weak and strong electrolytes, and describe their role in titrimetric analysis.</p> <p>CO2:Explain different types of electrochemical cells.</p> <p>CO3:Describe the theories behind potentiometric and conductometric titrations and apply these methods in practical scenarios.</p> <p>CO4:Explain the electrical properties of microscopic particles.</p> <p>CO5:Handle electrochemical instruments such as conduct meters and Potentiometers to perform qualitative estimations and develop skills for using these instruments effectively.</p>
<p>GE-IV Organometallics, Bioinorganic Chemistry, Poly Nuclear Hydrocarbons And UV, IR Spectroscopy</p>	<p>CO1: Study the properties and uses of 3d transition metals and their key compounds like potassium dichromate and potassium permanganate.</p> <p>CO2: Learn about organometallic compounds, their types, and examples like ferrocene and methyl lithium, and how carbon monoxide interacts with metals.</p>

	<p>CO3: Understand how metal ions like Na⁺, K⁺, Mg²⁺, and Ca²⁺ are important in biological processes such as blood clotting and energy production.</p> <p>CO4: Explore the properties and reactions of aromatic compounds such as naphthalene and pyridine, and learn about active methylene compounds and their uses.</p> <p>CO5: Use UV-Visible and IR spectroscopy to identify and analyze organic molecules, focusing on their functional groups and molecular vibrations.</p>
SEMESTER-V	
CORE--XI Organic Chemistry-IV	<p>CO1: Explain different spectroscopic methods for identifying organic molecules.</p> <p>CO2: Illustrate the principles of UV-Vis, IR, NMR spectroscopy, and Mass spectrometry.</p> <p>CO3: Interpret spectral data of simple molecules and solve related problems.</p> <p>CO4: Comprehend the preparation, properties, structure, and importance of carbohydrates, including mono-, di-, and Polysaccharides.</p> <p>CO5: Perform qualitative analysis of different carbohydrates and unknown organic compounds containing bi-functional groups, estimate the amounts of sugars in a sample, and identify labeled peaks of unknown organic compounds using NMR and IR data.</p>
CORE--XII Physical Chemistry-V	<p>CO1: Describe quantum mechanics and identify its applications in Molecular Orbital and Valence Bond theories, including the construction of hybridization schemes.</p> <p>CO2: Describe the basic principles of molecular spectroscopy and demonstrate the skill to elucidate the structure and chemical composition of samples from various molecular spectra.</p> <p>CO3: Explain chemical bonding in different covalent molecules qualitatively.</p> <p>CO4: Describe the principles of absorption spectra in the visible range and Raman spectra.</p> <p>CO5: Verify the laws of absorption for qualitative estimation of</p>

	<p>inorganic samples,</p> <p>CO6: Estimate different metal cations using the colorimetric method.</p>
<p>DSE-1</p> <p>Polymer Chemistry</p>	<p>CO1: Understand the fundamentals of Polymers, including biopolymers and synthetic Polymer's.</p> <p>CO2: Explain the mechanism and kinetics of Polymerization.</p> <p>CO3: Identify methods for characterizing Polymers.</p> <p>CO4: Describe the preparation, properties, and uses of different Polymers.</p> <p>CO5: Synthesize different Polymer's in the laboratory and identify labeled peaks in the IR spectra of known Polymer's.</p>
<p>DSE-2</p> <p>Green Chemistry</p>	<p>CO1: Comprehend the principles and limitations of green chemistry.</p> <p>CO2: Design chemical syntheses using green chemistry approaches.</p> <p>CO3: Implement real-world reactions using green methods.</p> <p>CO4: Explore future trends in research by applying green chemistry principles.</p> <p>CO5: Synthesize compounds using green methods and utilize safer chemicals for various syntheses.</p>
<p>SEMESTER-VI</p>	
<p>CORE--XIII</p> <p>Inorganic Chemistry-IV</p>	<p>CO1: Explain the classification and bonding in organometallic compounds.</p> <p>CO2: Describe various theories that explain the stability of organometallic compounds and apply these theories to practical scenarios.</p> <p>CO3: Identify the use of different organometallic compounds in synthesis and analyze inorganic salt mixtures qualitatively using the H₂S scheme.</p> <p>CO4: Deduce the thermodynamic and kinetic aspects of organometallic compounds.</p> <p>CO5: Separate and estimate salt mixtures qualitatively, and perform the separation of mixtures containing insoluble components or</p>

	interfering anions.
CORE--XIV Organic Chemistry-V	<p>CO1:Comprehend the classification and properties of amino acids and nucleic acids.</p> <p>CO2:Explain the classification, characteristics, and mechanisms of enzyme action.</p> <p>CO3:Describe various bio-metabolic processes.</p> <p>CO4:Analyze theories related to important pharmaceutical compounds and dyes, identify biologically significant molecules and their roles in human life, and define terminologies used in biological systems.</p> <p>CO5:Prepare different organic compounds, estimate amino acids and vitamin C, determine the iodine number of oils/fats, and develop skills in the quantitative analysis of biomolecules.</p>
DSE-III Industrial Chemicals And Environment	<p>CO1:Identify pollution caused by different industrial chemicals.</p> <p>CO2:Implement measures to control environmental pollution and describe methods for reducing pollution.</p> <p>CO3:Estimate different types of water Pollutants.</p> <p>CO4:Measure dissolved CO₂ in gas samples and prepare environmentally safer chemicals.</p> <p>CO5:Assess the impact of environmental pollution by measuring various testing parameters</p>
DSE-IV Project	<p>CO1:Select appropriate sources for reviewing literature and conduct basic research effectively.</p> <p>CO2:Compile and interpret research data, present findings in a publishable format, and utilize various chemistry software tools while understanding research ethics.</p>