

Core Course	Course Title	Program Specific Outcome	Course Outcome
CC-1	Organic Chemistry-I (Theo)	Demonstrate, solve and an understanding of major concepts in all disciplines of chemistry.	<ol style="list-style-type: none"> 1. To comprehend molecular interconversions and symmetry elements, as well as to describe the stereochemical characteristics of organic molecules and reactions. 2. To understand the fundamental physical properties of various organic molecules. 3. To explain nomenclature, stereochemistry, structures, reactivity, and mechanism of the chemical reactions. 4. To learn about aromaticity criteria and the effect of structure on organic compound reactivity. 5. Recognizing the MO Theory and the Valence Bond Theory.
	Organic Chemistry-I (Prac)	Gain the knowledge of Organic Chemistry through practical experiments.	<ol style="list-style-type: none"> 1. Identification of Organic Compounds 2. Separation of compounds from a binary mixture 3. Determination of boiling points
CC-2	Physical Chemistry-I (Theo)	Students gain elementary knowledge of certain core areas of Physical Chemistry viz. Chemical thermodynamics, reaction kinetics and kinetic theory of gases.	To acquaint with <ol style="list-style-type: none"> 1. Basic application of kinetic theory for derivation of pressure, distribution of molecular velocities and energies, binary collisions are taught. 2. Different thermodynamical laws, and their applications are studied.. 3. Order, molecularity, different rate processes, consecutive reactions, homogeneous and heterogeneous catalytic processes, Enzyme catalysis are studied.
	Physical Chemistry-I (Prac)	Experiments based on chemical kinetics & ionic equilibrium are set.	Students learn how to determine <ol style="list-style-type: none"> 1. Rrate constant and order of a chemical reaction, 2. pH of an unkown buffer and 3. Solubility product of PbI_2 titrimetrically.
CC-3	Inorganic Chemistry-I (Theo)	Understanding the basic general chemistry with the concepts of Atomic Structure, Chemical Periodicity, Acids And Bases, Redox Reactions.	<ol style="list-style-type: none"> 1. Conceptualisation of Extra nuclear Structure of atom 2. Different theories on atomic structures, postulates, drawbacks and applications. 3. Concept of orbits, orbitals, configurations. 4. Wave particle duality, uncertainty principal, relation between mass and energy. 5. Position of atoms in periodic table, along with chemical periodicity of different properties of various elements. 6. Understanding acids and bases; different theories. 7. Buffer, pH, equilibrium. 8. Redox behaviour of different elements; redox reactions. 9. Balancing reactions. 10. Solubilisation of different salts.
	Inorganic Chemistry-I (Prac)	Application of theoretical knowledge in practical	<ol style="list-style-type: none"> 1. General idea of quantitative and qualitative experiments in practical chemistry 2. Real time in hand experimental understanding of Redox chemistry.

		experiments.	3. Quantitative estimation of different metal ions from their mixtures.
CC-4	Organic Chemistry-II (Theo)	Solving a problem while simultaneously exercising independent thought, approach, and logic.	<ol style="list-style-type: none"> 1. To learn more about the mechanism of nucleophilic aromatic and aliphatic electrophilic substitution reactions, as well as the impact of different NGPs on reaction rates. 2. To understand about the genesis, stability, and processes of various named reactions. 3. To understand the kinetics and thermodynamics of a particular reaction. 4. Different organic processes and their intermediates are approached mechanistically.
	Organic Chemistry-II (Prac)	Discover environmentally friendly chemical reactions for sustainable growth.	<ol style="list-style-type: none"> 1. Be familiar with safe laboratory procedures. 2. Improve individual's research-related skills. 3. Make use of contemporary chemical tools, such as models, Chemdraw, charts, and equipment. 4. To experience Synthetic Organic Chemistry's essence. 5. Using Recrystallization procedures, determine physical constants and purify synthesised organic molecules.
CC-5	Physical Chemistry-II (Theo)	Students learn the laws which govern transport processes. Students can apply the laws of thermodynamics to various physical and chemical processes. Students are exposed to basics of quantum mechanics.	<p>To acquaint with</p> <ol style="list-style-type: none"> 1. Transport processes like Viscosity of liquids and conductance of ionic solutions are studied. 2. Chemical equilibrium as an application of chemical thermodynamics are taught. 3. Introductory quantum mechanics and application in Chemical science are studied.
	Physical Chemistry-II (Prac)	Gain knowledge on conductometric study of ionic solutions, viscosity of liquids and chemical equilibria	<p>Students, attending practical classes, understand how to determine</p> <ol style="list-style-type: none"> (i) viscosity co-efficient of an unknown liquid; (ii) equilibrium constant of the reaction $KI + I_2 = KI_3$; (iii) rate constant of saponification reaction and (iv) ionisation constant of a weak acid.
CC-6	Inorganic Chemistry-II (Theo)	Understanding various types of bonding in molecules with suitable examples. Nuclear chemistry of atoms,	<ol style="list-style-type: none"> 1. Understanding Ionic bond: General characteristics, radius ratio rule and its application and limitations. Packing of ions in crystals. Born-Landé equation with expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy. Solubility energetics of dissolution process. 2. Learning of Polarizing power and polarizability of ions, ionic potential, Fajan's rules. Hybridizations, equivalent and non-equivalent hybrid orbitals, VSEPR theory in covalent bonding. 3. Development of the concept of Molecular orbital theory of

		structure, chemistry stability and configuration. Understanding radioactivity, types, properties, applications and hazard management.	bonding, LCAO-MO; HOMO, LUMO. Orbital mixing,. MO diagrams of various molecules. Bond properties: bond orders, bond lengths. 4. Learning the Nuclear stability and nuclear binding energy; Nuclear Reactions: Artificial radioactivity, transmutation of elements, fission, fusion and spallation. Nuclear energy and power generation. Separation and uses of isotopes. 5. Radio chemical methods: principles of determination of age of rocks and minerals, radio carbon dating, hazards of radiation and safety measures.
	Inorganic Chemistry-II (Prac)	Application of theoretical knowledge in practical experiments.	1. Learning how to analyse unknown chemical samples. 2. Application of accrued knowledge to understand results to make conclusion over experimental findings. 3. Iodometric method, its application to quantitatively estimate metal ions from unknown samples.
CC-7	Organic Chemistry-III (Theo)	Using various approaches, investigate the mechanisms of electrophilic addition reactions, elimination reactions, and the determination of reaction mechanisms.	1. Mechanisms of aromatic substitution reactions. 2. Understanding the carbonyl group's different reactions. 3. Basic Green Chemistry concept. 4. Knowledge of the chemistry of organometallics. knowledge of unsaturated molecules' chemistry.
	Organic Chemistry-III (Prac)	Determination of functional groups	1. To identify the nature of the functional groups present in an Organic molecule.
SEC-1	Basic Analytical Chemistry	Understanding of basic techniques on Analytical chemistry	1. Analysis of soil compositions specially the metal ions by complexometric titration 2. Building knowledge on water purification process. 3. Separation of metal ions by different chromatographic methods 4. Idea on food product analysis 5. Analysis of cosmetic products like deodorants and antiperspirants etc... and their harmful effects on human body as well as on environment.
CC-8	Physical Chemistry-III(Theo)	Get knowledge about solution chemistry and understanding of quantum mechanical treatment of H-like system	1. As a result of utmost stress on the application part of thermodynamics, students get acquainted with certain areas of Physical Chemistry such as colligative properties, phase rule, binary solutions, ionic equilibria and electromotive force. 2. Students become conversant with the quantum mechanical treatment of hydrogenic system.

	Physical Chemistry-III(Prac)	Study of solubility product, effect of ionic strength on ionic reactions, phase diagram of liq-liq binary system	<ol style="list-style-type: none"> 1. Students can carry out potentiometric titration. 2. Students can draw phase diagram of phenol-water system.
CC-9	Inorganic Chemistry-III (Theo)	Introduction with inorganic materials which are industrially important; Extraction, preparation and application of varied such materials.	<ol style="list-style-type: none"> 1. Learning the General Principles of Metallurgy: Chief modes of occurrence of metals. Hydrometallurgy. Methods of purification of metals: Electrolytic Kroll process, Parting process, van Arkel-de Boer process and Mond's process, Zone refining. 2. Chemistry of s and p Block Elements; Nobel gases. 3. Knowledge building on Inorganic Polymers, their types, comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes. Borazines, silicates and phosphazenes. 4. Introduction to Coordination chemistry.
	Inorganic Chemistry-III (Prac)	Building interest on inorganic chemistry by learning synthesis of colourful coordination compounds in laboratory also understanding its importance in quantitative estimation using the complexometric method.	<ol style="list-style-type: none"> 1. Understanding how to choose metal and ligands for complex synthesis 2. Idea of internal and external parameter in complexation. 3. Colour property of complexes with preliminary idea of colour generation. 4. Application of complex synthesis in complexometric estimation of different metal ions from unknown samples.
CC-10	Organic Chemistry-IV (Theo)	This programme aims to explain the fundamental concepts, applications, importance of asymmetric synthesis, to describe numerous innovative organic synthesis processes and concepts.	<ol style="list-style-type: none"> 1. Mechanisms underlying rearrangement reactions. 2. Development of Organic Synthesis Logic. 3. Asymmetric synthesis knowledge. 4. Understanding of organic spectroscopy with a focus on UV-Vis, IR, and NMR spectroscopy and their applications. 5. To comprehend the significance of retrosynthesis in the design of organic compound synthesis. 6. To educate students about the mechanics and significance of new synthetic reactions.
	Organic Chemistry-IV (Prac)	Estimation of various organic molecules	<ol style="list-style-type: none"> 1. To introduce various experiments in order to develop organic Synthesis skills and strategic approaches. 2. Using some simple processes, estimation of some organic

			compounds.
SEC-2	Pharmaceuticals Chemistry/ Analytical Clinical Biochemistry	Basic understanding of Pharmaceuticals/ Basic understanding of Biochemistry	1. Development of various drug molecules. 2. Applications of drugs. 1. Knowledge of the concepts of amino acids and carbohydrates. 2. Gaining knowledge of how proteins and enzymes are made. 3. Fundamental idea behind the Watson-Crick model of DNA. 4. To create a conceptual framework for the biochemistry of disease.
C-11	Inorganic Chemistry-IV (Theo)	Building solid concept on the theory and application of Coordination Chemistry Additionally, understanding of general properties of <i>d</i> - and <i>f</i> -block elements	1. Conceptual approach on basic theories of coordination chemistry bonding including VBT, CFT and MOT 2. Distortion of complexes can be understood on the basis of Jahn Teller Theorem 3. Understanding of the origin of colour of the complexes: Selection rules; Orgel diagram; TS diagram 4. Investigation of magnetic interactions of different/same metal ions in the complexes: Magnetic materials like ferromagnet, antiferromagnet, ferrimagnet etc... Moreover super exchange phenomena can be understood with various examples. 5. Study on the comparisons of different general properties (like electronic configuration, oxidation state, electronic spectra, magnetic properties, etc...) of <i>d</i> - and <i>f</i> -block elements.
	Inorganic Chemistry-IV (Prac)	Chromatography of metal ion Gravimetry	1. Develop the technique for the separation of different metal ions (like Ni^{+2} & Co^{+2}) from the mixture by paper chromatography. 2. Estimation of metal ion quantitatively by gravimetric precipitation method.
CC-12	Organic Chemistry-V (Theo)	Basic understanding and synthesis of Biomolecules, Carbocycles and Heterocycles	1. Study in depth of heterocycles and carbocycles. 2. Understanding of cyclic compound stereochemistry. 3. Comprehension of pericyclic processes. 4. Study of carbohydrates in depth. 5. Study of peptides, nucleic acids, and amino acids. 6. Develop an interest in and comprehension of the theoretical basis for pericyclic reactions, as well as abilities for their use in organic synthesis.
	Organic Chemistry-V (Prac)	Chromatographic Separations of Biomolecules and Spectroscopic Analysis of various Organic Compounds.	1. To illustrate the use of Thin layer chromatography, Column chromatography and Paper chromatography to monitor a process. 2. Determination of the structure of various organic molecules using spectroscopic methods
DSE-1	Advanced Physical Chemistry-I	Basic knowledge of Solid State Chemistry,	1. Students learn the laws of crystallography, lattice structure of crystalline solids and the basic theory behind the X-ray crystallography.

	(Theo)	Statistical Thermodynamics, Polymer Science and dielectric properties of molecules	<ol style="list-style-type: none"> 2. They become acquainted with preliminary concepts of statistical thermodynamics. 3. The students get introduced to the subject of polymer science and dielectric properties of molecules
	Advanced Physical Chemistry-I (Prac)	Basic programming in fortran	1. Understanding numerical methods of computation with the help of Computer Programming in the Computer Lab
DSE-2	Analytical Methods in Chemistry (Theo)	Basic learning on Quantitative and qualitative aspects of analysis, optical methods of analysis, thermal methods of analysis, electroanalytical methods & solvent separation techniques	<p>To acquaint with</p> <ol style="list-style-type: none"> 1. sampling techniques 2. Spectroscopic methods of analysis 3. Thermogravimetric estimation of metals 4. Different electroanalytical methods e.g., potentiometric methods, pH metric methods, conductometric methods
	Analytical Methods in Chemistry (Prac)	Learn practical separation using chromatographic methods, Spectrographic expts etc.	<p>Learning</p> <ol style="list-style-type: none"> 1. Chromatographic separation of inorganic & organic molecules 2. Spectrophotometric determination of pK_{in} 3. pH determination of soil
CC-13	Inorganic Chemistry-V (Theo)	Bioinorganic Chemistry Organometallic Chemistry Reaction Kinetics and Mechanism	<ol style="list-style-type: none"> 1. Understanding of different biological process in human body (like O_2 & CO_2 transport mechanism) and role of metal ions in different redox active metalloenzymes. 2. Mechanism of nitrogen fixation and photosynthesis electron transfer process (PS-I & PS-II) 3. Effects of metal toxicity in human beings and hence recovery by administrating different chelating drugs or 1st generation/ 2nd generation drugs. 4. Understanding of synthesis and reactivity of different organometallic complexes with special attention to the metal carbonyl species. 5. Understanding of different catalysis reactions (e.g. alkene hydrogenation; Hydroformylation; Wacker Process; Synthetic gasoline; Ziegler-Natta catalysis etc..) done by organometallic compounds. 6. Building concept on inorganic reaction mechanism with special attention on S_N^2, S_N^1, S_N^1CB for substitution reactions of octahedral and square planar complexes. 7. Understanding of kinetic and thermodynamic stability of complexes.

	Inorganic Chemistry-V (Prac)	Qualitative semimicro analysis	<ol style="list-style-type: none"> 1. Different inorganic metal ions and anions can be detected by various chemical tests. 2. Understanding of solubility product principle in the precipitation of different group metal ions. 3. Heating effect of simple inorganic salts, Flame tests chemistry, Borax bead chemistry can be known. 4. Technique to separate similar acid radicals like Cl^-, Br^-, I^- etc...
DSE-3	Polymer Chemistry (Theo)	Functionality, kinetics of polymerisation, molecular wt determination, glass transition temperature	To acquaint with <ol style="list-style-type: none"> 1. Different polymerisation processes Step growth, chain growth polymerisation, 2. Viscometric, osmometric determination of molecular wt 3. Thermodynamics of polymer solutions 4. Properties and applications of different polymers
	Polymer Chemistry (Prac)	Hands on experiments on polymers	Perform experiment on <ol style="list-style-type: none"> 1. Viscometric determination of molecular weight of polymer 2. Preparation of nylon-66
DSE-4	Dissertation followed by power point presentation	Project on Inorganic topics	1. Building idea to write a project report on different scientific fields (especially on Inorganic Chemistry) and also expertise to present (by PPT) the topic as a seminar presentation mode.
Generic Elective -1	GE-1 (Theory)	Atomic Structure, Chemical Periodicity, Acids And Bases, Redox Reactions, General Organic Chemistry & Aliphatic Hydrocarbons	<ol style="list-style-type: none"> 1. Basic understanding on Atomic models 2. Concepts on different periodic properties like electronegativity; electron affinity; Ionisation energy etc... 3. Understanding of acid base equilibrium and concepts on pH 4. Building concepts on balancing of chemical equation by oxidation reduction and ion electron methods 5. To comprehend molecular interconversions and symmetry elements, as well as to describe the stereochemical characteristics of organic molecules and reactions. 6. Using various approaches, investigate the mechanisms of electrophilic addition reactions, elimination reactions, and the determination of reaction mechanisms.
	GE-1 (Prac)	Redox Titration Determination of functional groups	<ol style="list-style-type: none"> 1. Estimation of oxalic acid, Mohr salt or Fe(II) by both permanganometry and dichromatometry 2. To identify the nature of the functional groups present in an Organic molecule.
Generic Elective -2	GE-2 (Theo)	States of Matter & Chemical Kinetics, Chemical Bonding &	1. Understanding of general properties of main group elements with special attention to the synthesis and properties of main group compounds like diborane; borazine; borazole; phosphonitrilic compounds; silicates; silicones etc.

		Molecular Structure, P-Block Elements	
	GE-2 (Pract)	Inorganic Chemistry Qualitative semi-micro analysis of mixtures containing three radicals	1. Understanding of different chemical reaction associated with the detection of cationic and anionic radicals. As for example ring test; heating effects of salts; flame test; borax bead test etc.
Generic Elective -3	GE-3 (Theory)	Chemical Energetics, Equilibria, Organic Chemistry-II	1. Understanding different laws of thermodynamics 2. Applications of thermodynamics 3. Acquaint with Ionic equilibria 4. Mechanisms of aromatic substitution reactions. 5. Understanding the carbonyl group's different reactions. 6. Knowledge of the chemistry of organometallics. 7. knowledge of unsaturated molecules' chemistry
	GE-3 (Practical)	Expts based of thermodynamics, Identification of Organic compounds	1. Measurement of pH 2. Preparation of different buffer solutions 3. Solubility of sparingly soluble salt 4. Identification of pure organic compounds oxalic acid, succinic acid, resorcinol, urea, glucose, benzoic acid and salicylic acid, acetone, aniline and nitrobenzene
Generic Elective -4	GE-4(Theo)	Solutions, Phase Equilibria, Conductance, Electrochemistry & Analytical and Environmental Chemistry	Understanding 1. Ideal & non-ideal solutions 2. Phase equilibria 3. Conductance of ionic solutions 4. Electromotive force 5. Chemical analysis based on volumetric, gravimetric, chromatographic methods 6. BOD, TDS, COD, DO, hardness
	GE-4(Prac)	Solutions, Phase Equilibria, Conductance, Electrochemistry & Analytical and Environmental Chemistry	Perform experiments on 1. Conductometric determination of dissociation constant of weak acid 2. Potentiometric titration 3. Total hardness of water