CHEMISTRY

Programme Specific Outcomes

Programme offered by the Department	**Outcomes**
B.Sc Honours Programme	On completion of the Programme, the students would be able to: PSO1. *Theory and Knowledge:* have a firm foundation in the fundamentals and application of current chemical and scientific theories including those in Analytical, Inorganic, Organic and Physical Chemistry. Gain knowledge about key principles of Biochemistry to understand the life process. Mathematical foundations of quantum chemistry to be applied in practical, hands-on experience with modern quantum mechanics software packages in the future research program. PSO2. *Instrumentation:* understand theoretical concepts of instruments that are commonly used in most chemistry fields as well as interpret and use data generated in instrumental chemical analyses. PSO3. *Quantitative Skills:* design and carry out scientific experiments as well as accurately record and analyse the results of such experiments. Therefore, students would be skilled to communicate the results of scientific research work in oral, written and electronic formats to both scientists and the public at large in the future. PSO4. *Laboratory Skills:* skilled in problem-solving, able to employ critical thinking and scientific inquiry in the performance, design, interpretation and documentation of laboratory experiments, at a level suitable to succeed at an entry-level position in the chemical industry or a chemistry research program. PSO5. *Laboratory safety:* work in the laboratory following routine acceptable safe laboratory practices to handle hazardous chemicals (especially those of unknown toxicity), glassware, and common laboratory equipment. PSO6. *Teamwork mentality:* have demonstrated an ability to work effectively in diverse teams in both classroom and laboratory. PSO7. *Societal impacts:* appreciate the central role of chemistry in our society and use this as a basis for ethical behavior in issues that chemists are facing including an understanding of safe handling of chemicals, environmental issues, health and medicine.

B.Sc Programme Course	On completion of the Programme, the students would be able to: PSO1. Present the basic chemical aspects of the field. PSO2. Students will gain both practical and theoretical knowledge of main domains of chemistry: organic, inorganic, physical, analytical, cosmetic and pesticide chemistry. PSO3. Acquire comprehensive knowledge as well as skill and innovatively using this knowledge to generate self-employment. PSO4. Understand the concept of practical techniques and analytical procedures. PSO5. Plan and execute the problems.

CHEMISTRY

Course Outcomes

B.Sc Honours Programme

Semester	Course Code	Course Title	Outcomes
I	CC1	Inorganic Chemistry	Students would gain an understanding of: • fundamental atomic structure, atomic orbitals, chemical bonding and the periodicity of elements in the periodic table in terms of atomic and ionic sizes, ionization energy, electron affinity, electronegativity and the different scales for its measurements • simple quantum mechanical treatments of atoms and molecules • importance and limitations of valence bond theory and use them for predicting the shapes and hybridization. • different theories of bonding (Valence Shell Electron Pair Repulsion, Valence Bond and Molecular Orbital Theories) to determine the geometries of homonuclear and heteronuclear molecules. • the fundamentals of acid-base and

			redox reactions • preparing solutions of different concentrations.
	CC2	Physical Chemistry	Students would gain an understanding of: • the concept of kinetic theory of gas, Maxwell's distribution and deviation of gases from ideal behaviour. • surface tension and viscosity measurement. • ionic equilibrium involving dissociation of weak acid and weak base, sparingly soluble salts in aqueous medium and buffer solutions.
II	CC3	Organic Chemistry	• The course focuses on nurturing the fundamental ideas of organic chemistry such as structure and bonding, electronic displacement and their effect on the physical and chemical properties of the molecules. • The knowledge of the different reaction intermediates and their stability that will help them to understand the course of reactions. • The knowledge of stereochemistry enables the students to learn different projection formulas and to identify the symmetry properties, conformational analysis of acyclic and cyclic hydrocarbons, absolute configuration (R/S, DL and E/Z) of organic molecules. • It also provides an idea of the optical activity of chiral compounds its measurements, racemisation and resolution of enantiomeric mixtures. • Chemistry of aliphatic and aromatic hydrocarbons covering the synthesis, reactions such as electrophilic addition, electrophilic aromatic substitution and it's applications.
	CC4	Physical Chemistry	Students would gain an understanding of: • different laws of Thermodynamics and their applications. • chemical potential and its applications. • the concept of chemical equilibrium and various colligative properties.

III	CC5	Inorganic Chemistry	Students in this course would: • understand oxidation reductions and their use in metallurgy. • be able to understand various concepts of acids and bases with emphasis on hard-soft-acid-base (HSAB) • learn the descriptive chemistry of representative elements of *s*- and *p*-block elements and recognize the differences in their reactivity, chemical (formation of halides, oxides, hydroxides, oxoacids, oxo anions, electron deficiency in group 13 and the formation of polymeric inorganic compounds in groups 14 and 15) and physical properties • understand a systematic approach of learning noble gases • acquire the knowledge of quantitative inorganic analysis
	CC6	Organic Chemistry	• The course provides an understanding of the reactions and synthesis of various functional groups such halogenated hydrocarbons, carbonyl compounds, alcohols, phenols, carboxylic acid and its derivatives. This provides the students a better mechanistic understanding of reactions such as aliphatic and aromatic nucleophilic substitutions and nucleophilic addition and applying them to execute different functional group transformations. • Introduction to organometallic chemistry allows students to get insight towards modern organic synthetic methods and their application.
	CC7		Students would gain an understanding of: • the principles of thermodynamics to the study of equilibrium relationship within or between phases, corresponding to homogeneous and heterogeneous phase equilibria respectively. • order of a reaction and its determination. • kinetics of complex reactions.

	SEC1	Pharmaceutical Chemistry	• The course will develop the requisite rationale for the students by catering to the basic knowledge of drugs and their pharmacology. The course deals with the design and synthesis of a few important drugs viz. Aspirin, Ibuprofen, Sulfadrugs, Phenobarbitals, Diazepam, AZT-Zidovudine etc. • Fermentation deals with the production of different significant compounds like ethanol, antibiotics, amino acids and vitamins by microorganisms.
IV	CC8	Inorganic Chemistry	Students would be familiar with: • coordination chemistry (IUPAC nomenclature, isomerism, chelate effect, labile and inert complexes.) • principles of VBT to explain bonding in coordination compounds of different geometries • crystal field theory to different type of complexes (Tetrahedral, Octahedral, Square planar complexes) • general trends in the chemistry of *d*-block (first, second and third transition series) and *f*-block (lanthanoids) elements • bio-inorganic chemistry (essentiality of the elements for life and what kind of disease may result from their deficiencies in the biological systems, Sodium / K-pump, use of chelating agents in medicine, the metal complexes in biological system *e.g.,* carbonic anhydrase, carboxypeptidase, Haemoglobin,)
	CC9	Organic Chemistry	This course provides the basic insight: • to the chemistry of the nitrogenous organic compounds like aliphatic and aromatic amines, nitro compounds their reactions and synthesis, chemistry of diazonium compounds and their applications in organic synthesis. • helps to acquire knowledge about five and six membered heterocyclic compounds like furan, pyrrole, thiophene, pyridine and fused heterocycles like indole, quinoline and isoquinoline through their synthesis and chemical reactions.

			• about the occurrence, isolation and structure elucidation and synthesis of alkaloids like Hygrine and Nicotine and medicinal importance of some alkaloids. • regarding terpenes covering occurrence, classification, structure elucidation and their synthesis.
	CC10		Students would gain an understanding of: • the theories of conductance and electrochemistry. • some important topics such as solubility, solubility products, ionic products of water and conductometric titrations etc. • gain knowledge about different types of electrodes and applications of electrolysis in metallurgy and industry. • develop basic theoretical idea of electrical and magnetic properties of atoms and molecules.
	SEC2	Green Chemistry	• the course makes the students aware of the hazard and toxicity involved with chemicals and educates them about the method which mitigates the risk, hazard and toxicity by adopting 12 basic principles is known as "Green Chemistry" which is very benign to the environment. • it enables the student to design a clean and green chemical reaction following the principles.
V	CC11	Organic Chemistry	• pericyclic reaction incubates the idea of the orbital symmetry driven reactions such as cycloaddition, electrocyclic and sigmatropic reactions and their significance in modern organic synthetic chemistry. • grasp the basic knowledge about the biomolecules such as nucleic acid, amino acids, enzymes and lipids and their chemistry and metabolism to produce energy in the biological system.
	CC12	Physical Chemistry	• obtain a deep insight into the molecular spectroscopy and develop an idea about the application of spectroscopy in

			analysing chemical samples. • understand the application of quantum mechanics in some simple chemical systems such as hydrogen atoms or hydrogen like ions. • provides a deep insight into the basic principles of photochemistry and various photo chemical processes.
	DSE1	Analytical Methods in Chemistry	On successful completion of this course, students would be able to: • get to know various terminologies and concepts relevant to qualitative and quantitative aspects of analyses. • develop an understanding of the importance of separation and analytical techniques in chemistry. • principles of electroanalytical methods • understand the chemical methods employed for elemental and compound analysis. • do chromatographic separation of inorganic ions and organic compounds. • experimentally determine pH values of substances like soil, aerated drinks, fruit juices, shampoos, soaps, etc. • get introduced to spectrophotometry
	DSE2	Inorganic Materials of Industrial Importance	At the end of the course students would be able to: • establish the basic foundation of industrial inorganic chemistry among the students. This would be help to pursue further studies of industrial chemistry in the future. • learn the general principles, properties classification, use and applications of inorganic materials of industrial importance such as glass, ceramic, cement, fertilizers, batteries, alloys, catalysts, chemical explosives. • have an insight of the industrial manufacturing processes involved in the preparation of various inorganic materials of industrial importance. • understand the working principles of different kinds of batteries in our day – to day life. • catalytic role of organometallic compounds in different types of industrial processes.

VI	CC13	Inorganic Chemistry	Students would acquire knowledge of: • qualitative inorganic analysis • the preparation and properties of transition metal carbonyls • the 18-electron rule and its application • the nature of Zeise's salt and compare its synergic effect with that of carbonyls • important structural features of the metal alkyls tetrameric methyl lithium, dimeric trialkyl aluminium and ferrocene • ligand substitution reactions, applications of trans effect and stereochemistry of the mechanism • catalysis and the mechanism of Wilkinson's catalyst, Zeigler- Natta catalyst and synthetic gasoline manufacture by Fischer-Tropsch process.
	CC14	Organic Chemistry	• The topic gives the basic perceptiveness of different spectroscopic techniques like UV, IR and NMR. It allows them to determine the structure of an unknown compound by applying the knowledge of spectroscopy. • Carbohydrate chemistry gives the idea of their occurrence, classification and their biological importance. • Dyes covers classification, colour and constitution and synthesis and applications of different types of dyes such as azo dyes, triphenyl methane dyes, phthalein dyes and natural dyes.
	DSE3		• Know about polymeric materials, their classification, different mechanisms of polymerisation and polymerisation technique. • Evaluate the kinetic chain length of polymers based on their mechanism. • Learn about different methods of finding out the average molecular weight of polymers. • Learn properties and applications of

			various useful polymers in our daily life. • This paper will give a glimpse of the polymer industry to the student and help them to choose their career in the field of polymer chemistry.
	DSE4	Industrial Chemicals and Environment	After successful completion of the course, students would • understand the causes of environmental pollution and thereby apply environmental friendly policies instead of environmentally hazard ones in every aspect. • have learned about the manufacture, applications and safe ways of storage and handling gaseous and inorganic industrial chemicals. • get acquainted about industrial metallurgy and the energy generation industry. • learn about environmental pollution by various gaseous, liquid wastes and nuclear wastes and their effects on living beings. • know about industrial waste management, their safe disposal and the importance of environment friendly "green chemistry" in the chemical industry. • be able to experimentally determine parameters like dissolved CO_2, alkalinity used to measure the water quality
I	GE Paper 1		• gain knowledge about fundamentals of atomic structure, atomic orbitals, rules and filling of electrons in various orbitals, characterisation of ionic bonding, interaction and energies. • learn about the fundamentals of organic chemistry especially about bonding, physical properties, reactive intermediates organic acid and bases. • develop an idea about the concept of stereochemistry for organic molecules and the chemistry of aliphatic hydrocarbon.
II	GE Paper 2		• learn about the fundamental of thermodynamics and laws of

			thermodynamics, concepts of equilibrium in terms of free energy change, Le Chatelier's principle. • gain knowledge of electrolytes, salt hydrolysis, and solubility product principle. • learn about the chemistry of aromatic hydrocarbons their synthesis and different aromatic electrophilic substitutions. • understand the reaction and synthesis of various functional groups such as halogenated hydrocarbons, phenols and carbonyl compounds.
III	GE Paper 3		• have the concepts of ideal and non-ideal solutions, azeotropes, Nernst distribution law and its application, phase equilibrium and phase diagram, conductance and conductometric titrations. • get the knowledge of emf, Nernst equation, electrode potential and potentiometric titrations. • learn about the chemistry of carboxylic acids and their derivatives, aromatic and aliphatic amines and diazonium salts. • acquire the concept of chemistry and physical properties of amino acids, peptides, protein and chemistry of carbohydrates: mono, di and polysaccharides.
IV	GE Paper 4		• learn about chemistry of 3d transition elements, lanthanoids and actinoids. • understanding co-ordination chemistry with emphasis on valence bond theory, isomerism, IUPAC nomenclature, crystal field theory, CFSE and spectrochemical series. • develop a broad idea about gases, liquids and solids • to grow the concept of reaction rate, order of a reaction and activation energy.