

BSc Chemistry

CBCS (Honours)

Semester I

CHE-HC-1014 INORGANIC CHEMISTRY-I	<ul style="list-style-type: none">• To study atomic structure, Bohr's theory and its limitation, de Broglie equation, Heisenberg's Uncertainty Principle, Schrödinger's wave equation, wave functions, quantum numbers, orbitals, Pauli's Exclusion Principle, Hund's rule, Aufbau's principle, Variation of orbital energy with atomic number.• To learn s, p, d, f block elements, effective nuclear charge, shielding effect, Slater rules, variation of periodic properties with respect to groups and periods, electronegativity scales.• To know ionic bonding, general characteristics, radius ratio rule, packing of ions, Born-Landé equation, Madelung constant, Born-Haber cycle.• To acquire knowledge Lewis structure, Valence Bond theory, hybridization, Bent's rule, resonance structure and resonance energy, MO theory of diatomic and simple polyatomic molecules, formal charge, VSEPR theory, covalent character in ionic compounds, Fajan's rule, ionic character in covalent compound, bond moment, dipole moment, percent ionic character from dipole moment and electronegativity difference.• To understand metallic bond, band theories, semiconductors, insulators, defects in solids.• To study weak chemical forces, theories of weak chemical forces, effect of weak chemical forces on physical properties.• To learn oxidation-reduction, standard electrode potential, use of standard potential in inorganic reactions, principles involved in volumetric analysis.
CHE-HC-1012 INORGANIC CHEMISTRY-I LAB	<ul style="list-style-type: none">• To know calibration of common laboratory apparatus, preparation of standard laboratory solutions• To perform acid-base titrations, estimation of amount of bases present together.• To perform oxidation-reduction titrations, estimation of iron, oxalic acid and sodium oxalate in a given mixture using oxidation-reduction titrations.
CHE-HC-1024 PHYSICAL CHEMISTRY I	<ul style="list-style-type: none">• To perform surface tension measurements by different method, variation of surface tension with concentration.• To study viscosity measurements of different aqueous solutions at room temperature and its variation with concentration.• To discuss indexing of a given powder diffraction pattern of a cubic crystalline system.• To know effect on pH of addition of inorganic acid/base to organic weak acids, preparation of buffer solutions, pH titration, determination of dissociation constant of weak acids.
CHE-HC-1022 PHYSICAL CHEMISTRY I LAB	<ul style="list-style-type: none">• To demonstrate kinetic theory of gases, Maxwell distribution, behaviour of real gases and deviation from ideal gases, Van der Waals equation of state, law of corresponding states.• To study structure of the liquid state, radial distribution function,

	<p>physical properties of liquids, effect of addition of solutes in physical properties, cleansing actions of detergents, effect of temperature on viscosity, structure of water.</p> <ul style="list-style-type: none"> • To learn molecular and crystal symmetry, symmetry elements, symmetry operations, point and space groups, seven crystal systems and Bravis lattices. • To acquire knowledge on nature of solid state, Miller indices, X-ray diffraction, Bragg's law, analysis of powder diffraction pattern of simple inorganic salts, defects in crystal, liquid crystals. • To study different types of weak electrolytes, degree of ionization and factors affecting it, common ion effect, dissociation constants, salt hydrolysis constants calculations, buffer solutions, Henderson equation, buffer capacity, solubility and solubility products, theory of acid-base titrations, selection of indicators and their limitations, multistage equilibria in polyelectrolyte systems.
Semester II	
CHE-HC-2014 ORGANIC CHEMISTRY-II	<ul style="list-style-type: none"> • To learn basic organic chemistry such as classification, nomenclature, hybridization, etc. electronic effects in organic compounds and their application in explaining the relative acid base strengths of organic acids and bases, electrophiles and nucleophiles, shapes and stability of carbocations, carboanions, free radicals and carbenes. • To know about stereochemistry of organic compounds, various projection of compounds, geometrical isomerism, optical isomerism and stereochemical aspects. • To study chemistry of alkanes, alkenes, alkynes and cycloalkanes and their conformational analysis. • To acquire knowledge aromatic hydrocarbons, aromaticity rules, different electrophilic aromatic substitution reactions and directing effect of various groups on electrophilic aromatic substitution
CHE-HC-2012 ORGANIC CHEMISTRY-II LAB	<ul style="list-style-type: none"> • To perform checking calibration of thermometer, purification of organic compounds by crystallization techniques using various solvent systems, melting point determination of unknown organic compounds, effect of impurities on melting point, determination of boiling point. • To learn paper and thin layer chromatographic techniques to separate mixture of organic compounds.
CHE-HC-2024 PHYSICAL CHEMISTRY II	<ul style="list-style-type: none"> • To learn intensive and extensive properties in thermodynamics, different systems and functions, thermodynamic laws, concepts related to first law, laws of equipartition of energy, degrees of freedom, thermochemistry, Kirchoff's law, concept of entropy, statistical and molecular interpretation of entropy, residual entropy, Gibbs-Helmholtz energy, functions, equations, Maxwell relations, Joule-Thomson coefficient. • To study partial molar quantities, Gibbs-Duhem equation, chemical potential of ideal mixtures, thermodynamics of mixing ideal gases. • To know about thermodynamic equilibrium, chemical equilibria in ideal gases, fugacity, relation between Gibbs free energy of reaction and reaction quotient, exoergic and endoergic reaction, dependence of equilibrium constant on pressure, temperature and concentration, Le Chatelier's principle.

	<ul style="list-style-type: none"> To know about colligative properties of solutions, Raoult's and Henry's Laws and their applications, thermodynamic derivation of colligative properties using chemical potential.
CHE-HC-2022 PHYSICAL CHEMISTRY II LAB	<ul style="list-style-type: none"> To determine heat capacity of calorimeter, enthalpy of neutralization, enthalpy of ionization, enthalpy of hydration, solubility of benzoic acid in water, basicity/proticity of a polyprotic acid by thermochemical method.
Semester III	
CHE-HC-3014 INORGANIC CHEMISTRY-II	<ul style="list-style-type: none"> To learn the occurrence of different metals based on electrode potential, extraction processes of metals from their ores and minerals, refining of metals with standard metallurgical processes, apply basic knowledge of redox chemistry to study the metallurgical processes. To understand different theories related to acid-base principles, apply acid-base concepts to explain chemical reactions. To study s- and p- block elements with special focus on their synthesis, structure and bonding, properties and their uses. To learn about noble gases and their uses, preparation, properties, structure and bonding of noble gas compounds. To know about basic concepts of inorganic polymers and how they are different from organic polymers, synthetic strategies for inorganic polymers, their structure and applications.
CHE-HC-3012 INORGANIC CHEMISTRY-II LAB	<ul style="list-style-type: none"> To learn basic principles of various estimation, preparation of standard solutions, factors affecting the accuracy of estimation result, errors during estimation, handling different glasswares, setting up apparatus, calculating result and reporting. To demonstrate basic synthetic skills for inorganic synthesis, setting up reactions, isolation of product, stoichiometric calculation, crystallization techniques, collecting characterization data and their interpretation, reporting result.
CHE-HC-3024 ORGANIC CHEMISTRY-II	<ul style="list-style-type: none"> To study alkyl and aryl halides, synthesis, physical and chemical properties, utilization of these compounds to synthesize organometallic reagents and their uses in chemical transformations. To know about synthesis, physical properties and chemical reactivities of alcohols, phenols, ethers and epoxides. To learn about carbonyl and active methylene compounds, synthesis and their utilities in chemical transformations, nucleophilic addition elimination reactions of carbonyl compounds and various nucleophilic addition, name reactions of carbonyl compounds, oxidation and reduction reactions along with reaction mechanisms. To understand synthesis, physical and chemical properties of mono and dicarboxylic acid, ester hydrolysis mechanisms, different name reactions and their mechanisms. To know sulphur containing organic compounds such as thiols, thioethers, and sulphonic acids, their preparations and reactions.
CHE-HC-3022 ORGANIC CHEMISTRY-II LAB	<ul style="list-style-type: none"> To learn the testing of different functional groups, preparation of different reagents for testing functional groups, physical or chemical characteristics changes during the test of functional groups while a particular functional group is present or absent, inference drawing during test.

	<ul style="list-style-type: none"> To perform setting up organic reaction, handling different glass-ware while doing organic synthesis, precautions needed to take while using organic reagents, isolation of crude product, techniques used to purify the organic compound, characterization of product, calculation of yield of reaction.
CHE-SE-3034 BASIC ANALYTICAL CHEMISTRY	<ul style="list-style-type: none"> To know about soil analysis, composition, pH measurement, chelation and chelating agents, complexometric titration. To study water analysis, source of water contamination, water sampling and purification methods, pH, acidity and alkalinity determination, dissolve oxygen determination. To learn nutritional values of foods, food processing, food preservation, food adulteration, identification of common food adulterants, analysis of preservatives and coloring matter. To understand working principle of chromatography, paper chromatography, TLC, separation of mixture of metal ions by paper chromatography, comparing paint samples by TLC. To study ion-exchange and column chromatography, determination of ion exchange capacity of anion/cation exchange resin. To learn major and minor constituents of cosmetics and their function, analysis of deodorants and antiperspirants, analysis of constituents of talcum powder.
Semester IV	
CHE-HC-4014 INORGANIC CHEMISTRY-III	<ul style="list-style-type: none"> To study coordination chemistry, ligands, IUPAC nomenclature, isomerism, stereochemistry, coordination complexes theories – Werner theory, Valence bond theory, CFT theory, Molecular orbital theory, Jahn-Teller theory, Chelate effect, inert and labile ligands. To learn about transition elements, electronic configuration, colour, variable valency, magnetic and catalytic properties, explanation of different oxidation states based on Latimer & Frost diagrams, difference between first, second and third transition series. To study lanthanides and actinides elements, electronic configuration, oxidation states, spectral and magnetic properties and separation of lanthanides. To know about inorganic elements related to biological systems, functions, K/Na pump, enzymes, toxicity due to heavy metals, use of chelating agents in medicines, haemoglobin, storage and transfer of iron.
CHE-HC-4012 INORGANIC CHEMISTRY-III LAB	<ul style="list-style-type: none"> To perform gravimetric analysis technique, principles involved in gravimetric estimation of various metals Ni, Cu, Fe and Al and their estimation. To demonstrate inorganic complex preparation, characterization, crystallization, yield calculation. To study principles involved in chromatographic separation of inorganic ions, paper chromatographic separation of metal ions.
CHE-HC-4024 ORGANIC CHEMISTRY-III	<ul style="list-style-type: none"> To study synthesis of nitrogen containing compounds, basicity of amines, reactions involving amines, distinction between primary, secondary and tertiary amines, preparation and applications of diazonium salts. To learn about polynuclear hydrocarbons, synthesis, structure and reactions. To study heterocyclic compounds, aromaticity of heterocyclic

	<p>compounds, synthesis, reactions and mechanism of heterocyclic compounds</p> <ul style="list-style-type: none"> To know natural occurrence of alkaloid, structural features, isolation and physiological action, structure elucidation, synthesis. To learn occurrence of terpenes, classification, isoprene rule, structure, synthesis.
CHE-HC-4022 ORGANIC CHEMISTRY-III LAB	<ul style="list-style-type: none"> To perform test of N, S and halogens in organic compounds, various organic functional groups in organic compounds To perform qualitative analysis of unknown organic compounds by functional groups test.
CHE-HC-4034 PHYSICAL CHEMISTRY-IV	<ul style="list-style-type: none"> To study electrolytic dissociation, conductivity, theories of conductance, strong and weak electrolytes, ionic velocities, mobilities, applications of conductance measurement. To learn electrochemistry, Faraday's law of electrolysis, rules of oxidation/reduction based on half-cell potential, chemical cells, electromotive force and its measurements, Nernst equation, standard electrode potential and its applications to different half-cells, applications of EMF for various measurements, concepts of potentiometric titrations, applications of electrolysis in metallurgy and industry. To study preliminary concepts of electrostatics, Clausius-Mosotti equation, Lorenz-Laurentz equation, dipole moment, molecular polarizabilities, magnetism and its molecular interpretation.
CHE-HC-4012 PHYSICAL CHEMISTRY-IV LAB	<ul style="list-style-type: none"> To learn experiments related to conductometry, cell constant determination, equivalent conductance determination, degree of dissociation, dissociation constant, conductometric titrations. To perform various potentiometric titrations.
Semester V	
CHE-HC-5014 ORGANIC CHEMISTRY-IV	<ul style="list-style-type: none"> To learn about nucleic acids, nucleic acids role in the synthesis of biomolecules, various purine and pyrimidine bases. To study amino acids and their properties, synthesis of peptides. To learn about enzymes, their classifications, mechanism of action of enzymes, phenomenon of inhibition by enzymes and different types of inhibition mechanisms. To study about lipids and its different components, saponification value, acid value, iodine number and rancidity. To understand how cells obtain energy from foods, metabolic pathways of biosystems, electron transfer agents in biosystems, conversions of food to energy cycles, catabolic pathways of fat and protein, calorific value of food. To learn about pharmaceutical compounds and their importance, synthesis of common pharmaceutical drugs, medicinal values of curcumin (turmeric), azadirachtin (neem), vitamin C and antacid (ranitidine).
CHE-HC-5012 ORGANIC CHEMISTRY-IV LAB	<ul style="list-style-type: none"> To perform estimation of amino acids and proteins by titration. To experiment the action of enzyme on starch and its effect of temperature. To understand saponification value and iodine number of oil and fat experimentally. To perform isolation and characterization of DNA.

<p>CHE-HC-5024 PHYSICAL CHEMISTRY-V</p>	<ul style="list-style-type: none"> • To learn about the postulates of quantum mechanics, quantum mechanical operators and its applications. • To understand the Schrodinger equation of hydrogen atom and hydrogen like atoms, and of many-electron atoms. • To learn about chemical bonding through valence bond (VB) and molecular orbital (MO) approaches. • To study about different molecular spectroscopic principles and techniques. • To learn about photochemistry and the various photophysical phenomenon associated with it.
<p>CHE-HC-5022 PHYSICAL CHEMISTRY-V LAB</p>	<ul style="list-style-type: none"> • To study UV-vis spectroscopy, measuring the absorbance of standard solutions, calculating wavelength of maximum of absorbance, pH dependence on the UV-vis spectrum, effect of structure on the UV-vis spectra of organic compounds. • To verify experimentally the Beer-Lambert's Law using colourimetry and determine unknown concentrations. • To perform experiments using the principles of chemical kinetics.
<p>CHE-HE-5044 NOVEL INORGANIC SOLIDS</p>	<ul style="list-style-type: none"> • To know the various synthetic methods of preparing inorganic solids. • To learn about technological importance of inorganic solids, molecular material and fullerides, one-dimensional metals, molecular magnets, metal containing liquid crystals. • To learn about nanostructures and nanomaterials, preparation of nanomaterials, carbon nanotubes, inorganic nanowires, bio-inorganic nanomaterials. • To know the materials for mechanical construction, materials composition, various types of alloys, super alloys. • To understand composite materials, ceramics, and refractories.
<p>CHE-HE-5042 NOVEL INORGANIC SOLIDS LAB</p>	<ul style="list-style-type: none"> • To learn cation exchange capacity determination • To able to synthesize oxide ceramics, hydrogels, silver and gold nanoparticles.
<p>CHE-HE-5024 ANALYTICAL METHODS IN CHEMISTRY</p>	<ul style="list-style-type: none"> • To study sampling, evaluation of analytical data, errors, accuracy and precision, statistical test of data, F, Q and t test, rejection of data, and confidence intervals. • To learn optical methods of analysis, Beer Lambert's law, instrumentation and principle of UV-vis spectrophotometers, estimation of metal ions, Job's method. • To study principles of instrumentation of IR-spectrometers, sampling techniques, structure elucidation through interpretation of data. • To learn principles of instrumentation, techniques and applications of flame atomic absorption and emission spectrometry. • To learn about quantitative estimation through gravimetry and electroanalytical techniques. • To understand different types of separation techniques such as solvent extraction and chromatography, mechanism of chromatographic separation of components, chromatogram developments. • To learn qualitative and quantitative aspects of chromatographic methods IC, GLC, GPC, TLC and HPLC and their specific applications.

<p>CHE-HE-5022 ANALYTICAL METHODS IN CHEMISTRY</p>	<ul style="list-style-type: none"> • To study chromatographic separation of mixtures of cations, monosaccharides, dyes, active ingredients of plants, flowers and juices and determination of R_f values. • To learn solvent extraction of metal-DMG complex, extraction of zirconium, pH determination of aerated drinks, fruit juices, shampoos and soaps • To learn soil analysis, exchange capacity of resins, metal ions separation from binary mixture, amino acids separation from organic acids by ion exchange chromatography. • To learn pK_a value determination of indicator by spectrophotometry, structural characterization of compounds by infrared spectroscopy, determination of dissolved oxygen, chemical oxygen demand, biological oxygen demand of water, determination of composition by Job's method.
<p>Semester VI</p>	
<p>CHE-HC-6014 INORGANIC CHEMISTRY IV</p>	<ul style="list-style-type: none"> • To learn reaction mechanisms of inorganic reactions, thermodynamic and kinetic stability of inorganic complexes, kinetics of substitution reactions, ligand field effects and reaction rates, electro transfer reactions. • To study structure, bonding, reactivity, and catalytic activities of organometallic chemistry. • To learn theoretical principles in qualitative inorganic analysis, basic principles, solubility products, common ion effect, choice of group reagents, interfering anions.
<p>CHE-HC-6012 INORGANIC CHEMISTRY IV LAB</p>	<ul style="list-style-type: none"> • To learn qualitative analysis of mixtures containing three anions and three cations along with interfering anion or insoluble component. • To learn synthesis of metal inorganic complexes and determination of extinction coefficient and 10 D_q of metal complexes from spectrophotometric analysis.
<p>CHE-HC-6024 ORGANIC CHEMISTRY V</p>	<ul style="list-style-type: none"> • To learn about absorption and emission spectroscopy, application of uv spectroscopy in organic molecules, Woodward rules for calculation of λ_{max}. • To study IR spectroscopy, fundamental and non-fundamental molecular vibrations, IR-frequencies of various functional groups and effect of electronic factors and weak forces on stretching frequencies, fingerprint region, functional group analysis. • To learn NMR basic principles, factors influencing chemical shift, couplings, interpretation of NMR spectra of simple molecules, principles of ESR spectroscopy, ESR spectrum of simple radicals. • To learn IR, UV and NMR techniques for identification of organic and inorganic molecules. • To study carbohydrates and their biological relevance, constitution and absolute configuration, synthesis of monosaccharides. • To study structure elucidation of disaccharides and polysaccharides. • To learn about dyes, their classification, color and constitution, synthesis and applications of various dyes • To study polymers and their classifications and characteristics based on different molecular weight, polymerization reactions, preparation

	and applications of plastics, fabrics, rubbers, natural and synthetic polymers, biodegradable and conducting polymers.
CHE-HC-6022 ORGANIC CHEMISTRY V LAB	<ul style="list-style-type: none"> • To learn extraction of caffeine from tea leaves, analysis of carbohydrates. • To study synthesis of sodium polyacrylate, urea formaldehyde and methyl orange • To study analysis of organic compounds by IR spectroscopy and NMR spectroscopy.
CHE-HE-6014 GREEN CHEMISTRY	<ul style="list-style-type: none"> • To know about the various aspects of green chemistry and its principles. • To understand the role of green chemistry in designing a sustainable chemical synthesis. • To know about the tools of green chemistry and their utilization. • To learn about the development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical processes. • To learn the use of green chemistry tools in the synthesis of specific industrially important chemicals. • To understand the future of green chemistry and its role in sustainable development.
CHE-HE-6012 GREEN CHEMISTRY LAB	<ul style="list-style-type: none"> • To perform the clock reaction using vitamin C and study the effect of concentration and temperature. • To know to prepare biodiesel from vegetable oil. • To perform atom economy reactions. • To experiment reactions using enzyme catalysts. • To perform organic reactions in water. • To experiment reactions using alternative sources of energy such as microwave and sunlight.
CHE-HE-6046 RESEARCH METHODOLOGY FOR CHEMISTRY	<ul style="list-style-type: none"> • To know about literature survey and able to construct a rational literature survey using print and digital media. • To learn about internet resources for chemistry and utilize it for finding and citing published information. • To understand the methods of scientific research and writing scientific papers. • To aware and understand chemical safety and ethical handling of chemicals. • To learn investigation, analysis, and presentation of scientific data. • To know the fundamentals of electronic circuits of sophisticated instruments like spectrophotometers. • To generate fruitful output in terms of publications and patents in the field of chemical sciences.
CBCS (Honours Generic & Regular)	
Semester I	

CHE-HG-1016 CHEMISTRY1	<ul style="list-style-type: none"> To learn the atomic structure through the basic concepts of quantum mechanics. To understand the chemical bonding through Lewis structure, VSEPR theory, valence bond (VB) and molecular orbital (MO) approaches. To learn basic ideas used in organic chemistry, stereochemistry, functional groups, alkanes, alkenes, alkynes.
CHE-HG-1016 CHEMISTRY 1 LAB	<ul style="list-style-type: none"> To perform volumetric analysis of acid-base and redox reactions. To know to detect extra elements (N, S, Cl, Br, I) in organic compounds. To perform chromatographic separation of mixture of (a) amino acids and (b) sugars.
Semester II	
CHE-HG-2016 CHEMISTRY2	<ul style="list-style-type: none"> To understand the periodicity in s- and p-block elements. To learn the general group trends and redox stabilities of transition elements. To understand coordination compounds through valence bond theory (VBT), crystal field theory (CFT) and ligand field theory (LFT). To learn kinetic theory of gases, ideal gas and real gases, surface tension, viscosity, basic solid state chemistry and chemical kinetics.
CHE-HG-2016 CHEMISTRY2 LAB	<ul style="list-style-type: none"> To perform semi-micro qualitative analysis using H₂S in the mixtures of cations and anions. To perform quantitative analysis and complexometric titrations. To know to evaluate the unknown concentration using Beer Lambert's law and flame photometry. To experiment the composition metal complexes in solution by Job's method. To learn to determine surface tension and viscosity of liquids. To know to determine the rates of chemical reactions with the principles of chemical kinetics.
Semester III	
CHE-HG-3016 CHEMISTRY 3	<ul style="list-style-type: none"> To understand the chemical system from thermodynamic point of view. To learn about chemical equilibrium and ionic equilibrium. To learn various classes of organic molecules- alkyl halides, aryl halides, alcohols, phenols, ethers, aldehydes and ketones, their preparations, and reactions.
CHE-HG-3016 CHEMISTRY 3 LAB	<ul style="list-style-type: none"> To perform reactions of thermochemistry to determine various thermodynamic parameters. To know to prepare buffer solutions and measure pH of different solutions. To perform purification of organic compounds by crystallization. To perform experiments to understand the reactions of substituted aromatic hydrocarbons and carbonyl compounds.
Semester IV	

<p>CHE-HG-4016 CHEMISTRY4</p>	<ul style="list-style-type: none"> • To understand thermodynamics of solutions, phase rule and its application in specific cases, basics of conductance and electrochemistry. • To learn the preparation and reactions of carboxylic acids and its derivatives and amines. • To learn important topics of biochemistry- amino acids, peptides, proteins and carbohydrates.
<p>CHE-HG-4016 CHEMISTRY4 LAB</p>	<ul style="list-style-type: none"> • To perform experiments of phase equilibria, conductance, and potentiometry. • To perform systematic qualitative organic analysis of organic compounds. • To perform paper chromatographic separation of amino acids. • To know to determine the saponification value and the iodine value of an oil/fat. • To perform extraction of DNA from onion/ cauliflower. • To perform the action of salivary amylase on starch and its effect of temperature. • To know to determine the titration curve of glycine and the determination of the concentration of glycine solution by formylation method. • To understand the differentiation between a reducing/nonreducing sugar experimentally.

