

Program Name: **B. Sc. Chemistry**

Program specific Outcomes

A student completing this program will be able to

PSO1: Knowledge: Apply the principles of analytical, organic, inorganic and physical chemistry to solve basic chemical problems locally and globally

PSO2: Laboratory skills: Employ classical and modern laboratory techniques in the performance and documentation of experiments, suitable for a chemical industry or a chemistry graduate program.

PSO3: Environmental concern: Practice environmentally benign chemistry

PSO4: Employability/future prospects: Develop problem-solving skills and aptitude that are highly valuable to employers and entrepreneurship skills for self-employment

PSO5: Scientific communication: Have effective written and oral scientific communication skills, especially the ability to transmit complex technical information in a clear and concise manner

Course outcomes for all courses offered by the department:

Semester	Course code	Course name	Course Outcomes Student completing this course is able to
1	CH-1501	General chemistry-I	1: Interpret the fundamentals of organic reaction mechanisms and describe the chemical properties as well as synthetic methods for hydrocarbons 2: Apply the principles of some selected quantitative analysis methods to derive information regarding organic compounds 3: Recognize and apply the fundamentals of quantum mechanics and chemical bonding to describe atomic structure as well as molecular structure 4: Interpret the role of entropy in various thermodynamic process and also apply the principles of chemical kinetics to derive the rate equations for various types of reactions
1	CH-1502 L	Chemistry practicals-I	1: Perform semi-micro qualitative analysis of inorganic salts to identify the cation and anion 2: Use the principles of titrimetric analysis to determine the concentration of unknown acid or base

2	CH-2501	General Chemistry-II	<p>1: Use the fundamentals of stereochemical and conformational analysis to identify the configuration and conformation of the given organic compounds</p> <p>2: Recognize and apply the principles of Werner's theory and VB theory to understand bonding in coordination complexes formed by transition metals</p> <p>3: Interpret the basic laws and conditions governing ionic equilibria, hydrolysis of various types of salts, catalysis including mechanism and derivation for enzyme catalysed reactions</p> <p>4: Apply the basics of titrimetric analysis to find solutions to simple analytical problems</p>
2	CH-2502L	Chemistry Practicals-II	<p>1: Apply the principles of organic separation and functional group reactivity to identify qualitatively the given organic compound</p> <p>2: Use the principles of titrimetric analysis to determine the concentration of unknown metal solution and redox reagents</p>
3	CH-3501	Organic Chemistry	<p>1: Apply the fundamentals of organic chemistry to describe the structure, synthesis and chemical properties of carbohydrates, amino acids, some selected heterocycles and beta dicarbonyl compounds</p> <p>2: Remember and recognize the reagents and reaction mechanisms employed to synthesize derivatives of benzene, naphthalene and other polynuclear hydrocarbons</p> <p>3: Apply the concepts of resonance, inductive effects etc to evaluate the acid-base properties of organic molecules</p>
3	CH-3502	Physical Chemistry	<p>1: Calculate the work function and free energy of chemical systems to determine the spontaneity of the reaction and also modify the kinetic rate equation to include temperature</p> <p>2: Remember and recognize the definition of colloids and different types of colloidal systems as well as adsorption and different adsorption isotherms</p> <p>3: Remember and recognize the basics of polymer chemistry as well as nuclear chemistry</p> <p>4: Employ the fundamentals of electrochemistry to determine the outcome of simple acid-base titrations conductometrically</p> <p>5: Comprehend the terms used in phase rule; derive the phase rule and use it to understand the behaviour of one component system as well as systems with simple congruent melting point with illustrations</p>

3	CH-3503L	Inorganic & Physical Chemistry Practicals	<p>1: Perform semi-micro qualitative analysis of a mixture of inorganic salts (four ions) and identify the cations and anions</p> <p>2: Apply the principles of conductometry, refractometry, chemical kinetics and viscometry to perform chemical analysis</p>
3	CH-3504	Organic chemistry	<p>1: Apply the fundamentals of organic chemistry to describe the structure, synthesis and chemical properties of some selected heterocycles and beta dicarbonyl compounds</p> <p>2: Remember and recognize the reagents and reaction mechanisms employed to synthesize derivatives of benzene, naphthalene and other polynuclear hydrocarbons</p> <p>3: Apply the concepts of resonance, inductive effects etc to evaluate the acid-base properties of organic molecules</p> <p>4: Use the 12 principles of green chemistry to design green synthetic processes and methodologies</p>
4	CH-4501	Inorganic Chemistry	<p>1: Apply the postulates of quantum mechanics to solve the Schrodinger wave equation for simple chemical systems</p> <p>2: Use the bonding theories like CFT and MOT to understand the chemical properties and structure of simple molecules, co-ordination compounds and organometallic compounds</p> <p>3: Employ the basics of organometallic chemistry to infer the stability and catalytical reactions of organometallic complexes</p>
4	CH-4502	Analytical Chemistry	<p>1: Employ the fundamentals of quantitative analysis to interpret the theory and locate the end point for various acid-base systems, determine the theoretical construction of the graph and understand its actual nature.</p> <p>2: Apply the basics of classical analysis methods to comprehend the various aspects of gravimetric analysis</p> <p>3: To employ the method of solvent extraction and remember its use in single and batch process, extraction of metals and also determine the separation efficiency</p> <p>4: Remember the theory and uses of 8-Hydroxy Quinoline, Cupferron, DMG and N-benzoyl-N-phenylhydroxylamine as precipitants</p>
4	CH-4503L	Organic and Analytical Chemistry Practicals	<p>1: Apply the principles of organic separation and functional group reactivity to identify qualitatively the given multi-functional organic compound</p>

			<p>2: Use the basic principles of classical analytical techniques to determine an inorganic or organic analyte gravimetrically or volumetrically</p>
5	CH-5501	Organic Chemistry	<p>1: Apply the knowledge of stereochemistry to determine the configuration of molecules without a chiral carbon and to determine the stereochemical outcome of chemical reactions</p> <p>2: Remember and decipher the mechanistic details of nucleophilic substitution reactions on aliphatic and aromatic molecules</p> <p>3: Remember and apply inorganic reagents, important name reactions and molecular rearrangements for organic synthetic applications</p> <p>4: Apply the fundamentals of organic chemistry to describe the structure, synthesis and chemical properties of disaccharides and biochemically important heterocycles</p>
5	CH-5502	Inorganic Chemistry	<p>1: Remember the basics of symmetry elements and operations as well as use them to determine the point group of molecules</p> <p>2: Use the fundamentals of MOT and construct the MO diagram for all types of complexes as well as remember the mechanistic details of reactions of transition metal complexes</p> <p>3: Remember the principle, instrumentation and application of Mossbauer spectroscopy</p> <p>4: Remember the preparation, structure and properties of inorganic polymers containing boron and silicon</p>
5	CH-5503	Physical Chemistry	<p>1: Derive the Clausius-Clapeyron equation and apply it for various systems as well as derive equations to study the effect of temperature on equilibrium constant Van't-Hoff isochore</p> <p>2: Remember the fundamentals of electrochemistry and apply them to comprehend the working of electrodes as well as fuels cells</p> <p>3: Predict the reaction rates of heterogenous reactions, retarded reactions and also determine the primary and secondary salt effect on reaction rates</p> <p>4: Remember the techniques and types of polymerization as well as determine the molecular mass based on various methods</p> <p>5: Recognize the methods for the used for the detection of isotopes by different types of mass spectrograph. The student will also be able to remember the applications of isotopes and different tracer techniques</p> <p>6: Remember and recognize the fundamental principles of rotational and vibrational spectra</p>

5	CH-5504	Analytical Spectroscopic Techniques	<p>1: Remember the theoretical principles and instrumentation of UV, visible, IR, Raman and NMR spectroscopy and apply these to solve structural problems in chemistry</p> <p>2: Remember the theoretical principles and instrumentation of atomic absorption spectroscopy and Flame emission spectroscopy with the interferences in the technique</p>
5	CH-5505L	Inorganic, Physical, Organic & Analytical Chemistry Practicals-I	<p>1: Perform semi-micro qualitative analysis of a mixture of inorganic salts (6 ions) and identify the cations and anions</p> <p>2: Apply the principles of conductometry, chemical kinetics, pH metry, Potentiometry and colorimetry to perform chemical analysis</p> <p>3: Perform single step organic synthesis using green methods</p> <p>4: Perform the quantitative analysis of simple organic molecules and drugs by volumetric and chromatographic methods</p>
5	CH-5401	Nanomaterials and Nanotechnology	<p>1: Remember and recognize the fundamentals of nanotechnology and nanomaterials</p> <p>2: Remember and recognize the characterization techniques for nanomaterials</p> <p>3: Recognize the applications of nanotechnology in various fields</p>
6	CH-6501	Organic Chemistry	<p>1: Predict the stereochemical outcome of a reaction with a pro-chiral centre or suggest methods to control the stereochemistry of the product formed</p> <p>2: Determine the configuration of chiral molecules containing nitrogen, sulphur and phosphorous</p> <p>3: Use the basics of organic reaction mechanisms to understand the classification, structure, preparation and chemical properties of some alkaloids, isoprenoids, dyes, explosives, pesticides, drugs and vitamins</p>
6	CH-6502	Inorganic Chemistry	<p>1: Determine and remember the terms related to energy levels of the d-orbitals in transition metals as well as the theories and rules that govern the transition of electrons in electronic spectra of transition metals</p> <p>2: Recognize more aspects of operators in quantum chemistry as well as use the Schrodinger wave equation to determine the energy of complex systems such as the rigid rotator and the hydrogen atom</p> <p>3: Remember the approximations methods such as variation method and apply it to determine the structure of simple linear conjugated systems and for hybridisations</p>

			4: Remember the structure and bonding as well as reaction mechanisms of organometallic compounds
6	CH-6503	Physical Chemistry	<p>1: Remember the colligative properties, partial molal properties, the third law of thermodynamics as well as its applications</p> <p>2: Remember and recognize the working of a concentration cell; apply electromotive force for desalination and reverse osmosis as well as prevention of corrosion</p> <p>3: Use the basics of phase rule to describe binary systems and solve numericals based on them</p> <p>4: To remember the basics of photochemistry, the laws and various phenomena associated as well as solve numericals based on them</p>
6	CH-6504	Analytical Chemistry	<p>1: To interpret data scientifically and employ various statistical tests for the same.</p> <p>2: Recognize the methods of separation like Solid Phase Extraction, solvent extraction by flow injection analysis, chromatography and specialized techniques as well as remember the instrumentation of sophisticated chromatographic techniques like HPLC, HPTLC etc</p> <p>3: Remember and employ the principles of polarography and potentiometry for quantitative analysis</p> <p>4: Employ the fundamentals of titrimetric analysis for titrations involving polyprotic acids and base, mixtures of acids/bases, reducing agents, oxidising agents and complexes; solve based on these principles</p>
6	CH-6401	Everyday Chemistry	<p>1: Remember and recognize the classification of fertilizers as well as the preparation and properties of various fertilizers</p> <p>2: Remember and identify the additives in food and their functions</p> <p>3: Remember and recognize the classes of adhesives, their preparation and bonding mechanisms</p> <p>4: Remember the chemical and physical properties of oils, fats and waxes; their extraction methods and applications</p>
6	CH-6505L	Inorganic, Physical, Organic & Analytical Chemistry Practicals	<p>1: Use the principles of quantitative analysis and determine the amount of metal ions in mixtures and alloys gravimetrically as well as volumetrically</p> <p>2: Apply the principles of conductometry, chemical kinetics, pHmetry, Potentiometry and colorimetry to perform chemical analysis</p> <p>3: Separate a mixture of organic compounds based on their nature and identify them qualitatively</p>

Vocational industrial chemistry courses

1	IC-1401	Conceptual Industrial Chemistry	<p>1: Identify the hydrocarbons through their chemical & physical properties and their application in Industry.</p> <p>2: Interpret the basic calculations of compounds, chemical reaction and their application.</p> <p>3: Synthesize petroleum products and their processing through different techniques.</p> <p>4: Define the types of renewable resources and to operate the technique for distillation and crystallization</p>
1	IC-1402L	Industrial Chemistry Practicals-I#	<p>1: Use the principle of titrimetric analysis to determine the concentration of unknown acid or base.</p> <p>2: Use of unit operation for purification and preparation method.</p>
2	IC-2401	Selected topics in Industrial Chemistry	<p>1: To relate the trivial names of chemical compound with modern era and use of equipment in Industries.</p> <p>2: Apply the techniques of unit operation in different processes</p> <p>3: Employ the principles to control the pollution of industries & importance of inorganic compounds in industries.</p> <p>4: Describe the types of system and their correlation with energy</p>
2	IC-2402L	Industrial Chemistry Practicals-II#	<p>1: Calculate the total acidity of industrial water sample and assay of $ZnSO_4$ & H_3BO_3</p>
3	IC-3401	Industrial Process Chemistry	<p>1: Distinguish between unit operation and unit process and preparation of nitro and sulfo aromatic compounds.</p> <p>2: Design the commercial products through halogenations & hydrogenation.</p> <p>3: Classify the dyes on the basic of structure and method of application.</p> <p>4: Synthesize different dyes and their application in commercial ways.</p>
3	IC-3402L	Industrial Chemistry Practicals-III#	<p>1: Evaluate the C.O.D & D.O value from industrial water sample.</p> <p>2: Preparation of different types of dyes used in industry.</p>
4	IC-4401	Applied Industrial Chemistry	<p>1: To prepare commercial products through alkylation, amminolysis and hydrolysis.</p> <p>2: Interpret large range of engineering material of increasing importance in industrial application as polymer.</p> <p>3: To analyze and formulate the chemicals and natural materials used in cosmetics.</p>

			4: To develop a creative and marketing skill through fundamentals of entrepreneurship.
4	IC-4402L	Industrial Chemistry Practicals-IV#	1: Preparation of chemical compounds through unit process.
5	IC-5401	Pharmaceutical Chemistry	1: To recognize the basic terms related to pharmacopeia and monograph of drugs. 2: Classify pharmaceutical drug as sedatives, antimicrobial, cardiovascular and vitamins. 3: To formulate pharmaceutical drug and plan their routes of administration. 4: Design a drug choosing its target through functional group modification.
5	IC-5402L	Industrial Chemistry Practicals-V #	1: Estimation & identification of drugs through different techniques.
6	IC-6401	Medicinal Chemistry	1: Identify the fundamentals terms and definition related to pharmacodynamics and pharmacokinetics. 2: Interpret pharmaceutical agent as Anesthetic, analgesic and sulfa drug. 3: To describe basic concept of prodrug. 4: Interpret fundamentals of combinatorial chemistry and their analysis
6	IC-6402L	Industrial Chemistry Practicals-VI #	1: Preparation and analyze the pharmaceutical drug through different technique. 2: Perform the assay of pharmaceutical drug.