

## **B. Sc. CHEMISTRY**

### **PROGRAMME OUTCOME:**

The students perusing this course can have ability to:

- Demonstrate an understanding of major concepts in all disciplines of chemistry.
- Employ critical thinking and the scientific method to design, carry out, record and analyse the results of chemical experiments.
- Get an awareness of the impact of chemistry on the environment, society, and other cultures outside the scientific community.
- Explain chemical nomenclature, structure, reactivity, and functions in their specific field of chemistry.
- Design and execution of the experiments should demonstrate the understanding of good laboratory and the proper handling of chemicals
- Explain how the applications of Chemistry related to the real world

### **B Sc Part One—Code-004**

#### **COURSE OUTCOME-- CHEMISTRY [ code-06 & 26 ]**

<b>Paper</b>	<b>Co Code</b>	<b>CO</b>
<b>Inorganic</b>		After successfully completing this course students will be able to:
	CO 1	predict the shape and also the angles between the bonds of a molecule with the knowledge of the hybridisation used by the central atom of the molecule
	CO 2.	Understand the shapes of different orbitals.
	CO 3.	Understand different principles for filling electrons.
	CO 4 .	Understand how to draw energy diagrams, how to calculate bond order, how to calculate lattice energy through Born Haber Cycle.
	CO 5 .	Write electronic configuration of given atomic number and calculate effective nuclear charge using Slaters Rule
	CO 6 .	Tell the name of orbitals by recognizing shapes of orbitals.

	CO 7 .	Draw MO diagrams of different molecules , calculate bond order of different molecules, structures of different ionic solids.
	CO 8	Describe the periodic table as a list of elements arranged so as to demonstrate trends in their physical and chemical properties.
	CO 9.	State the principle resemblances of elements within each main group in particular alkali metals, alkaline earth metals , halogens and noble gases
<b>Organic</b>	CO 1	After successfully completing this course students will be able to: Understand the core concepts of organic chemistry i.e. resonance, hyperconjugation, inductive effect etc. and their application
	CO 2.	Study about the isomerism and types of isomerism.
	CO 3.	Understand optical isomerism, geometric isomerism and conformational isomerism.
	CO 4 .	Acquire basic knowledge of reactive intermediates and mechanism of organic reactions.
	CO 5 .	Study about nomenclature, synthesis, isomerism and physical properties of alkanes and cycloalkanes.
	CO 6 .	Recognize and draw constitutional isomers, stereoisomers, including enantiomers and diastereomers, racemic mixture and meso compounds .
	CO 7 .	Know the fundamental principles of organic chemistry and predict outcomes and derive mechanism of various types of organic reactions.
	CO 8	Understand various types of reactive intermediates and factors affecting their stability .
	CO 9	Understand the nomenclature, synthesis, isomerism and physical properties of alkanes and cycloalkanes

<b>Physical</b>	<p>CO 1</p> <p>CO 2.</p> <p>CO 3.</p> <p>CO 4 .</p> <p>CO 5 .</p> <p>CO 6 .</p> <p>CO 7 .</p> <p>CO 8</p>	<p>After successfully completing this course students will know to</p> <p>Describe the concept of pressure from a macroscopic and microscopic perspective.</p> <p>Explain the quantitative relationship between T,V, n &amp; P as described by kinetic molecular theory.</p> <p>Compare and contrast the chemical behaviour and physical properties of common substances.</p> <p>Classify matter by its state and bonding behaviour using the periodic table as a reference.</p> <p>Describe a reaction rate in terms of a change in concentration divided by a change in time (at constant volume) and a general form of a (differential) rate law.</p> <p>Write a general form of the rate law for any chemical reaction and define the order of a chemical reaction.</p> <p>Determine integrated rate expression for zero order, first order, second and third order reaction and their respective half-life period expressions.</p> <p>Study the various factors which affect the rate of a chemical reaction such as concentration ,temperature, solvent, catalyst etc. And theories of chemical kinetics.</p>
<b>Practical</b>	<p>CO 1</p> <p>CO 2.</p>	<p>After successfully completing this course students will able to:</p> <p>Gain hands on experience in identification of organic compounds</p> <p>To study Qualitative analysis of mixture containing 4 radicals with removal of interfering radicals</p>

	CO 3.	Use double burette method and burette –pipette methods for titration Prepare standard solutions
	CO 4 .	Know handling of glassware's and care to be taken, handling of organic flammable as well as toxic solvents in laboratory
	CO 5 .	Know use of safety goggles, shoes and gloves, fire extinguisher and its use and action to be taken in accidental cases
	CO 6	Get awareness of safety techniques and handling of chemicals..

**B Sc Part Two—Code-005**

**COURSE OUTCOME-- CHEMISTRY [ code-06& 26 ]**

<b>Paper</b>	<b>Co Code</b>	<b>CO</b>
<b>Inorganic</b>		After successfully completing this course students will be able to:
	CO 1	Understand general trends in the chemistry behind p-block elements.
	CO 2.	The students will be able to know the important compounds and important applications of compounds of boron and carbon.
	CO 3.	The students will understand the biological significance of sodium, potassium, magnesium and calcium.
	CO 4 .	The students will be able to explain large scale preparation and properties of industrially viz., cement, plaster of paris, sodium hydroxide, sodium carbonate

	CO 5 .	and bicarbonate etc.  The students will be able to describe the salient features of alkali and alkaline earth metals.
	CO 6 .	Study transition metals to understand the trends in properties and reactivity of the d-block elements.
	CO 7 .	Explain the typical physical and chemical properties of the transition metals.
	CO 8	Identify simple compound classes for transition metals and describe their chemical properties.
<b>Organic</b>	CO 1	After successfully completing this course students will be able to  Develop green methodologies for the synthesis of nitrogen containing heterocyclic.
	CO 2.	Aware about most of drugs in the present market are the compounds containing various heterocyclic moieties.
	CO 3.	Understand the reaction mechanism of carbonyl compound, alcohol, phenol and carboxylic acid
<b>Physical</b>	CO 1	After successfully completing this course students will be able to:  Acquire basic knowledge of electrode conduction.
	CO 2.	Determine the solubility of sparingly soluble salts.
	CO 3.	Explain the various methods for the determination of transport number
	CO 4 .	State the basic principles electrochemistry
	CO 5 .	Mention and explain various methods for the

		determination of transport number
	CO 6 .	Explain the concepts of electrolytic conduction and dilution
	CO 7 .	Understand thermodynamic terms: system, surrounding etc. Types of systems, intensive and extensive properties. State and path functions and their differentials.
	CO 8	Understand Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law
	CO 9	Understand the concept of equilibrium constant, free energy, chemical potential
	CO 10	Understand of the laws of thermodynamics and their applications
	CO 11	know the phase diagram of single component systems and binary mixtures
	CO 12	Understand of the applications statistical thermodynamics
<b>Practical</b>		After successfully completing this course students will be able to:
	CO 1	Ability to use instruments for chemical analysis and separation.
	CO 2.	Follow reaction by using thin layer chromatography
	CO 3.	Ability to perform experiments, analyse data and interpret results and observe scientific conduct.
	CO 4 .	Ability to identify presence or absence of number of cations or anions in solution, using tests based on acid –

		base and solubility.
	CO 5.	Ability to work effectively in diverse teams in laboratory

**B Sc Part Three—Code-006**

**COURSE OUTCOME-- CHEMISTRY [ code-06 & 26 ]**

<b>Paper</b>	<b><u>CO Code</u></b>	<b><u>CO</u></b>
<b>Inorganic</b>		After successfully completing this course students will know,
	CO 1	Understand the role of metal ions in biological system.
	CO 2.	Understand the role of metal ions in oxygen transport.
	CO 3.	Understand the concept of acid and bases.
	CO 4 .	Understand the uses of inorganic polymers.
	CO 5 .	Understand the nature of bonding of different metals with carbon atom.
	CO 6 .	Describe role of different metal ions in biological system.
	CO 7 .	Recognize role of porphyrin ring in haemoglobin.
	C O 8	Count total of electrons in organometallic compound
<b>Organic</b>		After successfully completing this course students will be able to:
	CO 1	Study the NMR spectroscopy to understand the important role of nuclear magnetic resonance spectroscopy in the study of the structures of organic compounds.
	O 2.	Develop an understanding of the significance of the number, positions, intensities and splitting of signals in

	<p>CO 3. Assign structures to simple molecules on the basis of nuclear magnetic resonance spectra.</p> <p>CO 4. Study carbohydrates will develop the skills to recognize and draw particular carbohydrate structures.</p> <p>CO 5. Know general structural elements of cyclic monosaccharide and disaccharides and their implications for structure and function.</p> <p>CO 6. Ability to identify organic compounds by analysis and interpretation of spectral data.</p> <p>CO 7. Ability to explain common terms in NMR spectroscopy such as chemical shift ,coupling constant and anisotropy and describe how they are affected by molecular structure.</p> <p>CO 8. Perform the most commonly used NMR experiments and to interpret and document their results.</p>
<b>Physical</b>	<p>After successfully completing this course students will be able to:</p> <p>CO 1. Recognize the basic rules of electronic spectroscopy.</p> <p>CO 2. Predict the term symbols of diatomic molecules</p> <p>CO 3. Understand the concept of black body radiations.</p> <p>CO 4. Understand the concept of wave functions.</p> <p>CO 5. Understand different properties of molecular structure.</p> <p>CO 6. Understand the basic features of spectroscopy</p> <p>CO 7. Understand the Harmonic Oscillator.</p>



	C O 8	Recognize different regions for different spectroscopy.
	C O 9	Explain the concept of Electromagnetic Waves.
	C O 10	Explain the concept use in Black Body Radiation
<b>Practical</b>		After successfully completing this course students will know,
	C O 1	Understand the principle and working of different instruments like colourimeter, conductometer, spectrophotometer, etc.
	C O 2	How to synthesize organic molecules
	C O 3	How to maintain reaction conditions.
	C O 4	Arrangement of assembly

## **M. Sc. CHEMISTRY**

### **Program Outcome of M Sc Chemistry:[Annual System]**

PO1: Work in the interdisciplinary and multidisciplinary areas of chemical sciences and its applications.

PO2: Analyse the data obtained from sophisticated instruments (like FTIR, NMR, GCMS, HPLC, GCMS UV Vis, Fluorescence, and TGA) for the structure determination and chemical analysis.

PO3: Apply green/sustainable chemistry approach towards planning and execution of research in frontier areas of chemical sciences.

PO4: Have sound knowledge about the fundamentals and applications of chemical and scientific theories

PO5: Apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries

PO6: Helps in understanding the causes of environmental pollution and can open up new methods for environmental pollution control.

PO7: Acquires the ability to synthesize, separate and characterize compounds using laboratory and instrumentation techniques.

PO8: Carry out experiments in the area of organic analysis, estimation, separation, derivative process, inorganic semi micro analysis, preparation, conductometric and potentiometric analysis

PO9: Learns about the potential uses of analytical industrial chemistry, medicinal chemistry and green chemistry.

PO10: Understands the background of organic reaction mechanisms, complex chemical structures, and instrumental method of chemical analysis, molecular rearrangements and separation techniques

#### **Course Outcome of M Sc Previous**

<b>PAPER</b>	<b><u>CO</u> <u>Code</u></b>	<b><u>CO</u></b>
<b>INORGANIC CHEMISTRY</b>		After successfully completing this course, students will be able to:
	CO 1	Able to visualize molecule in 3-D, understand the concept of symmetry elements and symmetry operations.
	CO 2	know the point groups of molecules and understand symmetry considerations for optical activity and dipole moment.
	CO 3	Understand the group multiplication table, character table and representations of group.
	CO 4	Correlate application of symmetry to spectroscopy and find IR active modes of vibration.
	CO 5	Understand the detail chemistry of s- and p- block elements with respect to their compounds, reactions and applications.
	CO 6	Learn the advance chemistry of boranes,

		fullerenes, zeolites, carbon nanotubes, Polymers, etc.
	CO 7	Understand the organometallic chemistry of some important elements of s- and p- block.
	CO 8	Understand how to construct molecular orbitals using various symmetry operations and their representations.
	CO 9	Understand the effect of various ligand field strengths on d-metal ions and find out ground state terms with their energies, microstates, degeneracy and microstate table for different transition metal ions and complexes.
	CO10	Know the magnetic properties of complexes and understand spin-only and effective magnetic moments, Zeeman effect, properties of complexes with A, E, and T terms.
<b>ORGANIC CHEMISTRY</b>		After successfully completing this course, students will be able to:
	CO 1	Understand various reactions and rearrangements.
	CO 2	Understand and write mechanism of reactions and their applications.
	CO 3	Understand how to convert one molecule into another by using oxidising and reducing, reagents.
	CO 4	Apply theoretical knowledge in practical's for various conversions
	CO 5	Understand chemical bonding and reactivity, various effects in organic molecules
	CO 6	Understand Acidity and Basicity as well as

	CO 7	aromaticity.  Understand concepts of stereochemistry and will be able to stereochemical aspects in organic chemistry.
	CO 8	Develop knowledge of substitution (electrophilic, nucleophilic), addition and elimination reactions.
<b>PHYSICAL CHEMISTRY</b>		After successfully completing this course, students will be able to:
	CO 1	Represent of the rate law of the elementary and chain reaction
	CO 2	Understand of the theories for the determination of the rate of the reactions
	CO 3	Understand of the kinetics of the explosive photochemical and unimolecular reactions
	CO 4	Understand of the laws of thermodynamics and their applications
	CO 5	Know the phase diagram of single component systems and binary mixtures
	CO 6	Understand of the applications statistical thermodynamics
	CO 7	Understand of the quantum chemistry of free electron and H-atom
	CO 8	Understand of the principle of Microwave, IR, Raman, Electronic, NMR, ESR and Mossbauer spectroscopy
	CO 9	Draw the schematic Microwave, IR and Raman spectrum of di and triatomic molecules based on the selection rules.

<b>ANALYTICAL CHEMISTRY</b>		After successfully completing this course, students will be able to:
	CO 1	Understand the Principles of mass spectroscopy, gas chromatography and HPLC
	CO 2	Apply the techniques for structure determination of organic molecules.
	CO 3	Perform statistical analysis of chemical data by developing analytical mind
	CO 4	To define methods for the characterization of surfaces.
	CO 5	To explain the principle and instrumentation of microwave, infrared vibration-rotation Raman and infra-red spectroscopy
	CO 6	To interpret microwave, vibration-rotation Raman and infra-red spectra for chemical analysis
	CO 7	To explain the principle and instrumentation of electronic spectroscopy and analyse the electronic spectra of different species

### MSc Final

Paper	CO Code	CO
Application of spectroscopy		After successfully completing this course, students will be able to:
	CO 1	To explain the principle and instrumentation of microwave, infrared vibration-rotation Raman and infra-red spectroscopy

	CO 2	To interpret microwave, vibration-rotation Raman and infra-red spectra for chemical analysis
	CO 3	To explain the principle and instrumentation of electronic spectroscopy and analyse the electronic spectra of different species
	CO 4	To explain the principle and instrumentation of nuclear magnetic and electron spin resonance spectroscopy
	CO 5	Apply the knowledge in characterizing the molecules and also their use in medical diagnostics.
	CO 6	To explain the principle, instrumentation, and application of Mass spectroscopy to study bonding in iron derived complexes
Bioinorganic ,Bioorganic & Biophysical		Upon successful completion of this course, the student should be able to:
	CO 1	Apply the basic principles in inorganic and general chemistry to interdisciplinary topics in the field of bioinorganic chemistry.
	CO 2	Describe the main roles of metal ions in biological processes, and identify the chemical properties that are required to each particular function.
	CO 3	Describe the role of metal ions in enzymes involved in acid-base reactions. Describe the role of metal ions that are involved in electron-transfer reactions in biological systems.
	CO 4	Describe how oxygen is transported in different species and identify the metal centres involved in this task.
	CO 5	Describe the different metal-activation sites in enzymes that are involved in the activation of

	CO 6	oxygen.  Identify the main toxicological mechanisms of metals and the biological defences against the toxic effects
	CO 7	List some medical applications of inorganic compounds.
Natural product & Medicinal Chemistry	CO 1	After successfully completing this course, students will be able to:  Understand different Secondary metabolites and their importance.
	CO 2	Become familiar with many reagents used in organic synthesis.
	CO 3	Understand nature better by studying mechanisms in biological reactions.
	CO 4	Understand various laboratory methods to determine structure of unknown organic sample.
	CO 5	Develop interest in Biogenesis of naturally occurring essential compounds.
Heterocyclic & Physical Organic	CO 1	Upon successful completion of this course, the student should be able to:  Outline the basic quantum-mechanical approach to deriving molecular orbitals from atomic orbitals
	CO 2	Describe traits of bonding and anti-bonding molecular orbitals
	CO 3	Calculate bond orders based on molecular electron configurations

	CO 4	To acquire the knowledge and understanding of the basic experimental principles of heterocyclic chemistry.
	CO 5	To draw the structures and synthesize simple pharmaceutically active organic compounds having five and six membered heterocyclic compounds.
	CO 6	Know the use of heterocyclic compounds in our daily life.
	CO 7	Significance in our living system.