# **Postgraduate Department of Chemistry B.Sc. Chemistry**

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# **Programme Outcomes**

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PO1	Read, understand and interpret chemical information – verbal, mathematical and graphical.
PO2	Impart skills required to gather information from resources and use them.
PO3	To give need based education in chemistry of the highest quality at the undergraduate level.
PO4	Perform experiments and interpret the results of observation.
PO5	Provide an intellectually stimulating environment to develop skills and enthusiasm of students to the best of their potential.
PO6	Use Information Communication Technology to gather knowledge at will.
PO7	To bridge the gap between plus two and post graduate levels of Chemistry by providing a more complete and logical framework in almost all areas of basic Chemistry.

# **Program Specific Outcomes**

PSO1	Learn Chemistry through lectures, laboratory sessions, tutorials and interaction with eminent academicians.
PSO2	Develop laboratory skills for qualitative and quantitative analysis, organic synthesis, distillation, filtration, crystallization and chromatography.
PSO3	Safe working procedures, chemical toxicology, environmental concerns, handling of chemicals, glassware and range of instruments available at graduation level.
PSO4	Kindle the urge for higher studies, entrepreneurship and lifelong learning.

# **Programme: B.Sc**

## **Discipline: Chemistry**

#### **SEMESTER I**

#### Course Title: CH1CRT01 – GENERAL AND ANALYTICAL CHEMISTRY

CO	Course Outcome
1	Understand the methodology and historical evolution of chemistry
2	Recall the Long-form periodic table and its arrangement. Apply the Slater rule to
2	predict the effective nuclear charge for a given element.
3	Explains the theoretical basis of various analytical methods in chemistry
4	Understand the concept of Rf (retention factor) values and their significance in thin-
	layer chromatography. Apply the principles of column chromatography to set up and
	perform separations.
	Understand the significance of units, significant digits, and rounding in ensuring
5	accurate analytical results. Use scientific notation to represent numerical values in
	analytical calculations.

#### SEMESTER II

#### Course Title: CH2CRT02 – THEORETICAL AND INORGANIC CHEMISTRY

СО	Course Outcome
1	Analyzes the concept of quantum numbers
2	Identify and describe the types of chemical bonds, particularly ionic bonds, and covalent bonds. Predict molecular shapes and geometries for given molecules using hybridization and VSEPR theory.
3	Evaluate the significance of ionic and covalent bonding in the behavior of chemical compounds.
4	Analyses the periodic properties of s and p block elements
5	Explains the general characteristics of d and f block elements, Isolation of lanthanides from monazite sand, lanthanide contraction and its consequences

#### SEMESTER III

#### CH3CRT03- ORGANIC CHEMISTRY I

СО	Course Outcome
1	Recall the fundamentals of organic chemistry, including nomenclature, polarity, and factors affecting reaction mechanisms, such as electronic displacements, steric effects, and cleavage of bonds.
2	Understand the key concepts of stereochemistry, including optical and geometrical isomerism, conformational analysis, and the nomenclature of chiral compounds.
3	Gain proficiency in the preparation and reactions of aliphatic hydrocarbons, alkyl halides, alkenes, alkynes, and organometallic compounds, as well as their mechanisms and synthetic applications.
4	Acquire a deep understanding of aromaticity and its application to benzene and other aromatic compounds, including their preparation and electrophilic aromatic substitutions.
5	Develop competence in pericyclic reactions, including electrocyclic reactions, cycloadditions, and sigmatropic rearrangements.

#### SEMESTER IV

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## Course Title: CH4CRT04 –ORGANIC CHEMISTRY II

CO	Course Outcome
1	Understand the synthesis and reactions of alcohols, phenols, ethers, aldehydes, ketones, carboxylic acids, and their derivatives.
	ketones, carboxyne actus, and then derivatives
	Develop problem-solving skills to predict the outcomes of various organic reactions
2	and differentiate between different functional groups.
2	Apply fundamental principles of organic chemistry, such as electrophilic substitutions,
3	addition reactions, and oxidation-reduction reactions, in complex chemical scenarios.
4	Gain hands-on experience in laboratory techniques related to organic synthesis,
	compound identification, and chemical analysis.
5	Demonstrate a comprehensive understanding of the structural and chemical aspects of
	organic molecules, enabling them to solve real-world problems and pursue advanced
	studies in organic chemistry or related fields.
6	Cultivate a deep appreciation for the significance of organic chemistry in various
	scientific and industrial applications, from pharmaceuticals to materials science

#### **SEMESTER: V**

# Course Title: CH5CRT05 ENVIRONMENT, ECOLOGY, HUMAN RIGHTS

СО	Course Outcome
1	Apply the knowledge of environmental studies to analyze real-world situations related to natural resource management. Apply the principles of sustainable development to address environmental problems. Propose solutions and strategies for conserving land resources and preventing land degradation.
2	Apply knowledge of pollution sources and impacts to real-world scenarios and case studies.
3	Understand the relationship between population dynamics and environmental issues.
4	Understand the impact of chemicals on ecosystems, develop framework and risk assessment associated with environmental chemicals, especially persistent organic pollutants.
5	Understand the foundations of human rights, their international and national dimensions, and the role of international organizations, evaluate the challenges and opportunities in the field of human rights.

# Course Title: CH5CRT06 ORGANIC CHEMISTRY III

СО	Course Outcome
1	Apply knowledge effectively to synthesize and comprehend structures and reactions involving heterocycles.
2	Apply understanding of active methylene compounds and their reactions, equipping for practical problem-solving.
3	Achieve a comprehensive understanding of carbohydrate structures, properties, and interconversions, facilitating a grasp of complex carbohydrate-related concepts.
4	Apply knowledge of drug classification, structures, therapeutic uses, and mode of action, enhancing the ability to analyze and make informed decisions regarding drugs.
5	Gain analytical skills to assess theories of color, chemical constitution, and the synthesis and application of various dyes, fostering a deeper understanding of the subject.
6	Apply knowledge of polymerization reactions, types of polymers, and their applications, equipping for effectively addressing real-world challenges related to polymer science.

#### Course Title: CH5CRT07 PHYSICAL CHEMISTRY I

СО	Course Outcome
1	Compares the behaviour of real gases and ideal gases
2	Analyse liquid properties like surface tension and viscosity
3	Analyse diffraction pattern to determine cubic crystal systems
4	Understands different adsorption isotherms and electrical properties of colloids

# Course Title: CH5CRT08 PHYSICAL CHEMISTRY II

СО	Course Outcome
1	Apply the principles of quantum mechanics to simple systems such as the particle in a 1-D box. Analyze the postulates of quantum mechanics and their implications for understanding the behavior of particles.
2	To understand the basic principles and theory of microwave, IR and Raman spectroscopy.
3	Understand the principles underlying UV-Visible Spectroscopy, Nuclear Magnetic Resonance (NMR) spectroscopy and ESR Spectroscopy.
4	Apply the principles of NMR spectroscopy to predict chemical shifts and spin-spin coupling and Interpret NMR spectra of simple organic molecules

#### **OPEN COURSE**

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## Course Title: CH5OPT01 CHEMISTRY IN EVERYDAY LIFE

СО	Course Outcome
1	Recognizes different Food Additives and discusses food laws and standards.
2	Understand the classification of soaps and synthetic detergents
3	Apply the knowledge of soaps, synthetic detergents, cosmetics and drugs in everyday life.
4	Understand the classification of plastics and dyes.
5	Understand the role of chemistry in agriculture.
6	Discuss the applications of nanomaterials in everyday life.

#### SEMESTER VI

#### Course Title: CH6CRT09 - INORGANIC CHEMISTRY

СО	Course Outcome
1	Understands basic concepts in coordination chemistry
2	Understand bonding theories in coordination chemistry
3	Understand the definition of organometallic compounds and their significance in chemistry.
4	Understand the functions of transition metal ions in biological systems.
5	Understand the structure and bonding in interhalogen and pseudohalogen compounds.

#### CH6CRT10- ORGANIC CHEMISTRY – IV

СО	Course Outcome
1	Analyze the structures, classification, and applications of natural products, including terpenoids, alkaloids, and natural rubber, emphasizing their physiological and medicinal significance.
2	Evaluate the diverse roles and classifications of lipids, including oils, fats, waxes, and their impact on health, while also examining their chemical properties.
3	Examine the functions, structures, and importance of vitamins, steroids, and hormones in biological systems, with a focus on deficiency diseases and biological functions.
4	Understand the classification of amino acids, peptides, and proteins, as well as their synthesis, properties, and structural determinants, including primary, secondary, tertiary, and quaternary structures.
5	Assess the components, structures, and functions of nucleic acids, DNA, RNA, and their roles in genetic processes, replication, transcription, and translation.
6	Analyze the characteristics, mechanisms, and applications of enzymes in biological reactions
7	Explore the principles of supramolecular chemistry, encompassing molecular recognition, host-guest interactions, and their relevance to biopolymers and photochemical reactions, with an emphasis on non-covalent interactions and spectroscopy techniques.

### Course Title: CH6CRT11 PHYSICAL CHEMISTRY - III

СО	Course Outcome
1	Understand the fundamental principles of thermodynamics, including the laws, concepts of entropy and free energy, and their applications in chemical equilibria.
2	Analyze thermodynamic calculations and assess the spontaneity of processes,
3	Apply thermodynamic principles to practical problems in chemistry.
4	Applies phase rule to one component systems and two component solid-liquid equilibria
5	Understands different theories of kinetics and kinetics of different types of reactions

#### Course Title: CH6CRT12 PHYSICAL CHEMISTRY – IV

СО	Course Outcome
1	Analyze the factors leading to abnormal molecular masses and calculate van't Hoff
	molar mass determinations.
2	Understand the concept of electrical conductance and its applications.
3	Apply the Nernst equation to calculate electrode potentials and cell potentials. Conduct
	potentiometric titrations for acid-base and redox reactions.
4	Apply the laws of photochemistry to analyze photochemical reactions.Use the
	Jablonsky diagram to explain fluorescence, phosphorescence, and non-radiative
	processes in specific contexts.
5	Define elements of symmetry, understand the concept of combination of symmetry
	elements and identify Schoenflies symbols and point groups such as C2v, C3V, and
	D3h.

#### Course Title: CH6CBT02 - NANOCHEMISTRY AND NANOTECHNOLOGY

CO	Course Outcome
1	Classify nanomaterials based on dimensions and understand various synthetic approaches of nanomaterials.
2	Understand the important methods for the characterization of nanomaterials
3	Understand the electrical and optical properties of nanomaterials
4	Describe the applications of nanomaterials in fields of medicine, biotechnology and sensors.

#### COMPLIMENTARY

#### **SEMESTER 1**

#### Course Title: CH1CMT01 -BASIC THEORETICAL AND ANALYTICAL CHEMISTRY

СО	Course Outcome
1	Understand fundamental concepts in atomic structure, chemical bonding and chemical
I	equilibrium.
	Understand the fundamental principles and concepts of analytical chemistry, including
2	the various techniques and methods used for chemical analysis.
3	Demonstrate a fundamental understanding of chromatography, including its principles,
5	history, and significance in analytical chemistry.

#### **SEMESTER II**

#### Course Title: CH2CMT02 –BASIC ORGANIC CHEMISTRY

СО	Course Outcome
1	Understand fundamental concepts of reaction intermediates, types of organic reactions,
2	Discuss the mechanisms of organic reactions in organic chemistry.
3	Understand the principles underlying stereoisomerism and conformational isomerism.
4	Demonstrate a fundamental understanding of polymers, including their definition, classification and significance in various industries.

#### SEMESTER III

#### Course Title: CH3CMT03 –PHYSICAL CHEMISTRY I

CO	Course Outcome
1	Understand the characteristics and properties of solid state and symmetry of molecular structure
2	Understand the properties of liquid state, gaseous state and solutions
3	<u>U</u> nderstand the phenomenon of adsorption and discuss the classification and properties of colloidal state.
4	Understand the basic concepts of phase equilibria and discuss the phase diagram of one-component and two-component systems.

#### **PRACTICALS**

#### I. SEMESTER I AND II - CORE CHEMISTRY PRACTICALS

#### Course Title: CH2CRP01 - VOLUMETRIC ANALYSIS

CO	Course Outcome
1	Analyses the amount of substance in a sample

#### Course Title: CH2CMP01 - VOLUMETRIC ANALYSIS

CO	Course Outcome
1	Analyses the amount of substance in a sample

#### II. SEMESTER III & IV CHEMISTRY PRACTICALS Course Title: CH4CRP02 - QUALITATIVE ORGANIC ANALYSIS

СО	Course Outcome
1	Identify common functional groups and their characteristic chemical
1	reactions.

#### Course Title: CH4CMP02- PHYSICAL CHEMISTRY PRACTICALS

СО	Course Outcome
1	Apply fundamental principles, analyze data, and draw conclusions in various experimental contexts.

#### III. SEMESTER V & VI CHEMISTRY PRACTICALS

#### Course Title: CH6CRP03 - QUALITATIVE INORGANIC ANALYSIS

CO	Course Outcome
1	Analyses the presence of various ions present in a sample

# Course Title: CH6CRP04-ORGANIC PREPARATIONS AND LABORATORY TECHNIQUES

СО	Course Outcome
1	Master basic laboratory techniques like crystallization, distillation, solvent extraction.
2	Learn and apply various organic preparation techniques
3	Apply chromatographic techniques for TLC separation and identification, as well as column chromatography purification

#### Course Title: CH6CRP05- PHYSICAL CHEMISTRY PRACTICALS

CO	Course Outcome
1	To determine molecular weight and mass of the compound.
2	To find out the heat of neutralization
3	To determine the concentration of a given solution using viscosity measurements, conductometric and potentiometric titrations.

#### Course Title: CH6CRP06- GRAVIMETRIC ANALYSIS

СО	Course Outcome
1	To estimate the amount of substance in the whole of the solution.