DEPARTMENT OF CHEMISTRY

Program: BSc Chemistry

PLO, PSO and CLO

PROGRAM LEARNING OUTCOMES (PLOs)

The students would be able to have:

PLO 1: Knowledge and understanding of the fundamental concepts of Physical Chemistry, Organic Chemistry, Inorganic Chemistry, and allied subjects, along with their applications in research and industry.

PLO 2: Better learning through a theoretical and evidence-based approach to explaining the chemical synthesis, analysis, and characterization of materials.

PLO 3: Ability to demonstrate the basic principles of equipment and instruments.

PLO 4: Ability to work both independently and in groups on complex problems to apply scientific knowledge to develop entrepreneurial abilities.

PLO 5: Capacity to identify the research problem(s), plan, design, execute, and present the results and findings in a scientific manner.

PROGRAM SPECIFICE OBJECTIVE (PSOs)

Students, who choose B.Sc (H) Programme, develop the ability to think critically, logically and analytically and hence use chemistry knowledge in everyday life. Pursuing a degree in chemistry will introduce the students to a number of interesting and useful ideas in preparations for a number of chemistry careers in education, research and industry.

PSO1: To impart knowledge and understanding of the concepts of Organic Chemistry, Inorganic Chemistry, Physical Chemistry and related allied subjects.

PSO2: To equip students to handle apparatus and basic instrumentation used in chemistry laboratory to synthesize, isolate and characterize molecules and materials.

PSO3: To interpret, analyze the problems and connect the multiple concepts of various topics through numericals, assignments, quizzes and experiments/project.

PSO4: To organize seminars, workshops, group discussions on subjects related topics and societal problems.

PSO5: To develop and enhance the writing, reviewing and presentation skills of students.

Semester-I

Inorganic Chemistry-I (Atomic Structure & Chemical Bonding)	
Course Code: 23CYBS101	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Solve the conceptual questions about all the models of the atom, quantum numbers, electronic configuration, radial and angular distribution curves, shapes of s, p, and d orbital.
- Explain periodicity in atomic radii, ionic radii, ionization energy and electron affinity of elements.
- Replicate the plausible structures and geometries of molecules using VSEPR theory and MO diagrams (homo- & hetero-nuclear diatomic molecules).
- Describe the importance and applications of chemical bonding and their effect on physical & chemical properties.

PHYSICAL CHEMISTRY-I (Gaseous State and Kinetics)	
Course Code: 23CYBS102	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course ,students would be able to:

- Derive mathematical expressions for different properties of gas and understand their physical significance.
- Demonstrate the behavior of real gases.
- Determine the rate law and rate of reaction.
- Explain the mechanism of enzyme catalysis.

PRACTICAL INORGANIC CHEMISTRY-I	
Course Code: 23CYBS151	Continuous Evaluation: 60 Marks
Credits: 2	End Semester Practical Examination: 40 Marks
L T P : 0 0 4	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Illustrate the calibration, use of laboratory apparatus & preparation of standard solutions of different concentrations.
- Explain concept of basicity & acidity on the basis of volumetric analysis.
- Demonstrate external & internal indicators in redox titrimetry.

PHYSICAL CHEMISTRY PRACTICAL-I	
Course Code: 23CYBS152	Continuous Evaluation: 60 Marks
Credits: 2	End Semester Practical Examination: 40 Marks
L T P : 0 0 4	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Describe the reaction kinetics by different methods.
- Apply the concepts of chemical kinetics for studying the kinetics of various reactions.
- Set up model kinetic reaction and monitor them.

Semester II

ORGANIC CHEMISTRY-I (Basic Concepts in Organic Chemistry)	
Course Code: 24CYBS201	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Apply the fundamental concepts of different nature and behavior of organic compounds.
- Elucidate the conformational, configurational and geometrical isomerism of organic molecules.
- Identify the various organic reaction mechanisms with examples
- Separate different organic compounds using chromatographic techniques.

PHYSICAL CHEMISTRY-II (Liquid & Solid State and Equilibria)	
Course Code: 23CYBS202	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Describe the chemistry of Micelles and cleansing agents.
- Explain the crystal structure and calculate related properties of cubic systems.

- Demonstrate the effects of parameters like pressure, temperature and catalyst on chemical reactions.
- Replicate the preparation of buffer solutions to store enzymes or to carry out biological reactions.

ORGANIC CHEMISTRY PRACTICAL-I	
Course Code: 23CYBS251	Continuous Evaluation: 60 Marks
Credits: 2	End Semester Practical Examination: 40 Marks
L T P : 0 0 4	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Determine boiling and melting point of organic compounds.
- Analyze the effect of impurity in organic compounds and their purification by crystallization method.
- Apply the concepts of separation techniques such as chromatography to separate mixtures.
- Elucidate detecting various extra elements present in an organic compound.

PHYSICAL CHEMISTRY PRACTICAL-II	
Course Code: 23CYBS252	Continuous Evaluation: 60 Marks
Credits: 2	End Semester Practical Examination: 40 Marks
L T P : 0 0 4	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Explain the concept of surface tension and its measurement by different methods.
- Determine the coefficient of viscosity at different concentrations.
- Identify the types of crystal structures.

Semester-III

INORGANIC CHEMISTRY II (Chemistry of s & p block elements)	
Course Code: 23CYBS301	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks

L T P : 4 0 0	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Describe the fundamental principles of metallurgy and the importance of recovery of byproducts during extraction.
- Illustrate the periodicity in atomic and ionic radii, electronegativity, ionization energy, electron affinity of elements of the s-block elements.
- Explain the periodicity in atomic and ionic radii, electronegativity, ionization energy, electron affinity of elements of the p-block elements.
- Demonstrate the preparation, structure and properties of some inorganic compounds.
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ORGANIC CHEMISTRY II (Haloalkanes, Haloarenes and Oxygen Containing Functional Groups)	
Course Code: 23CYBS302	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Describe the preparation, properties and reactions of haloalkanes, haloarenes.
- Explain the chemical reactions of alcohols, phenols, ethers and epoxides. Will be able to carry out the functional group transformations.
- Correlate the concept of chemistry of carbonyl compounds and their application in organic transformations.
- Illustrate various reactions of carboxylic acids and its derivatives.

Introduction to Nanochemistry & Applications	
Course Code: 23CYBS303	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 2 0 2	**Course Type: Core Course (Minor)**

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Describe the size dependent properties of nano-materials/particles.
- Demonstrate different methods for synthesis of nanomaterials.
- Illustrate basic principles of techniques used for characterization of nanomaterials.

INORGANIC CHEMISTRY PRACTICAL-II	
Course Code: 23CYBS351	Continuous Evaluation: 60 Marks
Credits: 2	End Semester Practical Examination: 40 Marks
L T P : 0 0 4	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Apply the concept of redox titration by using iodine.
- Perform the complexometric titration.
- Demonstrate the preparations of different inorganic compounds.

ORGANIC CHEMISTRY PRACTICAL-II	
Course Code: 23CYBS352	Continuous Evaluation: 60 Marks
Credits: 2	End Semester Practical Examination: 40 Marks
L T P : 0 0 4	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Perform qualitative analysis of unknown organic compounds.
- Prepare different organic compounds by conventional method as well as green approach.

Semester-IV

Inorganic Chemistry-III (Chemistry of d & f Block Elements and Coordination Chemistry)	
Course Code: 23CYBS401	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Describe the basic concept of coordination compounds.
- Explain the properties of transition elements.
- Demonstrate the reaction mechanism of coordination compounds.
- Analyze the various properties of lanthanides and actinides.

PHYSICAL CHEMISTRY-III (Phase Transition and Chemical Thermodynamics)	
Course Code: 23CYBS402	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Identify the state of various component system using phase diagrams.
- Illustrate the effect of solute on the physical properties of solution.
- Implement the laws of thermodynamics to explain the behavior of a system.
- Demonstrate the second and third law of thermodynamics and related applications.

ANALYTICAL METHODS IN CHEMISTRY	
Course Code: 23CYBS403	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: Core Course (Minor)**

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Perform experiment with accuracy and precision and develop methods of analysis for different samples independently.

- Elucidate the basic principle and working of instrument like Flame Photometer, XRD & electron microscopy.
- Demonstrate separation of analytes by chromatography and test contaminated water samples.
- Determine the applications of separation techniques.

INORGANIC CHEMISTRY PRACTICAL- III	
Course Code: 23CYBS451	Continuous Evaluation: 60 Marks
Credits: 2	End Semester Practical Examination: 40 Marks
L T P : 0 0 4	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Determine the Execute gravimetric analysis of different transition metals.
- Demonstrate how to prepare coordination compounds.
- Explain the properties of transition metal complexes experimentally.

PHYSICAL CHEMISTRY PRACTICAL-III	
Course Code: 23CYBS452	Continuous Evaluation: 60 Marks
Credits: 2	End Semester Practical Examination: 40 Marks
L T P : 0 0 4	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Determine the critical solution temperature and composition.
- Estimate the equilibrium of reactions by distribution method.
- Demonstrate the pH metric titration of different acids and bases.

Semester-V

ORGANIC CHEMISTRY-III (Heterocyclic Chemistry, Nitrogen Containing Functional Groups and Polynuclear Hydrocarbons)	
Course Code: 23CYBS501	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Describe the preparation and properties of nitrogen containing molecules.
- Explain the polynuclear hydrocarbons, their structure elucidation and preparation with properties.
- Demonstrate the various types of five and six-membered heterocyclic molecules, their methods of preparation and properties such as aromaticity, basicity, etc.
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Inorganic Chemistry-IV (Organometallics & Bioinorganic Chemistry)	
Course Code: 23CYBS502	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: Core Course (Major)**

. COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Explain the structure, properties, preparation & bonding in organometallic compounds.
- Identify important structural features of important complexes and explain the concept of multicentre bonding in these compounds.
- Demonstrate the mechanism of Wilkinson's catalyst, Zeigler- Natta catalyst
- and synthetic gasoline manufacture by Fischer-Tropsch process.
- Explain the importance of various categories of metal ions in biological systems.

PHYSICAL CHEMISTRY IV (Electrochemistry, Surface Chemistry & Photochemistry)	
Course Code: 23CYBS503	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Demonstrate the conductance behavior of different electrolytes in solution.
- Compare the reduction potential and cell potential of ionic solutions.
- Describe the theories of photochemistry.
- Elucidate the absorption of light and subsequent photochemical reactions

Medicinal Chemistry	
Course Code: 23CYBS504	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: Core Corse (Minor)**

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Describe basics of medicinal chemistry, biophysical properties
- Analyze the biological activity, mode of action of therapeutic agents
- Illustrate drug metabolism, biophysical and chemical properties of enzymes, hormones, vitamins
- Explain the concept of rational drug design, SAR & QSAR

Biomolecules of Life	
Course Code: 23CYBS505	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: Core Course (Minor)**

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Explain how structure of carbohydrates determines their reactivity and biological functions.
- Illustrate the concepts of enzyme, proteins and their acting mechanism along with their biological importance.
- Demonstrate the lipid metabolic pathways, their inter-relationship and biological implications.
- Interpret the concept of genetic code, central dogma of life process.

ORGANIC CHEMISTRY PRACTICAL- III	
Course Code: 23CYBS551	Continuous Evaluation: 60 Marks
Credits: 2	End Semester Practical Examination: 40 Marks
L T P : 0 0 4	**Course Type: Core Course (Major)**

. COURSE LEARNING OUTCOMES (CLO)

- The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:
- Perform qualitative analysis of unknown organic compounds containing simple functional groups.
- Employ the practical experience about organic preparation and selective reduction.

PHYSICAL CHEMISTRY PRACTICAL-IV	
Course Code: 23CYBS552	Continuous Evaluation: 60 Marks
Credits: 2	End Semester Practical Examination: 40 Marks
L T P : 0 0 4	**Course Type: Core Course**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Determine the cell constant and conductivity by conduct meter.
- Describe the concept of buffer solution and working principle of pH meter,
- potentiometer and its applications.
- Describe the adsorption properties of some acids.

Semester-VI

Organic Chemistry-IV (Spectroscopy and its Applications)	
Course Code: 23CYBS601	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course students will be able to

• Describe the basic principle of spectroscopy, electromagnetic radiation, electronic transition and its applications.

• Identify the different functional group of various classes of compounds.

• Explain the basic principles of NMR and its applications for the characterization of compounds.

• Demonstrate the Mass Spectroscopy and determination of the mass of compounds.

PHYSICAL CHEMISTRY-V (Fundamentals of Molecular Spectroscopy)	
Course Code: 23CYBS602	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Describe the concepts behind molecular and rotational spectroscopy.
- Explain the concepts of vibrational spectroscopy in explaining the properties of molecules.
- Illustrate Raman spectroscopy and electronic spectra.
- Interpret the NMR and ESR spectra for the characterization of molecules/radicals.

Fundamentals of Quantum Chemistry	
Course Code: 23CYBS603	Continuous Evaluation: 60 Marks
Credits: 4	End Semester Examination: 40 Marks
L T P : 4 0 0	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Describe the postulates of quantum chemistry.
- Formulate and solve Schrodinger wave equation for simple chemical systems.
- Determine the probability distribution, and energy of hydrogen and hydrogen-like atoms.
- Elucidate the LCAO-MO treatment of homo-nuclear and heteronuclear diatomic molecules.

COMPUTER FOR CHEMISTS	
Course Code: 23CYBS605	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 2 0 2	**Course Type: Core Corse (Minor)**

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Describe basics applications of computer in chemistry.
- Explain the programming language
- Illustrate the applications of computers in chemistry.
- Execute computer programming in chemistry.

Practical Organic Chemistry-IV	
Course Code: 23CYBS651	Continuous Evaluation: 60 Marks
Credits: 2	End Semester Examination: 40 Marks
L T P : 0 0 4	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Demonstrate the purification process of liquid and solid organic compounds.
- Analyze different spectra obtained by FTIR, NMR & UV-Vis Spectroscopy for the identification of compounds/substances.

PRACTICAL PHYSICAL CHEMISTRY -V	
Course Code: 23CYBS652	Continuous Evaluation: 60 Marks
Credits: 2	End Semester Practical Examination: 40 Marks
L T P : 0 0 4	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES:

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Determine the concentration of unknown solution of $CuSO_4$/$KMnO_4$/$K_2Cr_2O_7$.
- Calculate λmax values and J values.
- Find out the dissociation constant of indicators.

Semester-VII

Reagents and Chemical Process	
Course Code: 23CYBS701	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 3 0 1	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Illucidate the reaction mechanism and their practical demonstration of the name and coupling reactions
- Explain the role of the reagents in organic synthesis and apply these reagents for the bulk chemical synthesis
- Describe the application of various reagents for selective synthesis organic products
- Demonstrate the techniques for chemical processes and will enhance skills for human resource development for the chemical industry.

Polymers and Colloidal Chemistry	
Course Code: 23CYBS702	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 3 0 1	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Explain the types of polymers, kinetics of polymerization and polymer properties.
- Understand and apply the concepts of properties of polymer solutions and their thermodynamics.
- evaluate kinetic chain length of polymers based on their mechanism • differentiate between polymers and copolymers
- Comprehend the basic concepts of surface chemistry specifically in relation to colloids
- Understand and apply the important characterization of colloidal particles

GREEN CHEMISTRY	
Course Code: 23CYBS703	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 4 0 0	**Course Type: Core Course (Major)**

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Describe the twelve principles of green chemistry and will build the basic understanding of toxicity, hazard and risk of chemical substances.
- Perform stoichiometric calculations and relate them to green chemistry metrics. Understand benefits of use of catalyst and bio catalyst, use of renewable feed stock which helps in energy efficiency and protection of the environment, renewable energy sources.
- Design safer chemical, products and processes that are less toxic, than current alternatives.

- Demonstrate that chemistry can be used to solve rather than cause environmental problems.