BHATTER COLLEGE, DANTAN
DEPARTMENT OF CHEMISTRY

COURSE OUTCOME (CO):

1. **ORGANIC CHEMISTRY-I (Basics of Organic Chemistry: Bonding and Physical Properties, General Treatment of Reaction Mechanism I, Stereochemistry I)**

CO1 – To get knowledge about all fundamental aspects of all the elements of chemistry.

CO2 - To acquainted with bonding, physical properties, general reaction mechanism, stereochemistry organic molecules.

CO3 – To know the process of separation a mixture of solid organic compounds and identify an organic compound by systematic analysis.

2. **PHYSICAL CHEMISTRY-I (Kinetic Theory and Gaseous state, Chemical Thermodynamics, Chemical kinetics)**

CO1 - To demonstrate, solve and an understanding of primary concepts of gas, Thermodynamics and kinetics in the discipline of chemistry.

CO2 - To understand the applications of Thermodynamics and Kinetics in real world Problems.

CO3 - To acquire knowledge to set up Thermodynamic and kinetics related experiments in laboratory.

3. **INORGANIC CHEMISTRY-I (Extra nuclear Structure of atom, Chemical Periodicity, Acid-Base Reactions, Redox Reactions and precipitation reactions)**

CO1 - To understand quantum mechanical picture of the extra-nuclear structure of atom, different aspects of periodic tab.

CO2 – To systematically acquainted with the physical and chemical properties of all the elements available in nature with the help of periodic table.

CO3 - To impart knowledge of acid-base reactions and their theories, redox reactions, their diagrammatic summaries some redox titrations, and precipitation reactions with their principles.

CO4 - To make students get skilled at carry out acid-base and redox titrations.

4. **ORGANIC CHEMISTRY-II (Stereochemistry-II, General Treatment of Reaction Mechanism II, Substitution and Elimination Reactions)**

CO1 - To acquire knowledge of stereoisomerism of different three dimensional organic molecules and compounds.

CO2 – To understand acidity and basicity of organic acids and bases, different substitution and elimination reactions of organic compound thermodynamics aspects of different organic reactions, and how to carry out the selected organic reactions.

CO3 – To know in detail the basics of the substitution and elimination Reactions in organic chemistry and thereby to study extensively.

5. **Physical Chemistry-II (Transport processes, Applications of Thermodynamics – I, Foundation of Quantum Mechanics)**

CO1 - To understand different aspects of transport processes of fluids, conductance and transport number electrolyte solutions, applications of the principles of chemical thermodynamics to open systems, chemical equilibrium and ideal solutions.

CO2 - To know basic postulates of quantum mechanics and how to solve the simple quantum mechanical models/problems, and how to carry out different physical experiments.

CO3 – The Quantum mechanics allows the calculation of probabilities for how physical systems can behave. Quantum mechanics is typically applied to microscopic systems: molecules, atoms and sub-atomic particles.

6. **Inorganic Chemistry-II (Chemical Bonding-I, Chemical Bonding-II, Radioactivity)**

CO1 - To understand ionic bonding, lattice energy with their associated rules and equations, the concepts of MO, LCAO , VSPER and band theories, and different aspects of radioactivity, and how to carry out selected iodo/iodimetric titrations and estimate metal content in some selective samples.

CO2 – It helps to differentiate between polar and nonpolar covalent bonding and describe the significance of different properties (e.d. electronegativity, ionic character) in bonding.

CO3 – A detail knowledge in chemical bonding is essential for study any type of molecule or reactions.

7. **Organic Chemistry-III (Chemistry of alkenes and alkynes, Aromatic Substitution, Carbonyl and Related Compounds, Organometallics)**

CO1 - To have knowledge about the chemistry of alkenes and alkynes, different aromatic substitution reactions, reactions a mechanisms associated with different carbonyl and related compounds and organometallics.
CO2 – To know the qualitative analysis of single solid organic compounds.
CO3 – Organometallics has diverse applications in modern life, it is a demanding research field also, and thereby the course gives students a good exposure to the research.

8. **PHYSICAL CHEMISTRY-III (Application of Thermodynamics – II, Electrical Properties of molecules, Quantum Chemistry)**

CO1 - To understand the applications of thermodynamics to different solutions properties, the concept of phase rule and its applications to systems of different components.
CO2 - To gain knowledge of properties of electronically solutions, electrolysis, applications of EMF measurements and quantum mechanics of rigid rotator, H-atom and many electron atoms (He, Li), the basics of Hartree-Fock method, SCF and configuration interaction.
CO3 – It help us to predict how the quantum mechanics have been verified experimentally to an extremely high degree of accuracy

9. **INORGANIC CHEMISTRY-III (General Principles of Metallurgy, Chemistry of s and p Block Elements, Noble Gases, Inorganic Polymers, Coordination Chemistry-I)**

CO1 - To acquire knowledge on general principles of metallurgy, chemistry of s, p block elements, noble gases and inorganic polymers, and Werner's theory, IUPAC nomenclature and isomerism of coordination compounds.
CO2 - To learn procedure of complexometric titration of selected ions and prepare inorganic compounds.
CO3 – As Inorganic Polymers and Coordination Chemistry-I are two emerging research field in chemistry, to study detail on these is essential.

10. **ORGANIC CHEMISTRY-IV (Nitrogen compounds, Rearrangements reactions, The Logic of Organic Synthesis, Organic Spectroscopy)**

CO1 - To know chemistry and synthesis of different aliphatic and aromatic nitrogen compounds, different types of organic rearrangement reactions, various methods and reagents employed in organic synthesis.

CO2 - To know the procedure of spectroscopic methods (UV, IR and NMR) and characterisation of organic compounds.

CO3 – Spectroscopic study on these nitrogenous compounds are very important for future study.

11. **Inorganic Chemistry – IV (Coordination Chemistry-II, Chemistry of d- and f- block elements, Transition Elements, Lanthanoids and Actinoids)**

CO1 - To understand bonding, magnetic and spectral properties of coordination compounds, chemistry of d- and f- block elements, and how to carry out gravimetry estimation of ions.

CO2 – As the compounds of Lanthanoids and Actinoids and their properties are an emerging field in various perspective in modern era, a detail study on Lanthanoids and Actinoids is primary object of this course.

12. **Organic Chemistry – V (Carbocycles and Heterocycles, Cyclic Stereochemistry, Pericyclic reactions, Carbohydrates, Bio-molecules)**

CO1 - To understand structures, functions and preparative methods of carbohydrates, lipids.

CO2 – To know the synthetic methods of different carbocycles and heterocycles, cyclic stereochemistry.

CO3 - To get insight into pericyclic reactions, chemistry of carbohydrates and bio-molecules.

CO4 – To learn procedure to carry out chromatographic separations of a mixture of selected organic compounds and selected organic compounds spectroscopically by IR & 1H NMR methods.

13. **Inorganic Chemistry-V (Bioinorganic Chemistry, Organometallic Chemistry, Catalysis by Organometallic Compounds, Catalysis by Organometallic Compounds)**

CO1 - To get insight into bioinorganic chemistry, organo-metalic chemistry and their application in our daily life.

CO2 – To know the kinetics and mechanism of reactions of inorganic complexes/reactions and the role of catalysis.

CO3 – To learn procedures to carry out qualitative semi-micro analysis of mixtures containing four radicals.

14. Physical Chemistry-V (Molecular Spectroscopy, Photochemistry, Surface phenomenon)

CO1 - To study the origin, theory and important applications of Microwave, IR, Raman, UV, NMR, ES spectroscopy.

CO2 - To get insight into photochemistry, its laws and applications.

CO3 - To know phenomena related surface such as surface tension, adsorption and colloids.

CO4 - To become acquainted with the selected physical chemist experiments.

SKILL ENHANCEMENT COURSE (ANY TWO)

1. Analytical Clinical Biochemistry (Basic understanding of the structures, properties and functions of carbohydrates, lipids and proteins, Biochemistry of disease: A diagnostic approach by blood/ urine analysis)

CO1 - Familiarize learners with the specific characteristics of a laboratory of clinical biochemistry.

CO2 - Understanding the pathophysiology and molecular basis of the most prevalent diseases.

CO3 – To know the analytical methods commonly used in the clinical laboratory.

2. Pharmaceutical Chemistry (Drugs & Pharmaceuticals, Fermentation)

CO1 – impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs.

CO2 - To understand the synthesis and properties of some representative drugs.

CO3 - how to prepare some selected compound through fermentation, the chemistry of some antibiotics and vitamins.

CO4 - To acquainted with the preparative methods and analyse of some drugs.

3. BASIC ANALYTICAL CHEMISTRY (Introduction, Analysis of soil, Analysis of water, Analysis of food products, Chromatography, Ion-exchange, Analysis of cosmetics)

CO1 - The course gives an introduction to inorganic and organic analytical chemistry, including basic analytical methods.

CO2 - The course gives the students experience with quantitative methods of working in laboratory.

CO3 – To know the analysis methods of soil, water, sampling, chemical analysis as a measure of soil fertility and water pollution.

CO4 – To Know the Importance of water Resources and study about water harvesting concept and methods.

4. CHEMISTRY OF COSMETICS & PERFUMES (Preparation, properties of different cosmetics and perfumes)

CO1 – The students will be familiar with specific actives used in cosmetic formulations, their technical aspects and evaluation methods.

CO2 - Students will be familiar with chemistry of actives used in cosmetic formulations. They will know common natural raw materials, especially the basic functional group involved, their physical and chemical properties and their applications.

CO3 - To gather knowledge of preparation and uses of some cosmetics and perfumes.

5. PESTICIDE CHEMISTRY (Preparation, properties, uses, abuses and alternative uses of pesticides)

CO1 – To know the classification, use, chemical nature, formulation, toxicity and action etc. of different pesticides.

CO2 – To have knowledge of various pesticides, insecticides, fungicides and herbicides.

CO3 - To understand Pesticide pollution: Pesticides and their kinds, possible sources and pathways of pesticide Pollution.

CO4 – To study the impact of pesticides on living organisms.

CO5 – To understand the application of Bio-pesticides; know about sources, methods and production of bio-fuels.

6. FUEL CHEMISTRY (Uses of renewable and non-renewable energy sources)

CO1 - Impart the knowledge of fossil fuels and derived fuels with its properties and applications.

CO2 - To bring adaptability to new developments in renewable and non-renewable energy sources and their future prospects.

CO3 – To know about sources, methods and production of bio-fuel.

CO4 - To have knowledge about the manufacturing of different fuels, some important industrial products and chemistry of oils and fats.

DISCIPLINE SPECIFIC ELECTIVE (ANY FOUR)

1. **Advanced Physical Chemistry (Crystal Structure, Statistical Thermodynamics, Specific heat of solid, Adiabatic demagnetization, Polymers)**

CO1 – As the crystal structure and symmetry play a critical role in determining many physical properties, such as cleavage, electronic band structure, and optical transparency of different solids, the course helps to understand the unit cells, lattice parameters, crystallography of different types of solids.

CO2 - To understand the link between thermodynamics to the micro description used in classical Statistical Mechanics.

CO3 – Students will able to account for the physical interpretation of partition functions and be able to calculate thermodynamic properties of model systems with using Boltzmann -, Fermi-Dirac and Bose-Einstein statistics.

CO4 – To study the properties of different types of polymers, their properties and synthetic methods.

2. Analytical Methods in Chemistry (Qualitative and quantitative aspects of analysis, Optical methods of analysis, Thermal methods of analysis, Electroanalytical methods, Separation techniques)

CO1 – To explain the theoretical principles and important applications of classical **analytical** methods within titration (acid/base titration, complexometric titration, redox titration, precipitation titration), and various techniques within gravimetric and coulometric methods.

CO2 - To understand qualitative and quantitative aspects of analysis, and how to employ different methods suc as Optical, Thermal , Electro-analytical and separation techniques for chemical analysis.

CO3 – To get skilled with the procedures of how to carry out chromatography separation of selected mixtures, separate selected mixtures by solvent extraction analyse and estimate COD and BOD of water.

3. **Instrumental Methods of Chemical Analysis (Introduction to spectroscopic methods of analysis, Molecular spectroscopy (UV, IR, near IR), Separation techniques**

(Chromatography), Elemental analysis (Mass spectroscopy), NMR spectroscopy, Electroanalytical Methods (Potentiometry & Voltammetry), Radiochemical Methods (Elementary idea), X-ray analysis and electron spectroscopy (surface analysis)

CO1 - To study UV, IR and NMR spectroscopy and to discuss corresponding problems.

CO2 – To determine molecular structure by using UV, IR and NMR and the students will develop basic skills in the techniques of TLC, boiling point determination; functional groups tests, UV-VIS spectral characterizations.

CO3 – To understand the combined application of spectroscopic techniques (UV, IR, NMR, MS) in elucidation of structure and study of reactions of organic compounds and which factors affecting UV-absorption spectra, Interpret IR spectra.

4. **Green Chemistry (Principles of Green Chemistry and Designing a Chemical synthesis, Future Trends in Green Chemistry:)**

CO1 – To find out the green route for chemical reaction for sustainable development.

CO2 – To understand the current status of chemistry and the environment.

CO3 – To know the definition of green chemistry and its applications of green chemistry for sustainable development.

CO4 – To know the Principles, methodologies and techniques in Green Chemistry and to be familiarise with the future trends in green chemistry.

5. **Inorganic Materials of Industrial Importance (Silicate Industries, Fertilizers, Surface Coatings, Batteries, Alloys, Catalysis, Chemical explosives)**

CO1 – It defines the importance of chemistry in industry and explain the production of inorganic and organic industrial products such as Silicate Industries, Fertilizers, Surface Coatings, Batteries, Alloys, Catalysis, Chemical explosives.

CO2 - To learn the synthetic methods, characterization and applications of few selected inorganic materials.

CO3 - To get acquainted with the manufacturing processes of those materials.

CO4 - To know manufacturing processes and applications of different types of batteries, their function and types of alloys.

6. Polymer Chemistry (Introduction and history of polymeric materials, Functionality and its importance, Kinetics of Polymerization, Crystallization and crystallinity, Nature and structure of polymers, Determination of molecular weight of polymers, Tg, Polymer Solution)

CO1 – Ability to understand the general techniques of polymerizations, uses and applications.

CO2 - Ability to understand the kinetics and properties of various polymerization techniques

CO3 - To get insight into different types of polymers and their properties, polymerizations and their kinetics.

CO4 - To know the synthesis methods of some selected polymers, characterizing polymers and their analysing techniques.

BHATTER COLLEGE, DANTAN
DEPARTMENT OF CHEMISTRY

PROGRAMME OUTCOMES (PO)

PO-1. After completion of chemistry program students will able to get exposed to strong theoretical and practical background in fundamental concepts, demonstrate, solve and an understanding of major concepts in all disciplines of chemistry.

PO-2. Students can solve the problems and also think methodically, independently and draw a logical conclusion.

PO-3. Employ critical thinking and the scientific knowledge to design, carry out, record and analyse the results of chemical reactions.

PO-4. To create an awareness of the impact of chemistry on the environment, society, and development outside the scientific community.

PO-5. Find out the green route for chemical reaction for sustainable development.

PO-6. to demonstrate professional and ethical attitude with enormous responsibility to serve the society. The course further helps to inculcate the scientific temperament in the students and outside the scientific community.

PO-7. Use modern techniques, decent equipments and Chemistry softwares which are essential in modern research in various fields of chemistry.

BHATTER COLLEGE, DANTAN
DEPARTMENT OF CHEMISTRY

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1. Have sound knowledge about the fundamentals and applications of chemical and scientific theories.

PSO2. Every branch of Science and Technology is related to Chemistry.

PSO3. Easily assess the properties of all elements discovered.

PSO4. Apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries.

PSO5. Will become familiar with the different branches of chemistry like analytical, organic, inorganic, physical, environmental, polymer and biochemistry

PSO6. Helps in understanding the causes of environmental pollution and can open up new methods for environmental pollution control.

PSO7. Develops analytical skills and problem solving skills requiring application of chemical principles.

PSO8. Acquires the ability to synthesise, separate and characterize compounds using laboratory and instrumentation techniques.