

Tarakeswar Degree College

Department of Chemistry

B.Sc. (Hons.) Chemistry

Programme Outcomes and Course Outcomes of B.Sc. (Hons.) Chemistry (CBCS)

Programme Outcome:

PO 01: Learning Assimilation: To utilize current chemical research methods and context awareness to solve difficulties

PO 02: Decisive Thinking: To cultivate a strong foundation in the principles and applications of modern scientific and chemical theories, including those in analytical, inorganic, organic, and physical chemistry.

PO 03: Chemistry Knowledge: To understand the significance of the various elements in the periodic table, coordination chemistry, molecule structure, compound attributes, and structural analysis of complexes using theories and tools.

PO 04: Knowledge of Elementary Chemistry: To be familiar with the history of organic reaction mechanisms, intricate chemical structures, instrumental methods of chemical analysis, and molecular rearrangements and separation methods.

PO 05: Analytical Ability: To possess the capacity to plan, execute, accurately record, and assess the outcomes of scientific experiments.

PO 06: Professional development: To be able to interpret and apply data from instrumental chemical studies, as well as comprehend theoretical principles of instruments that are frequently employed in most branches of chemistry following completion of graduation in Chemistry

PO 07: Environment and Sustainability: Find out how to make chemical reactions more environmentally friendly for sustainable development.

PO 08: Usage of Sophisticated Tools: Learn to use contemporary chemical apparatus, models, Chem-draw, ISIS draw, C-Program, diagrams, and devices etc.

PO 09: Scientific Ethics: To recognize the ecological, historical, philosophical, and ethical implications of the concerns and problems that face chemists.

Programme Specific Outcome:

PSO-1: To cultivate a firm foundation in the fundamentals and application of current chemical and scientific theories including those in Analytical, Inorganic, Organic, and Physical Chemistries.

PSO-2 To explain nomenclature, stereochemistry, structures, reactivity, and mechanism of the chemical reactions.

PSO-3: To Use modern chemical tools, Models, Chem-draw, Charts, and Equipment.

PSO-4: To employ critical thinking and scientific knowledge to design, carry out, record, and analyze the results of chemical reactions.

Ist Semester**CC-1 -Theory**

CO-1	To impart knowledge of bonding through valence bonding theory, molecular orbital theory
CO-2	To understand the electronic displacement of the c-c bond of organic molecules
CO-3	To understand the physical properties of organic compounds
CO-3	To know the concept, types, reaction mechanism, and examples of elimination, free-radical and nucleophilic substitution reactions.
CO-4	To learn stereochemistry of chiral compounds arises due to the presence of stereo-axis; the concept of prostereoisomerism and the concept of conformations of stereoisomers

CC-1(Practical)

CO-1	To impart knowledge on how to identify unique elements in molecules.
CO-2	To disseminate information on the systematic chemical assays used to detect distinct functional groups.
CO-3	To learn qualitative examination of an unidentified single organic sample.
CO-4	To apply those methods in research in future studies, in industry and pharmaceutical worlds.

CC-2 (Theory)

CO-1	To understand the basic concept of the kinetic theory of gases and know how to solve numerical problems related to that topic.
CO-2	To explain the comparative behaviour of real and ideal gas.

CO-3	To acquire basic knowledge regarding thermodynamics, the 1 st law, and its applications i.e. thermochemistry, the concept of heat capacity C_v and C_p , and their relation.
CO-4	To learn the interrelation of heat with a chemical reaction or physical change of state.
CO-5	To understand the concept of the rate of change associated with chemical change, recognize the rate of change and how it can be measured.

CC-2 (Practical)

CO-1	To understand and prepare buffers of different pH values.
CO-2	To determine the rate constant of hydrolysis reaction
CO-3	To learn to collect and analyze chemical kinetics data.
CO-4	To learn to recognize the end point of titration and utilize the data for further chemical analysis.

2nd Semester:

CC-3-Theory

CO- 1	To impart a thorough knowledge of the importance of quantum mechanics in the atomic model through the exposure of wave mechanics in the light of Photoelectric effect, Bohr's Model, De-Broglie's equation, Heisenberg's uncertainty principle as well as Schrodinger equation.
CO- 2	To understand the general periodic properties of elements according to the modern periodic table and get to know the periodic trend of ionization potential, electron affinity, electronegativity, bond radius, penetration and screening effects of the elements
CO-3	To learn the general acid-base character of chemical compounds in the light of the established acid base theories and will understand various chemical reactions from the acid-base backdrop.
CO- 4	To develop a clear understanding of electron transfer reactions that lead to redox reactions as well as the potential required for such types of reactions.
CO- 5	To understand the solubility of ions and the criteria of their precipitation.

CC-3-Practical

CO-1	To analyze the quantitative presence of metal ions by titrimetric method
CO-2	To estimate the quantitative amount of metal ions and basic ions from their mixture.

CC-4-theory

CO-1	To learn and apply various concepts such as stereochemistry
CO-2	To Recognize a stereogenic (chiral) center in a molecular structure and understand various representations of three-dimensional molecules
CO-3	To recognize the Chirality in organic chemistry, stereogenic elements and stereoisomerism, polarimetry, optical activity, stereogenic Elements Stereoisomerism, R,S conformer (L, D of carbohydrates)
CO-4	To be able to predict, identify and distinguish between enantiomers and diastereomers.
CO-4	To gain knowledge on organic reaction mechanism that includes nucleophilic, electrophilic, elimination, and free radical reactions
CO-5	To understand the relative stability of reactive intermediates which include carbocations, carbanions, and free radicals

CC-4 Practical

CO-1	To develop experimental skills like collection, analysis of data, the ability to draw conclusions
CO-2	To impart the knowledge of design syntheses towards specific targets using appropriate reactants and appropriate reaction sequencing.
CO-3	To learn basic techniques for the isolation and purification of synthesized organic molecules
CO-4	To develop experimental skill to determine melting point of organic compound

3rd Semester:

CC-5:

CO-1	To understand the fundamental aspects of three fundamental transport processes, momentum, heat, and mass, including conservation and constitutive equations
CO-2	To appraise the concept of flux and the relation between flux and force will be introduced.
CO-3	To understand ion transport properties in an electrolyte solution
CO-4	To develop the concept of chemical potential and explore how to use a substance's chemical potential to describe the physical properties of mixtures.
CO-5	To understand how the thermodynamic formulation of equilibrium enables one to establish the quantitative effects of changes in the conditions like temperature and pressures
CO-6	To develop an understanding of how classical concepts of 'particle' and 'wave' blend together giving rise to a new set of rules that lead to the formulation of quantum mechanics
CO-7	To learn Schrödinger equations with solutions in simple potentials, including particle in one-dimensional boxes, harmonic oscillators, etc.

CC-5 (Practical)

CO-1	To learn to determine the surface tension and viscosity of liquids.
CO2	To understand the partition coefficient and its determination from an immiscible mixture
CO3	To apply the knowledge of conductometry to study the progress of the reaction
CO-4	To verify dilution law and determine the acidity of a weak acid.

CC-6 (Theory)

CO-1	To understand the common themes running through ionic, covalent, and metallic descriptions of chemical bonding
CO2	To understand how the concept of electronegativity and its variation over the periodic table can be used to rationalize the nature of the bonding in substances
CO3	To appreciate how chemical substances can be described (and classified) in terms of structure and bond type
CO-4	To Distinguish between intramolecular forces and intermolecular forces and discuss their relative strengths
CO-5	To learn radiochemical principles are seen in conjunction with chemical concepts and other fields where radiochemical principles can be utilized.

CC-6 (Practical)

CO-1	To understand the concept that in acid solution practically all oxidizing agents will oxidize iodide ion to iodine quantitatively.
CO2	To understand the reactions involving a change of oxidation number or transfer of electrons among the reacting substances.
CO3	To identify the end point of the iodo/iodimetric titration by using starch as an indicator
CO-4	To apply knowledge of iodo/iodimetric titration to estimate metal like Cu, Cr, Mn etc. in their alloy.

CC-7 (Theory)

CO-1	To understand mechanistic pathways of reactions associated with the addition reactions of alkanes and alkenes with hydrogen, halogens, and water.
CO-2	To impart knowledge on mechanistic aspects and applications of aromatic electrophilic substitution reactions.
CO-3	To impart knowledge on synthesis and reactivity of carbonyl compounds with special thrust on nucleophilic addition reactions' mechanistic and application aspects.
CO-4	To impart knowledge on synthesis and reactivity of carbonyl compounds with special thrust on nucleophilic addition reactions' mechanistic and application aspects.
CO-5	To impart knowledge on synthesis, reactivity, and synthetic applications of carboxylic acids. This unit also aims to teach the fundamental mechanistic aspects of ester hydrolysis.
CO-6	To Explain and predict the chemical behavior and reactivity of organometallic compounds

CO-7 (Practical)

CO-1	To understand the method of determination of the functional group of an unknown compound by using classification tests.
CO-2	To impart knowledge on the preparation of a synthetic derivative.

SEC-1 (IT skill in Chemistry)

CO-1	To understand basic tools of computer science in relation to chemistry
CO-2	To recognize methods of collection, storage, and analysis of data

SEC-1 (Basic Analytical Chemistry)

CO-1	To develop an understanding of the range and uses of analytical methods in chemistry
CO-2	To develop an understanding of the broad role of the chemist in measurement and problem-solving for analytical tasks.

Semester-4**CC-8**

CO-1	To study the process of calculation changes in vapor pressure, melting point, and boiling point of solutions
CO-2	To explain the basic definitions and terms in a phase diagram
CO-3	To explain the application of thermodynamic laws to understand the transportation of ions.
CO-4	To discuss electrode potentials and cell thermodynamics.
CO-5	To learn to calculate the angular momentum of a rigid body rotating about a fixed axis.

CO-6	To learn to apply the technique of separation of variables to solve problems in more than one dimension and to understand the role of degeneracy in the occurrence of electron shell structure in atoms.
-------------	--

CC-8 (Practical)

CO-1	To understand basic tools of computer science in relation to chemistry
CO-2	To recognize methods of collection, storage, and analysis of data

CC-9

CO-1	To impart a basic understanding of the isomerism in coordination compounds and the classification of ligands.
CO-2	Understand the geometrical and optical isomerism in square planar and octahedral complexes.
CO-3	To develop the knowledge of the different theories to explain the bonding in coordination compounds.
CO-4	To Learn VBT, CFT and MOT of co-ordination complexes
CO-5	Learn spectral transitions of coordination compounds
CO-6	get a basic understanding in the general characteristics of d and f block elements including their ionization potential, redox properties, spectral and magnetic properties. They also will get an idea about the basic coordination chemistry of Lanthanides and Actinides.

CC-10

CO-1	To impart the knowledge on structure, synthesis, reactivity and synthetic applications of organo-nitrogen compounds and organometallic compounds.
CO-2	To impart the knowledge on molecular rearrangement; thorough mechanistic analysis of these rearrangements and their application, substrate scope and limitations in organic synthesis.
CO-3	To impart the knowledge on synthesis, reactivity and synthetic applications of carbocycles and basic heterocycles.
CO-4	To impart the formation, structure, stability and reactivity of various reactive intermediates.

SEC-2

CO-1	Impart the knowledge on basic classes of drugs, their synthesis and mode of action.
CO-2	Impart the knowledge about the sources of impurities and methods to determine the impurities in inorganic/organic drugs and pharmaceuticals
CO-3	Understand various tools and techniques available for the analysis of drugs.

5th Semester**CC-11 Theory**

CO-1	impart a basic understanding on the isomerism in coordination compounds along with the classification of ligands.
CO-2	Understand the geometrical and optical isomerism in square planar and octahedral complexes.
CO-3	To develop the knowledge of the different theories to explain the bonding in coordination compounds.
CO-4	Learn VBT, CFT and MOT of co-ordination complexes
CO-5	Learn spectral transitions of coordination compounds
CO-6	get a basic understanding in the general characteristics of d and f block elements including their ionization potential, redox properties, spectral and magnetic properties. They also will get an idea about the basic coordination chemistry of Lanthanides and Actinides.

CC-11-Prac

CO-1	Determine the amount of copper by iodometric process
CO-2	Determine the amount of Zinc by iodometric method
CO-3	Estimate the concentration of iron in a solution by iodometry
CO-4	Evaluate the temporary and permanent hardness of water
CO-5	Analyse the ores and minerals to estimate the amount of different elements present

CC-12 Theo

CO-1	To impart the knowledge on structure, synthesis, reactivity and synthetic applications of organo-nitrogen compounds and organometallic compounds.
CO-2	To impart the knowledge on molecular rearrangement; thorough mechanistic analysis of these rearrangements and their application, substrate scope and limitations in organic synthesis.
CO-3	To impart the knowledge on synthesis, reactivity and synthetic applications of carbocycles and basic heterocycles.
CO-4	To impart the formation, structure, stability and reactivity of various reactive intermediates.

CC-12 Prac

CO-1	To impart the knowledge on Chromatographic separation of mixtures of organic compounds.
CO-2	To impart the knowledge on structure elucidation using ^1H NMR spectra of the synthesized compounds by their relative δ values and splitting pattern.
CO-3	To impart the knowledge on structure elucidation of synthesized compounds using FT-IR spectra.
CO-4	To apply those methods in research in future studies, in industry and pharmaceutical worlds.

DSE-1

CO-1	Study the quantum mechanics to explain phenomenon this cannot be explained using classical mechanics.
CO-2	Interpret the wavefunctions in by calculating probability in a region, expectation values and matrix elements of Hermitian operators corresponding to physical observables.
CO-3	Learn the explanation of phase diagram and its application.
CO-4	Apprise phase equilibria can be described mathematically and which phenomena may occur if different phases (vapor, liquid, solid) coexist in equilibrium.
CO-5	Understand basic tools of computer science in relation with chemistry
CO-6	Recognize methods of collection, storage and analysis of data
CO-7	Acquire basic knowledge how atoms and molecules absorb and emit light and how this process can be affected by magnetic and electric fields

DSE-2

CO-1	To interpret the sources of random errors and effects of random errors on analytical results.
-------------	---

CO-2	To define the different gravimetric methods.
CO-3	To learn to interpret aqueous solution chemistry
CO-4	To solve the problems related to ion separation by control of the concentration of the precipitating reagents.
CO-5	Understand basic tools of computer science in relation with chemistry

DSE-2 Prac

CO-1	To learn to use advanced analytical instruments
CO-2	To understand the underlying chemical and physical of instrumental methods of analysis, including electronic and vibrational spectroscopy, reaction kinetics, chemical separation methods, and mass spectrometry
CO-3	To learn the skills of doing micro level analysis

Semester VI:

CC-13 (Theo)

CO- 1	To apply the basic principles in inorganic and general chemistry to interdisciplinary topics in the field of bioinorganic chemistry.
CO- 2	To describe the main roles of metal ions in biological processes, and identify the chemical properties that are required to each particular function
CO- 3	To describe the different metal-activation sites in enzymes that are involved in the activation of oxygen
CO- 4	To define the nomenclature, electronic structure, properties of transition-metal compounds.
CO- 5	To identify the basic fundamental reactions in organometallic chemistry

CC-13 (Prac)

CO- 1	To demonstrate basic laboratory technique of titration and analysis
-------	---

CO- 2	To develop the intellectual and psychomotor skills of the students by imparting knowledge in qualitative analysis of Inorganic compounds
CO- 3	To examine the quantitative estimation of inorganic compounds through volumetric techniques.

CC-14 (Theo)

CO- 1	To recognize spectroscopy in microwave, Rotational spectra of rigid diatomic molecules, selection rules, interaction of spectral lines
CO- 2	To understand the study of Vibrating diatomic molecule, energy levels of a diatomic molecule, simple harmonic and anharmonic oscillator, Scattering of light and Raman Spectrum. rotational and vibrational Raman Spectra
CO- 3	To understand concepts of Nuclear and Radiation Chemistry. Applications of Radioisotopes
CO- 4	To explain theory and practice of common photochemical and photophysical methods
CO- 5	To Understand difference between thermal and photochemical reactions
CO-6	To define and explain surface- and interfacial phenomena

CC-14 (Prac)

CO- 1	To understand the property of liquid state, the vapour pressure, the surface tension, viscosity
CO- 2	To learn to correlate the property of surface tension with different natural phenomena
CO- 3	To understand the definition of viscosity, and describe how viscosity can be measured

DSE-3 (Theo)

CO- 1	Understand the functional role of the field of green chemistry.
CO- 2	Understand the 12 working principle of green chemistry
CO- 3	Understand several real world examples where organizations used green chemistry to improve the sustainability performance of their products.
CO- 4	Appreciate about how the practice of green chemistry enhances competitiveness, innovation and faster time to market.
CO- 5	Know about the various analytical green methods

DSE-3 (Prac)

CO1	Estimate reactants and reaction mechanism to promote atom economy.
CO2	Learn about the bio-catalytic reactions
CO3	Explain the utility of synthesis in eco-friendly solvent
CO4	Maximize the application of alternate source of energy

DSE-4 (Theo)

CO- 1	Learn a thorough knowledge about the industrial inorganic materials.
CO- 2	Understand the roles of inorganic materials for industrial importance.
CO- 3	Learn about the occurrence, preparation and use of industrially important inorganic substances and materials.
CO- 4	Understand the inorganic processes
CO- 5	Develop awareness on the contributions of chemistry to society.

DSE-4 (Prac)

CO- 1	Learn a thorough knowledge of analysis of inorganic materials used in industry
CO- 2	Analyse ore and alloy samples
CO- 3	Learn about the electroplating process on hand
CO- 4	Analyse cements, fertilizers, etc.
CO- 5	Design inorganic materials of industrial importance