THE BHAWANIPUR EDUCATION SOCIETY COLLEGE

A MINORITY RUN COLLEGE AFFILIATED TO UNIVERSITY OF THE CALCUTTA
RECOGNISED UNDER SECTION 2(F) & 12(B) OF THE UGC ACT, 1956

PO/CO/PSO

Programme Outcomes (PO)
Course Outcomes (CO)
Programme Specific Outcomes (PSO)

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DEPARTMENT OF CHEMISTRY

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DEPARTMENT OF CHEMISTRY

PROGRAMME OUTCOMES (PO)

Upon completion of the undergraduate course in Chemistry the student will be able to:

PO	Programme Outcomes	Description
PO 1	**Critical Thinking**	Critically apply theories, methodologies and knowledge to identify and analyze current issues and trends related to chemistry and come up with intellectual and personal ideas and decisions from different perspectives.
PO 2	**Effective Communication**	Communicate scientific ideas clearly and effectively by involving chemistry-oriented languages through effective independent both writing and oral communication skills.
PO 3	**Ethics**	Apply ethical principles like safe handling of chemicals etc. and commit to professional ethics, responsibilities and norms of scientific practice.
PO 4	**Social Interaction**	Identify and describe the underlying principles behind varied chemical techniques relevant to academia, industry and government to inculcate scientific temperament in the inside as well as outside the scientific community.
PO 5	**Environment and Sustainability**	Find out sustainable solutions to far- reaching challenges, including energy provision involving green chemistry, Environmental protection, Food and water safety, Global healthcare and explore the resources to learn more about chemistry's role in sustainability.

PO 6	**Self-directed and Lifelong Learning**	Recognize the need for and ability to engage independently and life-long learning in the broadest context of technological changes.
PO 7	**Individual and Teamwork**	Develop individual and team work by functioning effectively as an individual or as a member in a group in practical classes.
PO 8	**Laboratory Skills and Instrumentation**	Employ scientific thinking and inquiry in the performance, design, interpretation and documentation of laboratory experiments at a level suitable to succeed at an entry-level position in the chemical industry or a chemistry graduate program. Also able to explain theoretical concepts of instruments that are commonly used in most chemistry fields as well as interpret and use data generated in instrumental chemical analyses. Again to apply the programming concept of C++ to various scientific investigations, problem solving and interpretation of chemistry related software.

DEPARTMENT OF CHEMISTRY (HONS)

THE BHAWANIPUR EDUCATION SOCIETY COLLEGE

COURSE OUTCOMES (CO)

Upon completion of the undergraduate course in Chemistry as an Honours subject, the student will be able to:

Semester	Course Name and Code	CO Number	Course Outcomes	Relevant POs
I	**Inorganic Chemistry-1 (CEMA-CC-1-1-TH)**	**CO-1**	1.1: Gain the knowledge of different quantum numbers and orbitals, filling of electrons in an atom. 1.2: Discuss different theories to define acid and base and their relative strength. Building the concept of Acid-Base equilibrium, neutralization, pH, buffer and acid base indicator.	**PO 1, PO 2, PO 4, PO 7, PO 8**

			1.3: Demonstrate the balancing redox reaction, elementary idea of standard redox potential with different influencing factors. Concept of redox titration and redox potential diagram.	
	Inorganic Chemistry-1 (CEMA-CC-1-1-P)	**CO-1**	1.4: Interpret the hands on difference between primary and secondary standard substance and titration indicator, estimation of analyte through redox reaction of single and mixture components.	
	Organic Chemistry-1A (CEMA-CC-1-1-TH)	**CO-1**	1.5: Apply the concept of hybridization to determine the shape of different organic molecules. 1.6: Discuss on different electronic displacement phenomenon like inductive effect, resonance effect, electromeric effect etc. 1.7: Describe the basic idea about Molecular Orbital Theory and Huckel's rules for aromaticity and their applications. 1.8: Explain the different physical properties like BDE and bond energy, bond angles, m.p. & b.p., dipole moment etc.	**PO 1, PO 2, PO 4, PO 7, PO 8**

			1.9: Describe the mechanistic classification such as ionic, radical and pericyclic reaction. Explain the concepts of nucleophiles, electrophiles, electronegativity etc.	
	Organic Chemistry-O (1A) (CEMA-CC-1-1-P)	**CO-1**	1.10: Demonstrate the hand-on skill to determine the nature of the organic compounds on the basis of acid-base treatment.	
	Physical Chemistry-1 (CEMA-CC-1-2-TH)	**CO-2**	2.1: Describe the effect of pressure and temperature on the collisions of gaseous molecules. 2.2: Explain the distribution of velocities and kinetic energies among the gaseous molecules. 2.3: Recognize average, root mean square, and most probable velocities. 2.4: Identify the deviations of gases from ideal behavior.	**PO 1, PO 2, PO 7, PO 8**
	Physical Chemistry-1 (CEMA-CC-1-2-P)	**CO-2**	2.5: Derive van der Waals equation.	

	Organic Chemistry-1B (CEMA-CC-1-2-TH)	**CO-2**	2.6: Execute the basic idea of three dimensional arrangements of the molecules, their stereo chemical features. 2.7: Discuss on the idea of stereoisomerism (enantiomerism, diastereoisomerism) and the basic idea of resolution and racemization.	**PO 1, PO 2, PO 7, PO 8**
	Organic Chemistry- O (1B) (CEMA-CC-1-2-P)	**CO-2**	2.8: Develop the skill of laboratory training to use melting point and boiling point apparatuses.	
II	**Organic Chemistry-2 (CEMA-CC-2-3-TH)**	**CO-3**	3.1: Describe the advanced idea of stereochemistry leads to axial chirality, topicity, prochirality etc. and the conformational analysis of the molecules. 3.2: Discuss on the reaction thermodynamics, acid-base equilibria and tautomerism. 3.3: Develop the basic concept of reaction kinetics includes kinetic isotope effect and KCP vs TCP. 3.4: Apply the concept of nucleophilic substitution (S_N1, S_N2) along with NGP and S_Ni to explain different reaction mechanisms.	**PO 1, PO 2, PO 4, PO 6, PO 7, PO 8**

			3.5: Justify and describe the Stereochemical and regiochemical outcome of elimination (E1, E2, E1CB) reactions.	
	Organic Chemistry-2 (CEMA-CC-2-3-P)	**CO-3**	3.6: Demonstrate the basic skill of organic synthesis through the preparation methodology.	
	Inorganic Chemistry-2 (CEMA-CC-2-4-TH)	**CO-4**	4.1: Develop the concept of covalent bonding using Fazan's rule, valence bond theory, hybridization, Bent's rule. Explain the VSEPR theory for determination of geometry and shape of molecule. 4.2: Understand the Molecular Orbital Theory with LCAO, MOT diagram and orbital interaction of homonuclear diatomics and heteronuclear molecules. 4.3: Infer the concept of Metallic bond using VB and band theories, semiconductor and insulator.	**PO 1, PO 2, PO 7, PO 8**

			4.4: Classify the nuclide based on nuclear stability and NBE. To build the concept of nuclear quantum number, magic number, artificial radioactivity, principle of determination of age of rocks and radiocarbon dating. 4.5: Apply the concept for the determination of oxidant and reductant using iodo/iodimetric method.	
	Inorganic Chemistry-2 (CEMA-CC-2-4-P)	**CO-4**	4.6: Enable the realistic application of iodo/iodimetric method for determination of metal content in some selective samples.	
III	**Physical Chemistry-2 (CEMA-CC-3-5-TH)**	**CO-5**	5.1: Describe the knowledge of laws of thermodynamics. 5.2: Discuss the concept of heat and work, enthalpy, internal energy, entropy, free energy, work functions. 5.3: Demonstrate elementary idea of chemical and thermodynamic equilibrium and Le Chatelier's principle. 5.4: Discuss of Conductance and its measurement, Ionic equilibrium and degree of ionization.	**PO 1, PO 2, PO 4, PO 7, PO 8**

			5.5: Express the knowledge of Nernst equation, electrode potentials, and cell thermodynamics.	
	Physical Chemistry-2 (CEMA-CC-3-5-P)	**CO-5**	5.6: Analyze the ionization constant of weak acid and strength of unknown acid conductometrically. 5.7: Demonstrate the determination of solubility product potentiometrically. 5.8: Examine the heat of neutralization of a strong acid by a strong base.	
	Inorganic Chemistry-3 (CEMA-CC-3-6-TH)	**CO-6**	6.1: Discuss different general periodic property across the modern IUPAC Periodic Table. 6.2: Explain the details of the chemistry of s and p block elements with respect to hydride, halide, oxide, oxyacid and other important compounds. 6.3: Illustrate the difference of organic and inorganic polymer and discuss the synthesis, structure and application of some selected inorganic polymer. 6.4: Compare and discuss of the double and complex salt in light of Werner's Theory and	**PO 1, PO 2, PO 7, PO 8**

			geometrical and optical isomerism in square planar and octahedral complexes.	
	Inorganic Chemistry-3 (CEMA-CC-3-6-P)	**CO-6**	6.5: Understand the principle and apply the concept for determination of analyze using complexometric titration method, chromatographic and gravimetric method for separation and estimation of inorganic metal ions respectively.	
	Organic Chemistry-3 (CEMA-CC-3-7-TH)	**CO-7**	7.1: Develop the idea of electrophilic addition to olefinic and acetylenic carbon-carbon bonds, regioselectivity of addition, functionalization, and downstream exploitation of unsaturated compounds. 7.2: Discuss the details of functionalizing the ubiquitous benzene ring, attack of electrophiles and nucleophiles, substituents' directing ability, accessing highly functionalized aryl targets. 7.3: Investigate the synthetic potential of the carbonyl group, its electrophilic and nucleophilic	**PO 1, PO 2, PO 4 PO 7, PO 8**

			character, formation of carbon-carbon bonds utilizing aldol and related reactions. 7.4: Explain the reversal of polarity, construction of carbon-carbon bonds using nucleophilic carbon reagents. 7.5: Design the synthesis of different organic compounds using Grignard reagents.	
	Organic Chemistry-3 (CEMA-CC-3-7-P)	**CO-7**	7.6: Develop analytical and laboratory skills. 7.7: Interpret the results and identify errors associated with a chemical analysis based on the analytical technique and nature of the sample and evaluate experimental data.	
	Analytical Clinical Biochemistry (CEMA-SEC-A2)	**CO-8**	8.1: Develop the Basic ideas about structures of biopolymers and their function in the human body. 8.2: Define the different enzyme catalysis in various biological processes & also kinetics of enzyme catalysis. 8.3: Demonstrate the estimation techniques and tests of constituents of human urine and blood samples.	**PO 1, PO 2, PO 3, PO 4, PO 5, PO 6, PO 7, PO 8**

			8.4: Develop the pathological concept and laboratory skill of how to estimate urine and blood samples.	
IV	**Organic Chemistry-4 (CEMA-CC-4-8-TH)**	**CO-9**	9.1: Describe the Chemistry of nitrogen compounds such as amines, nitro & diazo compounds, exploration into the realm of carbon-nitrogen bond, synthetic potential of organic nitrogen compounds, and their importance. 9.2: Utilize the concept of rearrangement reactions in organic chemistry and their importance in organic synthesis. 9.3: Develop the skill for the art of synthesis in organic chemistry, retro synthetic analysis, concept of disconnection and synthons, analysis and forward synthesis plans, the concept of protecting groups, basics of stereoselective synthesis. 9.4: Discuss on the Spectroscopic techniques as a characterization and identification tool in organic chemistry – UV, IR and ^{1}HNMR spectroscopy.	**PO 1, PO 2, PO 4, PO 7, PO 8**

	Organic Chemistry-4 (CEMA-CC-4-8-P)	**CO-9**	9.5: Investigate the advantages and disadvantages of a variety of qualitative analysis methods to identify various organic functional groups.	
	Physical Chemistry-3 (CEMA-CC-4-9-TH)	**CO-10**	10.1: Discuss the Colligative properties and Phase equilibrium. 10.2: Explain the properties of Ideal solutions and Raoult's law with derivation. 10.3: Identify phase, component and degrees of freedom in the light of phase rule and phase diagram. 10.4: Utilize the concepts of Quantum mechanics, Wave function, Schrodinger time-independent equation, elementary concepts of operators and eigenfunctions. 10.5: Express the knowledge of Crystal structure of solid, Laws of crystallography. 10.6: State the Bragg's law and Specific heat of solid.	**PO 1, PO 2, PO 4, PO 6 PO 7, PO 8**
	Physical Chemistry-3 (CEMA-CC-4-9-P)	**CO-10**	10.7: Differentiate between pH-metric titration and potentiometric titration.	

			10.8: Determine the partition coefficient, Phase diagram etc.	
	Inorganic Chemistry-4 (CEMA-CC-4-10-TH)	**CO-11**	11.1: Explain the elementary of Crystal Field Theory and to explain the magnetic property and color property of transition metal complexes. 11.2: Compare the 3d, 4d, 5d elements in terms of electronic configuration, oxidation state, redox property and coordination chemistry. 11.3: Explain the general physical and chemical property of lanthanides and actinides. 11.4: Discuss the theory of kinetics and mechanism of substitution reaction in square planar and octahedral complexes.	**PO 1, PO 2, PO 5, PO 7, PO 8**
	Inorganic Chemistry-4 (CEMA-CC-4-10-P)	**CO-11**	11.5: Experiment of the synthesis of different inorganic complexes using different procedures and interpret the results of such experiments.	
	Pharmaceuticals Chemistry (CEMA-SEC-B3)	**CO-12**	12.1: Develop the concept of medicinal chemistry and the history of drug discovery leads to structure-activity relationship. 12.2: Develop the basic idea about the Retrosynthetic analysis and forward synthesis of drugs of different kinds.	**PO 1, PO 2, PO 3, PO 4, PO 6, PO 7, PO 8**

			12.3: Describe the Fermentation techniques for common commercial products. 12.4: Execute the basic hands-on laboratory skill of organic synthesis through the preparation of drug molecules.	
V	**Physical Chemistry – 4 (CEMA-CC-5-11-TH)**	**CO-13**	13.1: Describe the knowledge of Simple Harmonic Oscillator, angular momentum, Hydrogen atom and Hydrogen-like ions and LCAO method. 13.2: Express the concept of Statistical Thermodynamics, Configuration, Equilibrium configuration. 13.3: Explain Boltzmann distribution, partition function and adiabatic demagnetization. 13.4: Analyze Numerical Analysis, Roots of equation, Quadratic formula, Iterative methods, Numerical differentiation and Numerical integration.	**PO 1, PO 2, PO 4, PO 5, PO 7, PO 8**
	Physical Chemistry – 4 (CEMA-CC-5-11-P)	**CO-13**	13.5: Operate Computer programming (Using FORTRAN) based on numerical methods. 13.6: Calculate roots of equations, numerical differentiation and numerical integration.	

	Organic Chemistry-5 (CEMA-CC-5-12-TH)	**CO-14**	14.1: Develop the concept of synthesis, reactions and importance of polynuclear hydrocarbons and heterocyclic compounds containing one heteroatom. 14.2: Illustrate the conformational analysis of cyclohexane ring systems and case studies regarding substitution, elimination, rearrangement and oxidation reactions of cyclohexyl substrates. 14.3: Develop the self-confidence about the FMO analysis and synthetic importance of the three fundamental pericyclic processes. 14.4: Describe the glycochemistry - reactions and stereochemistry of monosaccharides up to hexoses. 14.5: Classify Proteins and peptides – amino acids and describe their chemistry, formation of peptide bonds, structural hierarchy of proteins and their functions.	**PO 1, PO 2, PO 4, PO 6, PO 7, PO 8**

	Organic Chemistry-5 (CEMA-CC-5-12-P)	**CO-14**	14.6: Design the hands-on training to set the column for chromatographic separations. 14.7: Develop the analytical skill to interpret the unknown IR, 1HNMR spectra of organic compounds. 14.8: Discuss on the structural elucidation of organic compounds by IR, ^{1}HNMR spectral data.	
	Applications of Computers In Chemistry (DSE-A2-TH)	**CO-15**	15.1: Explain the knowledge of Computer Programming Basics (FORTRAN). 15.2: Express the concepts of Spreadsheet Software (MS Excel), SOLVER functions, excel Goal Seek function, discussion of Statistical analysis.	**PO 1, PO 2, PO 4, PO 6, PO 7, PO 8**
	Applications of Computers in Chemistry (DSE-A2-P)	**CO-15**	15.3: Interpret graphs using a spreadsheet, acid-base titration curve using excel Goal Seek function. 15.4: Develop knowledge of SOLVER and LINEST functions.	

	Inorganic Materials of Industrial Importance (DSE-B1-TH)	**CO-16**	16.1: Summarize the various structures of silicates, the properties of glass and quartz. 16.2: Illustrate the several types of fertilizers and to interpret the N-P-K analysis of a fertilizer product. 16.3: Discuss the composition, properties, and applications of Low alloy, high speed steel alloy, stainless steel, and commercial quality steels. 16.4: Explain the principles and mechanisms of catalysis applications and homogeneous and heterogeneous catalysis.	**PO 1, PO 2, PO 4, PO 5, PO 6, PO 7, PO 8**
	(DSE-B1-P)	**CO-16**	16.5: Differentiate the fertilizers on the basis of different properties. 16.6: Determine the % of metal in alloy and study the composition of cement.	
VI	**Inorganic Chemistry-5 (CEMA-CC-6-13-TH)**	**CO-17**	17.1: Explain the basic theoretical principle in analysis of cation and anion in qualitative analysis. 17.2: Explain the role of metal ions in the active site structure of metallo-protein for transport of ion, oxygen and hydrolytic behavior.	**PO 1, PO 2, PO 4, PO 5, PO 6, PO 7,**

			17.3: Classify organometallic compound and summarize 18-electron rule and illustrate 18-electron rule to metal carbonyl, nitrosyl and cyanides to explain the structure and bonding. 17.4: Evaluate the acid and basic radical determination. 17.5: Understand the beneficial and toxic effect of metals in biological system. 17.6: Gain the knowledge of catalyst characteristics, mechanism of catalytic reactions, and, design of catalytic reactors.	**PO 8**
	Inorganic Chemistry-5 (CEMA-CC-6-13-P)	**CO-17**	17.7: Identify basic and acid radicals through chemical tests from a given mixture qualitatively.	
	Physical Chemistry-5 (CEMA-CC-6-14-TH)	**CO-18**	18.1: Express the knowledge of spectroscopy in the microwave, rotational spectra of rigid diatomic molecules. 18.2: Interpret common photochemical and photophysical methods, and able to execute these experimentally. 18.3: Relate the idea of surface and colloid chemistry from a physical-chemical perspective.	**PO 1, PO 2, PO 4, PO 6, PO 7, PO 8**

			18.4: Discuss on basic adsorption models, permanent dipole moments of some polar molecules in a non-polar solvent based on Debye's theory and the Guggenheim approximation.	
	Physical Chemistry-5 (CEMA-CC-6-14-P)	**CO-18**	18.5: Examine the molar extinction coefficient of a fluorophore spectrophotometrically. 18.6: Determine the surface tension of an unknown liquid.	
	Green Chemistry (CEMA-DSE-A3)	**CO-19**	19.1: Describe how to reduce waste material and by-products. 19.2: Develop to design the synthetic process where a minimum amount of waste material to be formed. 19.3: Differentiate the less hazards, less polluting materials. 19.4: Describe the alternative source of energy, use of green solvents e.g., water, super conducting water and carbon dioxide, ionic liquids, PEG.	**PO 1, PO 2, PO 3, PO 4, PO 5, PO 6, PO 7, PO 8**
	Green Chemistry (CEMA-DSE-A3P)	**CO-19**	19.5: Develop the basic skill of organic green synthesis through the preparation methodology in green chemistry context.	

	Dissertation (DSE-B4)	**CO-20**	20.1: Understand and communicate research concepts and contexts clearly and effectively both in writing and orally. 20.2: Identify and investigate research problems. 20.3: Conduct research projects in an ethical fashion. 20.4: Apply critical knowledge from research studies.	**PO 1, PO 2, PO 3, PO 4, PO 5, PO 6, PO 7, PO 8**

CHEMISTRY GENERIC ELECTIVE

COURSE OUTCOMES (CO)

Upon completion of the undergraduate course in Chemistry as a Generic subject, the student will be able to:

Semester	Course Name and Code	CO Number	Course Outcomes	Relevant POs
I	**Kinetic Theory of Gases and Real Gases (CEMG-CC-1/ GE-1-TH)**	**CO-1**	1.1: Gain the basics of ideal and real gases, knowledge of kinetic energy and its variation of temperature and pressure.	**PO 1, PO 2, PO 4, PO 7, PO 8**
	Liquids	**CO-1**	1.2: Discuss the concepts of diffusion and Viscosity of liquids. 1.3: Justify knowledge of Poiseuille's equation with derivation.	
	Chemical Kinetics	**CO-1**	1.4: Discuss the Rate law, order and molecularity, role of temperature on kinetics, Homogeneous catalysis.	

	Atomic Structure	**CO-1**	1.5: Basic idea and different refinement model of extranuclear structure of atom. 1.6: Gain the knowledge of different quantum numbers and orbitals, filling of electrons in an atom.	
	Chemical Periodicity	**CO-1**	1.7: Discuss different general periodic property (Atomic and ionic radii, ionization potential, electron affinity, and electronegativity) across the modern IUPAC Periodic Table.	
	Acids and bases	**CO-1**	1.8: Discuss different theories to define acid and base and their relative strength.	
	Fundamentals of Organic chemistry	**CO-1**	1.9: Apply the concept of hybridization to determine the shape of different organic molecules. 1.10: Discuss on different electronic displacement phenomenon like inductive effect, resonance effect, electromeric effect etc.	
	Stereochemistry	**CO-1**	1.11: Execute the basic idea of three dimensional arrangements of the molecules, their stereo chemical features. 1.12: Discuss on the idea of stereoisomerism (enantiomerism, diastereoisomerism).	

	Nucleophilic substitution and elimination reaction	**CO-1**	1.13: Apply the concept of nucleophilic substitution (SN1, SN2) along with NGP to explain different reaction mechanisms.	
	(CC-1/GE-1 P)	**CO-1**	1.14: Demonstrate the hands on skill for quantitative estimation of different analyte using redox titration.	
II	**Chemical Thermodynamics (CEMG-CC-2/ GE-2 TH)**	**CO-2**	2.1: Gain the knowledge of laws of thermodynamics, concept of heat and work, enthalpy, internal energy, entropy, free energy, work functions, and spontaneity of the reaction.	**PO 1, PO 2, PO 4, PO 6, PO 7, PO 8**
	Chemical Equilibrium	**CO-2**	2.2: Demonstrate elementary idea of chemical and thermodynamic equilibrium and Le Chatelier's principle.	
	Solutions	**CO-2**	2.3: Gain the idea on properties of Ideal solutions and Raoult's law with derivation.	
	Phase Equilibria	**CO-2**	2.4: Explain phase, component and degrees of freedom in the light of phase rule and phase diagram.	
	Solids	**CO-2**	2.5: Gain the knowledge of Crystal structure of solid, Laws of crystallography, Miller indices.	

	Aliphatic Hydrocarbons	**CO-2**	2.6: Apply the concept of different reactions like hydrogenation, elimination reactions and addition reactions to prepare different aliphatic hydrocarbons.	
	Error analysis and Computer Applications	**CO-2**	2.7: Gain the knowledge of accuracy and error analysis for different chemical reactions. 2.8: Gain the concept of different components of computers and computer languages.	
	Redox reactions	**CO-2**	2.9: Demonstrate the balancing redox reaction, elementary idea of standard redox potential with different influencing factors. 2.10: Discuss the redox titration and its applications.	
	(CC-2/GE-2 P)	**CO-2**	2.11: Develop the laboratory skill to estimate the viscosity of liquid and also kinetics of different reactions.	
III	**Chemical Bonding and Molecular Structure (CEMG-CC-3/ GE-3 TH)**	**CO-3**	3.1: Explain the quantitative and qualitative concept of ionic bonding in inorganic solid and its application in determining physical and chemical properties. 3.2: Describe different theories of covalent bonding (VBT, VSEPR, MOT) in covalent inorganic molecules.	**PO 1, PO 2, PO 4, PO 7, PO 8**

	Comparative Study of P-block Elements	**CO-3**	3.3: Compare p-block elements and their important compounds in terms of electronic configuration, modification of pure elements, common oxidation states and inert pair effect.	
	Transition Elements (3d series)	**CO-3**	3.4: Compare transition metal elements and lanthanides in terms of electronic configuration, variable valency, colour, complex forming ability, magnetic and catalytic properties.	
	Coordination Chemistry	**CO-3**	3.5: Illustrate Werner's coordination theory, and Valence Bond Theory (VBT) in explaining bonding and isomerisation in coordination compounds.	
	Electrochemistry 1. **Ionic equilibria** 2. **Conductance** 3. **Electromotive force**	**CO-3**	3.6: Demonstrate elementary ideas of ionic equilibrium. 3.7: Discuss of Conductance and its measurement, Ionic equilibrium and degree of ionization. 3.8: Relate the knowledge of Nernst equation, electrode potentials, and cell thermodynamics.	
	Aromatic hydrocarbons & Aryl halides	**CO-3**	3.9: Discuss the details of functionalization of the benzene ring to prepare nitrobenzene, halobenzene and alkyl & acyl substituted benzene compounds.	

	Organometallic compounds	**CO-3**	3.10: Design the synthesis of different organic compounds using Grignard reagents.	
	(CC-3/GE-3 P)	**CO-3**	3.11: Gain the knowledge of qualitative analysis to identify inorganic basic and acid radicals through chemical tests from a given mixture.	
IV	**Alcohols, Phenols and Ethers (CEMG-CC-4/ GE-4 TH)**	**CO-4**	4.1: Develop the concept of preparations of different organic compounds like alcohol, phenol and ethers.	**PO 1, PO 2, PO 4, PO 6, PO 7, PO 8**
	Carbonyl Compounds	**CO-4**	4.2: Investigate the synthetic potential of the carbonyl group, its electrophilic and nucleophilic character, formation of carbon-carbon bonds utilizing aldol and related reactions.	
	Carboxylic acids and their derivatives	**CO-4**	4.3: Gain the knowledge of synthesis of different carboxylic acids and their derivatives (both aliphatic and aromatic).	
	Amines and Diazonium salts	**CO-4**	4.4: Describe the Chemistry of nitrogen compounds such as amines & diazo compounds, exploration into the realm of carbon-nitrogen bond, synthetic potential of organo nitrogen compounds, and their importance.	
	Amino acids and carbohydrates	**CO-4**	4.5: Describe the concept of biomolecules such as amino acids and carbohydrates their synthesis and reactions.	

	Crystal field theory	**CO-4**	4.6: Explain the elementary of crystal field theory in octahedral and tetrahedral coordination complexes.	
	Quantum Chemistry & Spectroscopy	**CO-4**	4.7: Define the concepts of Quantum mechanics, Wave function, Schrodinger time-independent equation, elementary concepts of operators and eigenfunctions, understanding of particle in a box problem.	
	(CC-4/GE 4 P)	**CO-4**	4.8: Gain the knowledge of qualitative analysis to identify single solid organic compounds.	

PROGRAMME SPECIFIC OUTCOMES (PSO)

Upon completion of the undergraduate course in Chemistry the student will be able to:

PSO-1: Gain the knowledge in the fundamentals and applications of current scientific theories involved in Inorganic, Organic and Physical Chemistry.

PSO-2: Explain, integrate and apply relevant knowledge in emerging and varied areas of chemistry for higher studies (including different interdisciplinary fields such as environmental and materials sciences, biochemistry, nanoscience, green chemistry etc.), research and industry and to be acquainted with state of the art techniques and technologies.

PSO-3: Develop leadership and managerial skills promoting the need for lifelong learning as required for competent professionals.

PSO-4: Develop a neat experimental hand in conformity with good laboratory practices including safety measures.