

# **HARIMOHAN GHOSE COLLEGE**

## **Department of Chemistry**

### **Program Outcome**

The mission of the undergraduate chemistry program at Harimohan Ghose College under the University of Calcutta is to equip students with the essential knowledge base and access to laboratory resources necessary for successful careers in the field of chemistry. This includes preparing students for upcoming careers in chemistry, advanced studies in chemistry and related aligned disciplines such as biological chemistry, as well as entry into other various professional professions (medical, dental, law, business programs and so on).

### **Educational Goals**

1. To provide students with a comprehensive understanding and practical application of contemporary chemical and scientific theories across Analytical, Inorganic, Organic, and Physical Chemistry disciplines.
2. To empower students to conceive, execute, and meticulously document scientific experiments, and adeptly analyze the outcomes thereof.
3. To cultivate students' problem-solving acumen, critical thinking abilities, and analytical reasoning skills, particularly as they pertain to scientific challenges.
4. To encourage students to explore emerging areas of research within chemistry and allied scientific and technological domains.
5. To instill an understanding of the pivotal role of chemistry in society, promoting ethical conduct in chemical practice, including the safe handling of chemicals and environmental stewardship.
6. To elucidate the significance of chemistry in addressing contemporary social, economic, and environmental concerns, fostering an awareness of its integral role in problem-solving.
7. To develop students' ability to collaborate within interdisciplinary problem-solving teams, recognizing the interconnectedness of scientific and societal challenges.

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### Course Outcome

Semester	Paper CC1/ GE1	Course	Course Outcome
SEM-I	ORGANIC CHEMISTRY	OC1	<p>Get idea about the term of fundamental properties of organic molecules, and different chemical entities.</p> <p>Get enriched with the concept of different types of stereo-isomerism; presentation of organic molecules in 3D space and different nomenclature.</p> <p>Get idea of various types of substitution reaction (<math>S_N^1</math> and <math>S_N^2</math> type reaction), elimination reaction (E1 and E2 type reactions).</p>
	INORGANIC CHEMISTRY	OC2	<p>Become familiar with the idea of structure of atoms, different models, quantum numbers, electron fill-up principle and atomic line spectra of H atom</p> <p>Get idea of elements classification into s-, p-, d- and f-block group, various properties of atom and their periodic trends.</p> <p>Get enriched with the concept of conjugate acids and bases, their relative strengths, various concepts of acid-base.</p>
	PHYSICAL CHEMISTRY	OC3	<p>Get idea of the effect of pressure and temperature on gas, Collision of gas molecules Collision number, Maxwell's distribution, different type of velocity of gaseous molecules, Principle of equipartition, concept of real gases, compressibility factor; Boyle temperature.</p> <p>Get enriched with the idea of the properties of liquid such as surface tension, viscosity of a liquid.</p> <p>Become familiar with various reaction order, mathematical derivation, rate constant, determination of half-life, Arrhenius equation, energy of activation, effect of catalyst.</p>
	PHYSICAL CHEMISTRY PRACTICAL	OC4	<p>Learn the techniques of Quantitative Analysis by titration procedure such as Permanganometry), acid-base titration, and Dichromametry etc.</p>

Semester	Paper CC2/ GE2	Course	Course Outcome
<b>SEM-II</b>	ORGANIC CHEMISTRY	<b>OC5</b>	Learn about the properties, preparation and reactions of alkanes, alkenes, alkynes including some Name reaction.
	INORGANIC CHEMISTRY	<b>OC6</b>	Get elementary idea about the various types of redox reactions, standard redox potentials, Nernst equation, and dependency of redox potentials on different reaction parameters.
	PHYSICAL CHEMISTRY	<b>OC7</b>	<p>This chapter introduces use of computer in chemistry. Students learn different analysis process using computer, computer language, hardware and software.</p> <p>Get preliminary idea about the chemical thermodynamics and thermodynamically parameter of various chemical reactions, Zeroth law and First law of thermodynamics and their consequence.</p> <p>Learn about the concept of chemical equilibrium, equilibrium constant, free energy, standard Gibbs free energy change; concept of <math>K_p</math>, <math>K_c</math> and <math>K_x</math> and their relation, Van't Hoff's reaction, Le Chatelier's principle from this chapter.</p> <p>Get idea about the Ideal and non-ideal solutions, and their different properties.</p>
	PHYSICAL CHEMISTRY	<b>OC8</b>	<p>Learn about the phases of a system, components and degrees of freedom, properties of phase equilibrium, and various rules and their application.</p> <p>This chapter introduces about the criteria of solid, crystal systems, different lattice types, different law of Crystallography, Miller indices and Bragg's law.</p> <p>❖Get idea about the phases of a system, components and degrees of freedom, properties of phase equilibrium, and various rules and their application</p>
	PHYSICAL CHEMISTRY PRACTICAL	<b>OC9</b>	This topic deals with the kinetics of various reactions. Such as- a) study of deposition rate of $H_2O_2$ b) determination of viscosity of unknown liquid c) Determination of surface tension of unknown liquid.

Semester	Paper CC3/ GE3	Course	Course Outcome
<b>SEM-III</b>	ORGANIC CHEMISTRY	<b>OC10</b>	<p>Get idea about the aromatic hydrocarbon compound, properties and various type of reactions- aromatic electrophilic and nucleophilic substitution reaction.</p> <p>Get knowledge about the organometallic compound, Grignard reagents.</p> <p>Get preliminary idea about the alkyl halides, their synthesis, properties and reactions.</p>

<b>SEM-III</b>	INORGANIC CHEMISTRY	<b>OC11</b>	<p>Get to know about the different types of bond, ionic bond, its general characteristic, Born-Landé equation, solvation energy, Born-Haber cycle, polarizability, and dipole moment.</p> <p>Shape of some molecules and ions on the basis of VBT, VSEPR, and MO theory has been taught with suitable example.</p>
	INORGANIC CHEMISTRY	<b>OC12</b>	<p>Get to know about the group trends, common oxidation states, and their important compounds of following groups of elements – IIIA, IVA, IVA and VA.</p> <p>Get idea about the transitional elements of 3d series, Lanthanoids and Actinoids, and their properties.</p> <p>Acquire the knowledge about the Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu, and their structure, structural and stereo-isomerism in complexes.</p>
	PHYSICAL CHEMISTRY	<b>OC13</b>	<p>Get familiar the concepts of electrolyte, their properties, pH scale, common ion effect; salt hydrolysis, buffer solutions; solubility and solubility product of sparingly soluble salts.</p> <p>Acquire the knowledge about the cell, cell constant and different type of conductance, various laws, Conductometric acid-base titrations, Transport Number.</p> <p>Get to know about the Faraday's laws of electrolysis, half-cell potentials, Chemical cells, Electromotive force, Nernst equation; Standard electrode potential; Electrochemical series;</p>
	SEC3-PHARMACEUTICALS CHEMISTRY	<b>OC14</b>	<p>Get to know about the drugs and pharmaceutical molecules of different categories such as analgesics agents, antipyretic agents, anti-inflammatory, antibiotics, antibacterial and antifungal agents etc.</p> <p>Acquire the knowledge about the fermentation process for the synthesis of various drugs and pharmaceutical molecules.</p>
	INORGANIC CHEMISTRY PRACTICAL	<b>OC15</b>	<p>Perform the Qualitative semi-micro analysis for the identification acids and basic radicals by different chemical reactions.</p>

Semester	Paper CC4/ GE4	Course	Course Outcome
SEM-IV	ORGANIC CHEMISTRY	OC16	<p>Get knowledge about the alcohols, di-ols, phenols and ethers, properties and synthesis of these compounds, reactions of those compounds.</p> <p>Get familiar with the aldehyde and ketone groups, properties and preparation of these compounds, various reactions.</p> <p>Get knowledge about the aliphatic and aromatic Carboxylic acids, their properties, synthesis, and various reactions.</p>
	ORGANIC CHEMISTRY	OC17	<p>Get familiar with the aliphatic and aromatic amines, their properties, and different reaction on amine functional groups.</p> <p>Get to know about structure of amino acids, their properties and preparation.</p> <p>Get idea about Carbohydrates, their classification, general properties, their reaction, and some reactions</p>
	INORGANIC CHEMISTRY	OC18	Get familiar with the effects of ligands's presence with metal ions, weak and strong fields, Crystal field stabilization energy (CFSE), octahedral and Tetrahedral symmetry, Jahn-Teller distortion.
	PHYSICAL CHEMISTRY	OC19	<p>Get idea about the quantum mechanical operators, free particle, Particle in a 1-D box, wave functions, zero-point energy.</p> <p>Get knowledge about the types of spectroscopy- Rotational Motion, Microwave pure rotational, Vibrational Motion and IR spectra.</p>
	SEC 4 - PESTICIDE CHEMISTRY	OC20	Get idea about the general introduction to pesticides, benefits and adverse effects, synthesis and their application.
	ORGANIC CHEMISTRY PRACTICAL	OC21	<p>Qualitative analysis of single solid organic Compound(s):, detection of special elements, detection of functional groups in solid organic compounds</p> <p>Identification of a pure organic compound</p>

Semester	Paper <b>DSE-A2</b>	Course	Course Outcome
<b>SEM-V</b>	DSE-A-2: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE	<b>OC22</b>	Get to know about the Silicate based materials such as glass, ceramics and cement, different fertilizers, surface coatings materials and their application.
		<b>OC23</b>	Become familiar with the Characteristics of battery, fuel cell, solar cell, alloys, catalyst and chemical explosives.
	DSE A2- PRACTICALS	<b>OC24</b>	Learn the technique about the quantitative estimation of cement, dolomite, free acidity in different fertilizers

Semester	Paper <b>DSE-B1</b>	Course	Course Outcome
<b>SEM-VI</b>	GREEN CHEMISTRY AND CHEMISTRY OF NATURAL PRODUCTS	<b>OC25</b>	Get ideas about the green chemistry, 12 principles of green chemistry, designing a reaction based on these 12 principles, green solvents, and green chemicals.
		<b>OC26</b>	Acquire the knowledge about the green as well as renewable energy as the alternative source of energy for chemical reaction.
		<b>OC27</b>	Get idea about the some green approaches towards some common well known organic reactions, some Name reactions, biomimetic approaches.
		<b>OC28</b>	Acquire knowledge about the various alkaloids, their extraction process and isolation, natural features, and their medicinal effect on human body.  Get knowledge about the occurrence, classification of terpenes, isoprene rule; Elucidation of structure and synthesis.
	SEC2 – ANALYTICAL CLINICAL BIOCHEMISTRY	<b>OC29</b>	Get idea about some biomolecules such as carbohydrate, proteins, lipid, lipoproteins, enzymes, DNA and RNA.  Students learn the technique of estimation of blood and urine qualitatively.
	DSE-B1 PRACTICAL	<b>OC30</b>	Learn the green synthesis of some chemical compounds in laboratory work