

DEPARTMENT OF CHEMISTRY
DARJEELING GOVERNMENT COLLEGE
UG HONOURS
UG PO-CO MAPPING (2018-2023)
UG-CBCS CURRICULUM (UNDER THE UNIVERSITY OF NORTH
BENGAL)

Programme Outcome (PO):

PO 1 Critical Thinking: Understanding and critical interpretation of theory, facts and figures available in chemical literature.

PO 2 Effective Communication: Use of knowledge of subject , scientific reasoning in problem solving and to understand chemistry in broad area.

PO 3 Social Interaction: Ability to communicate scientific result in academia, industry and government.

PO 4 Ethics : Use of chemistry for safe handling and key issues of our environments in the field of energy, health and medicine.

PO 5 Laboratory Skills and Instrumentation: For designing of chemical experiments and instruments. Theoretical understanding of instrument and their analytical application in diverse field.

PO 6 Environmental & Sustainability: Role of chemistry in environmental protection and food water safety for global healthcare .

PO 7 Self oriented and lifelong learning: Acquisition of flexible knowledge and problem solving ability for writing and communication.

Year	Paper	Course	Outcome
SEM-1 Honours	Inorganic Chemistry CC1 T	CO1	<p>Atomic Structure</p> <p>Periodicity of Elements s, p, d, f block elements Effective nuclear charge, (b) Atomic radii (van der Waals) (c) Ionic and crystal radii. (d) Covalent radii (octahedral and tetrahedral) (e) Ionization enthalpy, (f) Electron gain enthalpy</p> <p>Chemical Bonding ionic bond, covalent bond, metallic bond, weak chemical force</p> <p>Oxidation-Reduction Redox equations, Standard Electrode Potential and its application to inorganic reactions. Principles involved in volumetric analysis to be carried out in class.</p>
	Inorganic Chemistry Practical CC1 P	CO2	<p>(A) Titrimetric Analysis (i) Calibration and use of apparatus (ii) Preparation of solutions of different Molarity/Normality of titrants (B) Acid-Base Titrations (i) Estimation of carbonate and hydroxide present together in mixture. (ii) Estimation of carbonate and bicarbonate present together in a mixture. (iii) Estimation of free alkali present in different soaps/detergents (C) Oxidation-Reduction Titrimetry (i) Estimation of Fe(II) and oxalic acid using standardized KMnO_4 solution. (ii) Estimation of oxalic acid and sodium oxalate in a given mixture.</p>
	Physical Chemistry CC2 T	CO3	<p>Gaseous State Liquid state Solid State Ionic equilibria</p>
	Physical Chemistry Practical CC2 P	CO4	<p>Surface tension measurements. (a) Determine the surface tension by drop number method. (b) Study the variation of surface tension of detergent solutions with concentration. 2. Viscosity measurement using Ostwald's viscometer. (a) Determination of viscosity of aqueous solutions of polymer / ethanol / sugar at room temperature. (b) Study the variation of viscosity of sucrose</p>

			<p>solution with the concentration of solute.</p> <p>3. Indexing of a given powder diffraction pattern of a cubic crystalline system.</p> <p>4. pH metry (a) Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures. (b) Preparation of buffer solutions of different pH (i) Sodium acetate-acetic acid (ii) Ammonium chloride-ammonium hydroxide (c) pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base. (d) Determination of dissociation constant of a weak acid</p>
SEM 2 Honours	Organic Chemistry CC3 T	CO5	<p>Basics of Organic Chemistry</p> <p>Stereochemistry Chemistry of Aliphatic Hydrocarbons Carbon-Carbon sigma bonds</p> <p>Carbon-Carbon pi bonds</p> <p>Reactions of alkenes</p> <p>Reactions of alkynes Cycloalkanes and Conformational Analysis</p> <p>Aromatic Hydrocarbons Aromaticity</p>
	Organic Chemistry Practical CC3 P	CO6	<p>Checking the calibration of the thermometer</p> <p>2. Purification of organic compounds by crystallization using the following solvents: (a) Water; (b) Alcohol; (c) Alcohol-Water</p> <p>3. Determination of the melting points of above compounds and unknown organic compounds</p> <p>4. Effect of impurities on the melting point-mixed melting point of two unknown organic compound.</p> <p>5. Determination of boiling point of liquid compounds. (boiling point lower than and more than 100oC by distillation and capillary method)</p> <p>6. Chromatography (a) Separation of a mixture of two amino acids by ascending and horizontal paper chromatography</p>
	Physical Chemistry CC4 T	CO7	<p>Chemical Thermodynamics</p> <p>Systems of Variable Composition Chemical Equilibrium Solutions and Colligative Properties</p>
	Physical Chemistry Practical CC4 P	CO8	<p>Determination of Surface Tension of solutions</p>

			<p>2. Determination of Coefficient of Viscosity of solutions</p> <p>3. Determination of pH of a solution by Colour Matching.</p> <p>4. Determination of heat capacity of the calorimeter</p> <p>5. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.</p> <p>6. Calculation of the enthalpy of ionization of ethanoic acid.</p>
SEM 3 Honours	Inorganic Chemistry CC5 T	CO9	<p>General Principles of Metallurgy</p> <p>Acids and Bases</p> <p>Chemistry of s and p Block Elements</p> <p>Noble Gases</p> <p>Inorganic Polymers</p>
	Inorganic Chemistry Practical CC5 P	CO10	<p>A) Iodo / Iodimetry Titrations</p> <p>(i) Estimation of Cu(II) and K₂Cr₂O₇ using sodium thiosulphate solution (Iodimetrically).</p> <p>(ii) Estimation of (i) arsenite and (ii) antimony in tartar-emetie iodimetrically</p>
	Organic Chemistry CC6 T	CO11	<p>Chemistry of Halogenated Hydrocarbons</p> <p>Alcohols, Phenols, Ethers and Epoxides</p> <p>Carbonyl Compounds</p> <p>Carboxylic Acids and their Derivatives</p> <p>Sulphur containing compounds</p>
	Organic Chemistry Practical CC6 P	CO12	<p>Functional group tests for alcohols, phenols, carbonyl and carboxylic acid group.</p> <p>2. Organic preparations: (Any Five)</p> <p>(i) Acetylation of one of the following compounds: amines (aniline, o-, m-, p-toluidine and o-, m-, p-anisidine) and phenols (β-naphthol, vanillin, salicylic acid) by any one method:</p>
	Physical ChemistryCC7 T	CO13	<p>Phase Equilibria</p> <p>Chemical Kinetics</p> <p>Catalysis</p> <p>Surface chemistry</p>
SEM 3 Honours	Physical Chemistry Practical CC7 P	CO14	<p>Determination of critical solution temperature and composition of the phenol-water system</p> <p>.Distribution of acetic / benzoic acid between water and cyclohexane.</p> <p>Study the kinetics of the following reactions. Verify the Freundlich and Langmuir isotherms for adsorption of acetic acid on activated charcoal</p>
	Skill Enhancement Course SEC1 T	CO15	<p>Drugs & Pharmaceuticals</p> <p>antipyretic agents, anti-inflammatory agents (Aspirin, paracetamol, ibuprofen);</p> <p>Antimalarials: Chloroquine (with synthesis).</p> <p>antibiotics (detailed study of Chloramphenicol);</p> <p>antibacterial and antifungal agents</p>

			(Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Fermentation
	Skill Enhancement Course SEC1 P	CO16	Preparation of Aspirin and its analysis. 2. Preparation of magnesium disilicates (Antacid). 3. Preparation of methyl salicylate (oil of wintergreen). 4. Any other Practical as desired.
SEM4 Honours	Inorganic Chemistry CC8 T	CO17	Coordination Chemistry Transition Elements Lanthanoids and Actinoids Bioinorganic Chemistry
	Inorganic Chemistry Practical CC8 P	CO18	Gravimetric Analysis: (Any One) (i) Estimation of nickel (II) using Dimethylglyoxime (DMG) (ii) Estimation of copper as CuSCN Inorganic Preparations: (Any Three) Chromatography of metal ions: (Any One) Principles involved in chromatographic separations. Paper chromatographic separation of following metal ions: (i) Ni (II) and Co (II) (ii) Fe (III) and Al (III)
	Organic Chemistry CC9 T	CO19	Nitrogen Containing Functional Groups Polynuclear Hydrocarbons Heterocyclic Compounds Alkaloids Terpenes
	Organic Chemistry Practical CC9 P	CO20	Detection of extra elements. (2) Functional group test for nitro, amine and amide groups. (3) Qualitative analysis of unknown organic compounds containing simple functional groups (alcohols, carboxylic acids, phenols and carbonyl compounds)
	Physical Chemistry CC10 T	CO21	Conductance Electrochemistry Electrical and magnetic properties of atoms and molecules
	Physical Chemistry Practical CC10 P	CO22	Determination of cell constant Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid conductometric titration potentiometric titrations

	Skill Enhancement Course SEC2 T	CO23	Theory and Hand-on Experiments Definitions of Green Chemistry. Brief introduction of twelve principles of Green Chemistry, Green Chemistry and catalysis
	Skill Enhancement Course SEC2 P	CO24	Preparation and characterization of biodiesel from vegetable oil. (2) Bromination of Anilide Using Green Approach. (3) Preparation of Benzilic acid by using Green Approach. (4) Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper(II).

SEM 5 Honours	Organic Chemistry CC11 T	CO25	Pericyclic Reactions Nucleic Acids Amino Acids, Peptides and Proteins Enzymes Lipids Concept of Energy in Biosystems
	Organic Chemistry Practical CC11 P	CO26	Estimation of glycine by Sorenson's formalin method. 2. Study of the titration curve of glycine. 3. Estimation of proteins by Lowry's method. 4. Study of the action of salivary amylase on starch at optimum conditions. 5. Effect of temperature on the action of salivary amylase. 6. Saponification value of an oil or a fat. 7. Determination of Iodine number of an oil/fat.
	Physical Chemistry CC12 T	CO27	Quantum Chemistry Molecular Spectroscopy Photochemistry Colloids Statistical Thermodynamics
	Physical Chemistry Practical CC12 P	CO28	Verify Lambert – Beer's Law and determine the concentration of KMnO_4 / $\text{K}_2\text{Cr}_2\text{O}_7$ in a solution of unknown concentration. 2. Study the 200-500 nm absorbance spectra of KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$. (in 0.1 M H_2SO_4) and determine the λ_{max} values. Calculate the energies of the two transitions in different units (J molecule ⁻¹ , kJ mol ⁻¹ , cm ⁻¹ , eV). 3. Analysis of the given Vibration – Rotation Spectrum of HCl [g]. 4. Study the pH-dependence of the UV-Vis spectrum (200-500 nm) of $\text{K}_2\text{Cr}_2\text{O}_7$
	Discipline Specific Elective 1 T	CO29	Qualitative and quantitative aspects of analysis Optical methods of analysis Thermal methods of analysis Electroanalytical methods

SEM 5 Honours			Separation techniques Solvent extraction Chromatography
	Discipline Specific Elective 1 P	CO30	Chromatography: (a) Separation of mixtures (i) Paper chromatographic separation of Fe ³⁺ , Al ³⁺ , and Cr ³⁺ .
	Discipline Specific Elective 2 T	CO31	Glass Ceramics Cement Fertilizer Surface coating Battery Alloy Catalysis
	Discipline Specific Elective 2 P	CO32	Determination of free acidity in ammonium sulphate fertilizer. 2. Estimation of Calcium in Calcium ammonium nitrate fertilizer. 3. Estimation of phosphoric acid in superphosphate fertilizer. 4. Electroless metallic coatings on ceramic and plastic material. 5. Determination of composition of dolomite (by complexometric titration). 6. Analysis of (Cu, Ni); (Cu, Zn) in alloy or synthetic samples. 7. Analysis of Cement. 8. Preparation of pigment (zinc oxide).

	Inorganic Chemistry CC13 T	CO33	Theoretical Principles in Qualitative Analysis (H ₂ S Scheme) Organometallic Compounds Reaction Kinetics and Mechanism Catalysis by Organometallic Compounds
	Inorganic Chemistry Practical CC13 P	CO34	Qualitative semimicro analysis of mixtures containing four radicals Measurement of 10 Dq by spectrophotometric method
	Organic Chemistry CC14 T	CO35	Organic Spectroscopy Carbohydrates Dyes Classification, Colour and constitution; Mordant and Vat Dyes; Chemistry of dyeing; Synthesis and applications of: Azo dyes
	Organic Chemistry Practical CC14 P	CO36	Extraction of caffeine from tea leaves 2. Preparation of sodium polyacrylate 3. Preparation of urea formaldehyde 4. Analysis of Carbohydrate: aldoses and ketoses, reducing and non-reducing sugars

SEM 6 Honours			<p>5. Qualitative analysis of unknown organic compounds containing monofunctional groups</p> <p>6. Identification of simple organic compounds by IR spectroscopy and NMR spectroscopy (Spectra to be provided)</p> <p>7. Preparation of methyl orange</p>
	Discipline Specific Elective 3 T	CO37	<p>Introduction and history of polymeric materials: Functionality and its importance Kinetics of Polymerization Determination of molecular weight of polymers Properties of Polymers Brief introduction to preparation, structure, properties and application of the following polymers</p>
	Discipline Specific Elective 3 P	CO38	<p>Interfacial polymerization, preparation of polyester from isophthaloyl chloride (IPC) and phenolphthalein (a) Preparation of IPC (b) Purification of IPC (c) Interfacial polymerization</p> <p>2. Redox polymerization of acrylamide 3. Precipitation polymerization of acrylonitrile 4. Preparation of urea-formaldehyde resin 5. Preparations of novalac resin/ resold resin. 6. Microscale Emulsion Polymerization of Poly(methylacrylate)</p>
	Discipline Specific Elective 4 T	CO39	<p>Industrial Gases and Inorganic Chemicals Environment and its segments Energy & Environment</p>
	Discipline Specific Elective 4 P	CO40	<p>Measurement of chloride, sulphate and salinity of water samples by simple titration method (AgNO₃ and potassium chromate).</p> <p>Study of some of the common bio-indicators of pollution. Estimation of SPM in air samples. Preparation of borax/ boric acid</p>

PO-CO MAPPING

PO 1 Critical Thinking	PO 2 Effective Communicati on	PO 3 Social Interaction	PO 4 Ethics	PO 5 Laborator y Skills and Instrumen tation	PO 6 Environme ntal & Sustainabil ity	PO 7 Self oriented and lifelong learning
CO1	CO5	CO3	CO4	CO2	CO15	CO4
CO3	CO9	CO11	CO12	CO4	CO16	CO7
CO5	CO11	CO15	CO13	CO6	CO23	CO12
CO7	CO15	CO26	CO22	CO8	CO24	CO15
CO9	CO20	CO32	CO26	CO10	CO29	CO18
CO11		CO35	CO35	CO12	CO30	CO20
CO13				CO14	CO31	CO24
CO15				CO16	CO32	CO26
CO17				CO18	CO37	CO31
CO19				CO20	CO38	
CO21				CO22	CO39	
CO23				CO24	CO40	
CO25				CO26		
CO27				CO28		
CO29				CO30		
CO31				CO32		
CO33				CO34		
CO35				CO36		
CO37				CO38		
CO39				CO40		

PROGRAMME SPECIFIC OUTCOME (PSO)

PSO1: Upon completion of BSc Hons/Programme students should be able to know the facts , concepts, principles, theory related to chemistry

PSO2: Communication skill in subject should enrich

PSO 3: Mathematical and numerical calculation, error analysis ability will build up.

PSO 4: Computational knowledge using computer software will grow up.

PSO 5: They will learn the techniques of safe handling of chemicals, conduct laboratory experiments which are documented in chemical literature and research article format

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Sem 1 GE1 DSC1	Inorganic Chemistry T Organic Chemistry T	CO 1	Atomic Structure Chemical Bonding and Molecular Structure: Fundamentals of Organic Chemistry Stereochemistry Aliphatic Hydrocarbons Alkanes: (Upto 5 Carbons).
	Inorganic Chemistry P Organic Chemistry P	CO 2	1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture. 2. Estimation of oxalic acid by titrating it with KMnO ₄ . 1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds
Sem 2 GE2 DSC1	Physical Chemistry T Organic Chemistry T	CO3	Thermodynamics Chemical Equilibrium Ionic Equilibrium Alkyl and Aryl Halides Alcohols and Phenols and Ethers Aldehydes and ketones
	Physical Chemistry P Organic Chemistry P	CO4	Heat capacity determination pH determination of solution pH of Buffer Enthalpy of neutralization Purification, preparation Bromination of Phenol/Aniline (b) Benzoylation of amines/phenols
Sem 3 DSC3	Physical Chemistry T Organic Chemistry T SEC 1 T	CO5	Solution Phase equilibria Conductance electrochemistry Carboxylic acid & derivative Amine & diazonium salts Amino acid,peptide,protein Drug Pharmaceutical Fermentation
	Physical Chemistry P Organic Chemistry P SEC 1 P	CO6	Conductometric titration Potentiometric titration Functional group detection of organic compounds

Sem 4 DSC4	Physical Chemistry T Inorganic Chemistry T SEC 2 T	CO7	Gaseous state Liquid state Solid state Chemical Kinetics Cordination chemistry Crystal field theory Lanthanoids Actinoids Green Chemistry
Sem 5 DSC5	Physical Chemistry P Inorganic Chemistry P SEC 2 P Industrial ChemistryT Industrial ChemistryP	CO8 CO9	Determination of surface tension, viscosity Determination of rate of saponification Semi micro analysis Green chemistry project work Inorganic materials of industrial importance Analysis Estimation and Preparation
Sem 6 DSC6	Industrial ChemistryT Industrial ChemistryP	CO10	Industrial chemicals and environment Project / Industry visit

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