



Department of Chemistry

Suren Das College, Hajo, Kamrup, Assam

Program Outcome, Program Specific Outcome

Non CBCS GENERAL Course under Gauhati University

B. Sc. Chemistry General (Non-CBCS)

Program Outcomes (POs)

Department of Chemistry	After successfully completion of three years degree program in Chemistry under Non-CBCS, a student should be able to
Program Outcomes (POs)	<p>POs-1. To impart knowledge of General Chemistry covering all the aspects viz. inorganic, organic, physical and analytical Chemistry.</p> <p>POs-2. Solve the problem and also think methodically, independently and draw a logical conclusion.</p> <p>POs-3. Employ critical thinking and the scientific knowledge to design, carry out, record and analyse the results of chemical reactions.</p> <p>POs-4. Create an awareness of the impact of chemistry on the environment, society, and development outside the scientific community.</p> <p>POs-5. Find out the green route for chemical reaction for sustainable development.</p> <p>POs-6. To inculcate the scientific temperament in the students and outside the scientific community.</p>

Semester-I

PAPER E 101 GENERAL CHEMISTRY (Total Marks 75)

Semester-II

PAPER 201 GENERAL CHEMISTRY (Total Marks 75)

Semester-III

PAPER E 301 GENERAL CHEMISTRY (Total Marks 50)

PAPER E 302 PRACTICAL (Total Marks 50)

Semester-IV

PAPER E 401 GENERAL CHEMISTRY (Total Marks 50)

PAPER E 402 PRACTICAL (Marks 50)

Semester-V

PAPER E 501 GENERAL CHEMISTRY (Total Marks 100)

PAPER E 502 PRACTICAL (Total Marks 100)

Semester-VI

PAPER E 601 GENERAL CHEMISTRY (Total Marks 100)

PAPER E 602 Practical (Total Marks 100)

Programme Specific Outcomes (Chemistry General Non CBCS)

Programme Specific Outcomes (PSOs)	PSOs-1. Gain the knowledge of Chemistry through theory and practicals. PSOs-2. To explain nomenclature, stereochemistry, structures, reactivity, and mechanism of the chemical reactions. PSOs-3. Identify chemical formula and solve numerical problems. PSOs-4. Use modern chemical tools, Models, UV Spectrophotometer, Chemdraw, Charts and Equipments. PSOs-5. Know structure-activity relationship. PSOs-6. Understand good laboratory practices and safety. PSOs-7. Develop research-oriented skills. PSOs-8. Make aware and handle the sophisticated instruments/equipments.
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Course Outcomes (Chemistry General Non-CBCS)

PAPER E 101 GENERAL CHEMISTRY (Total Marks 75)

<i>Semester-I</i>	
Course	Outcome (After completion of these courses students should be able to)
Unit 1.1 Structure of matter (Marks 20)	CO-1. To know the origin of quantum theory – Black body radiation, Photoelectric effect. CO-2. To know about Bohr's theory of H-atom – atomic spectra of hydrogen. CO-3. Students will learn about the dual nature of matter (de Broglie equation). CO-4. Students will gain knowledge about Heisenberg's uncertainty principle, Schrodinger's time independent equation.

		CO-5. Students will be able to explain the many electrons' atoms system—electronic configuration – Aufbau principle, Pauli's principle, Hund's rule.
Unit 1.2 Covalent bonding (Marks 15)		CO-1. The students will learn about the valence bond approach: Lewis's electron pair bonds (H ₂ , HF, O ₂ , N ₂ , CO, NO, NH ₃ , H ₂ O, H ₂ O ₂). CO-2. The students will be able to understand the shapes of molecules. CO-3. Students will be able to explain/analyze the hybridisation (in BeH ₂ , C ₂ H ₂ , C ₂ H ₄ , CH ₄ , BF ₃ , CO ₃ ²⁻ , PCl ₅ , SF ₆ and benzene). CO-4. Knowledge will be gained on the concept of electronegativity (Pauling and Mullikan scale).
Unit 1.3 Ionic bonding and intermolecular forces (Marks 8)		CO-1. The students will learn Ion pairs, ionic bond, and properties of ionic compounds. CO-2. The students will be able to understand calculation of lattice energy and heats of formation of ionic compounds using Born-Haber cycle. CO-3. Students will be able to explain/analyze Ionic radii and factors effecting ionic radius, radius ratio and structure of ionic crystals.
Unit 1.4 States of matter (Marks 22)		CO-1. Students will be able to explain/analyze kinetic theory of gases. CO-2. Gained knowledge on distribution of molecular speed, Mean, root mean square and most probable speeds. CO-3. Students will learn deviation from ideal behaviour, van der Waals equation of state. CO-4. Students will be able to explain crystal lattices, unit cells of the seven crystal systems.
<i>Semester-II</i>		
PAPER 201 GENERAL CHEMISTRY (Total Marks 75)		
Course		Outcome (After completion of these courses students should be able to)
Unit 2.1 Hydrocarbons I (Marks 20)		CO-1. The students will learn the basics to classification and nomenclature of organic compounds on the basis of their functional groups. CO-2. The students will be able to understand alkanes: Preparation (Wurtz, Kolbe, Corey-House reactions) and their properties and reactions. CO-3. Students will be able to explain/analyse the cycloalkanes: preparation of cyclopropane, cyclobutane, cyclopentane, cyclohexane. Strain theory and stability. CO-4. Knowledge will be gain on the concept of alkynes and alkatrienes:

		Preparation, properties, reactions of alkynes (ethyne, propyne, butyne as example).
Unit 2.2 Hydrocarbons (Marks 15)	II	<p>CO-1. Students will learn about reactive intermediates: carbocations and carbanions – their shape, generation, stability and reactions.</p> <p>CO-2. The students will be able to understand the stereochemistry.</p> <p>CO-3. The students will be able to understand basic concepts of erythro and threo isomers, asymmetry, enantiomerism, diastereomerism, dissymmetry</p> <p>CO-4. Mechanism of SN1 and SN2 reactions, E1 and E2 reactions.</p>
Unit 2.3 Hydrocarbons (Marks 8)	III	<p>CO-1. Students will learn the preparation and synthetic uses of diazomethane, ketene.</p> <p>CO-2. The students will be able to understand aromatic hydrocarbons: IUPAC nomenclature, aromaticity, preparation and reactions of benzene.</p>
Unit 2.4 Chemical Thermodynamics (Marks 15)		<p>CO-1. Students will learn about the zeroth law, nature of work and heat.</p> <p>CO-2. The students will be able to understand the first law of thermodynamics – enthalpy and internal energy.</p> <p>CO-3. The students will be able to understand the basic of second law of thermodynamics. Carnot cycle. Entropy and spontaneity, calculation of entropy changes during vaporisation and fusion.</p>
Unit 2.4 Phase Rule (Marks 7)		<p>CO-1. Students will learn about definition of phase, component and degrees of freedom and Phase rule.</p> <p>CO-2. The students will be able to understand ideal and non-ideal solutions.</p> <p>CO-3. Students will be able to gain knowledge on principle of fractional distillation of liquid-liquid mixtures, azeotrope.</p>

Semester-III

PAPER E 301 GENERAL CHEMISTRY (Total Marks 50)

Course	Outcome (After completion of these courses students should be able to)
Unit 3.1 Chemistry of non-transition elements I	<p>CO-1. Students will learn about the basic groupwise study of physical properties, chemical reactivity of elements</p> <p>CO-2. Students will be able to understand the General trends in size, ionization energy, electron affinity and electronegativity.</p> <p>CO-3. Students will be able to gain knowledge on inorganic chains, rings and cages: synthesis, structure and reactions of silicones, borazine and diborane.</p>
Unit 3.2 Chemistry	CO-1. The students will be able to gather knowledge on the carbides and

of non-transition elements II	nitrides. CO-2. Students will be able to describe interhalogen compounds, CO-3. Students will be able to explain polyhalides, pseudohalogen-synthesis and structure, noble gas compounds-synthesis, structure and bonding.
Unit 3.3 Transition elements	CO-1. The students will be able to gather knowledge of first transition series elements with emphasis on electronic configuration. CO-2. Students will be able to describe Werner theory, types of ligands, isomerism and IUPAC nomenclature of coordination complexes, chelates.
Unit 3.4 Electrochemistry	CO-1. The students will be able to understand galvanic cells-description and working process. CO-2. Students will be able to describe standard electrode potentials and electromotive force (emf). CO-3. Students will be able to explain the Nernst equation and calculation of cell potential, concentration cells. CO-4. Students will be able to understand the transport number of ions and their determination.
PAPER E 302 PRACTICAL	In Laboratory experiment, Students will be able to understand detection of N, S and halogens in organic compounds and Paper Chromatography.

Semester-IV

PAPER E 401 GENERAL CHEMISTRY (Total Marks 50)

Course	Outcome (After completion of these courses students should be able to)
Unit 4.1 Aliphatic and aromatic hydroxyl compounds and ethers (Marks 10)	CO-1. Students will be able to understand the classification of alcohols, 1 ⁰ , 2 ⁰ , 3 ⁰ alcohols and their distinguishing reactions. CO-2. Students will be able to learned general methods of preparation, properties and general reactions of primary alcohols, glycols and glycerol. CO-3. Students will be able to gain knowledge on Williamson's ether synthesis and hydrolysis of ethers.
Unit 4.2 Aliphatic amines and aniline	CO-1. Students shall demonstrate the ability to describe 1 ⁰ , 2 ⁰ , 3 ⁰ amines. basicity of amines. preparation, properties and reactions of 1 ⁰ amines. CO-2. Students will gain knowledge on synthesis, properties and reactions of aniline. CO-3. Students will be able to gain knowledge on electrophilic aromatic substitution diazonium ions and their synthetic utility.

Unit 4.3 Aliphatic and aromatic carbonyl compounds	CO-1. Through this course the students will be introduced to general methods of preparation and reactions of carbonyl compounds (formaldehyde, acetaldehyde, acetone and 2-butanone as example).
Unit 4.4 Aliphatic and aromatic carboxylic acids	CO-1. Students will be able to explain/describe acidity of carboxylic acids, and substituted carboxylic acids. CO-2. General methods of preparation, properties and reactions of aliphatic carboxylic acid (methanolic ethanoic and propanoic acid as examples)
Unit 4.5 Amino acids, carbohydrates, fats and oils	CO-1. Students will be able to explain/describe structure, physical properties and differences of fats, oils and soaps. analysis of Fats and oils.
Unit 4.6 Chemical kinetics and surface chemistry	CO-1. Through this course the students are introduced to reaction rates and rate laws. order and molecularity of a reaction. CO-2. Students are introduced to the importance homogeneous catalysis, acid base catalysis.
Unit 4.6 Ionic equilibrium	CO-1. Students will be able to explain/describe Henderson-Hasselbach equation and calculation of pK values.
PAPER E 402 PRACTICAL (Marks 50)	In Laboratory experiment, Students are able to understand qualitative and quantitative inorganic analysis.
<i>Semester-V</i>	
PAPER E 501 GENERAL CHEMISTRY (Total Marks 100)	
Course	Outcome (After completion of these courses students should be able to)
Unit 5.1 Chemistry of materials	CO-1. Through this course the students are introduced to band theory (from MO theory), conductors, insulators and semi-conductors. CO-2. Students are introduced to the importance of ferroelectric and piezoelectric materials, preparation of electronic grade pure silicon.
Unit 5.2 Principles of chemical analysis	CO-1. Students will be able to explain/describe the principles of separation and identification of a mixture of cations and anions (qualitative analysis), CO-2. Will gain knowledge on basic principles of chromatography.

Unit 5.3 Principles and applications of spectroscopy-1	<p>CO-1. This course will boost their knowledge on the nature of electromagnetic radiation, the regions of electromagnetic spectrum.</p> <p>CO-2. Students will be able to understand on the topic of the Beer-Lambert law, Molar adsorption co-efficient and absorbance, the selection rules for electronic transition.</p> <p>CO-3. The students will be able to understand UV-Visible spectroscopy, colour and electronic transitions, quantitative estimation by Colorimetric method.</p>
Unit 5.4 Principles and applications of spectroscopy-2	<p>CO-1. Students will be able to understand on the basic principles of Mass Spectroscopy.</p> <p>CO-2. Students will be able to understand basic principles of Nuclear Magnetic Resonance (NMR) spectroscopy, representation of NMR spectra.</p> <p>CO-3. Students will be able to understand on the topic nuclear fission and fusion, nuclear reactors.</p>
Unit 5.6 Lanthanides and actinides	CO-1. The course helps in introducing the students Chemistry of Lanthanide and Actinide elements: Electronic configuration, oxidation states, properties, reactions and uses.
PAPER E 502 PRACTICAL (Total Marks 100)	Students will learn to determine the water of crystallization in hydrated salt by ignition and weighing and preparation of organic compounds.
<i>Semester-VI</i>	
PAPER E 601 GENERAL CHEMISTRY (Total Marks 100)	
Course	Outcome (After completion of these courses students should be able to)
Unit 6.1 Industrial Chemistry – Inorganic (Marks 20)	<p>CO-1. The course helps in introducing the student's modern methods of water treatment and purification.</p> <p>CO-2. Students will be able to learn different types of N and P fertilizers, manufacture of ammonia, ammonium nitrate, urea phosphates and superphosphates. Nitrogen fixation by plants.</p> <p>CO-3. Students will gain knowledge on various types of cement, their composition and manufacture. portland cement, setting of cement.</p>
Unit 6.2 Industrial Chemistry – Organic	<p>CO-1. Students learn about the laws of types of polymers and polymerization process. Manufacture, structure, properties and applications.</p> <p>CO-2. Students shall be learning about Fisher-Tropsch process, chemicals</p>

		<p>from coal.</p> <p>CO-3. Students will learn about manufacture and industrial reactions of ethane, propane, butadiene, acetylene and xylene.</p>
Unit	6.3	<p>CO-1. Gain knowledge on the composition of the atmosphere. photochemical reactions in the atmosphere.</p> <p>CO-2. Complete knowledge will be gained on photochemical smog, acid rain.</p> <p>CO-3. Pollution of water through use of chemical fertilizers.</p> <p>CO-4. Students will learn about the quality of water for drinking and other purposes.</p>
Environmental Chemistry		
Unit 6.4 Biological Chemistry		<p>CO-1. Students will be able to understand the cell and its components, the structure of cell membrane, transport of ions and molecules across the membrane.</p> <p>CO-2. Gain knowledge on the structure and function of amino acids, peptides, polypeptides.</p> <p>CO-3. Students are able to explain/gain knowledge on the double helical structure of DNA and structure of RNA.</p> <p>CO-4. Students are able to understand the concept enzymes and their role.</p>
UNIT 6.5 Natural products and medicines		<p>CO-1. Students will be able to understand the Terpenes: Classification, structure and isolation.</p> <p>CO-2. Gain knowledge on the Alkaloids: Classification, structure and isolation. Physiological action of alkaloids.</p> <p>CO-3. Students will be able to understand cancer and anti-cancer drugs.</p>
PAPER E 602 Practical		<p>CO-1. Students will be able to understand the hardness of water by complexometric titration.</p> <p>CO-2. Students will gain knowledge on conductometric titration between strong acid and strong base.</p>