

**UG SYLLABUS UNDER SYMESTER
SYSTEM
CHEMISTRY ELECTIVE PROGRAMME
FIRST AND SECOND SEMESTER
[Effective from July 2015]**



**DEPARTMENT OF CHEMISTRY
NORTH LAKHIMPUR COLLEGE
(AUTONOMOUS)**

P.O. KHELMATI, NORTH LAKHIMPUR, 787 031

**Scheme of Examination and Course of Study for
B.Sc. (Elective) Chemistry under Semester Programme**

Semester –I & II: Total credits 5 (Each)

Total marks: 100 (75 from semester exam+ 25 from I.A)

Semester	Paper	Titles /Contents	Marks	Total	Credits	Total credits
Semester-I	ET-5-CHE-101	General 1) Inorganic 2) Organic 3) Physical	25 25 25	75	5 [IA include]	5
Semester-II	ET-3-CHE-202	General 1. Inorganic 2. Organic 3. Physical	15 15 15	45	3 [IA include]	5
	EP-2-CHE-203	Lab1[Inorganic]	30	30	2 [IA include]	

FIRST SEMESTER
CHEMISTRY ELECTIVE PROGRAMME
NORTH LAKHIMPUR COLLEGE (AUTONOMOUS)
TOTAL CREDIT: 5 [L=112]
Paper Code: ET-5-CHE-101
Title: General Chemistry [A]

Section I: Inorganic Chemistry

Marks: 25

Unit -I : Atomic Structure: (Recapitulation of Bohr's Theory, de Broglie, Theory, Heisenberg Uncertainty Principle- a new approach to Atomic Structure)
Time independent Schrödinger wave equation ($H\psi = E\psi$). Significance of ψ and ψ^2
Schrodinger equation for Hydrogen atom (qualitative treatment only). Quantum numbers, Radial and angular wave functions, probability distribution curves, shapes of s,p, and d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configuration of elements based upon electronic configuration in the periodic table, periodic properties-effective nuclear charge ionization energy, electron affinity, electronegativity, Redox potential.

Marks: 15

Unit -II: Chemical Bonding and Molecular Structure

Ionic Bonding: Energy consideration in ionic bonding, lattice Energy, and Solvation Energy and their importance in the context of Stability and Solubility of ionic compounds. Born-lande equation for calculation of lattice energy. Born - Haber cycle and its application, polarizing power and polarizability. Fajan's rule, Bond moment, dipole moment and percentage ionic character. Hydrogen Bonding.

Marks: 10

Section -II Organic Chemistry-I

Marks: 25

Unit – I: Introduction to Organic Chemistry

- a) Importance of Organic Chemistry & organic systems to human beings & society. structure and Bonding- Hybridisation, bond lengths, bond angles, bond energy, localized and delocalized – electrons related to simple organic molecules. Electronic displacements: Inductive effect, Electrometric effect, Resonance and hyper conjugation.
- b) Mechanism of organic reactions Cleavage of Bonds: Homolysis and Heterolysis, Structure, Shape and reactivity of organic molecules- Nucleophiles and electrophils. Reactive Intermediates-Carbocation, Carbanions, free radicals, carbenes & nitrenes. Strength of organic acids and bases: comparative study with emphasis on factors affecting pka Values

Marks: 12

Unit-II **Aliphatic Hydrocarbons - Alkanes, Alkenes ,Alkynes**

Alkanes (upto 5 carbons) Preparation:- Catalytic hydrogenation, wurtz reaction, Kolbe's Synthesis, from Grignard reagent. Corey House Synthesis.

Reactions:- Free radical Substitution : Halogenations

Alkenes (upto 5 carbons) Preparation- Elimination reaction- Mechanism of E¹, E², E¹cB. Dehydration of alcohols and dehydrohalogenation of alkyl halides – Saytzeff's & Hoffmann's rule.

Reactions: cis-addition (alk. KMnO₄) and trans addition (bromine). Addition of HX (Markownikoff's and anti-Markownikoff's addition). Hydration, Hydroxylation by Osmium tetroxide, Hydroxylation via epoxydation, Ozonolysis.

Oxymercuration-demercuration, hydroboration-oxidation.

Alkynes (up-to 5 carbons) Preparation: Acetylene from CaC₂ and conversion into higher alkynes: by dehydrohalogenation of tetra halides, dehydrohalogenation of vicinal-dihalides.

Reactions-formation of metal acetylides, addition of bromine and alkaline KMnO₄ ozonolysis and oxidation with hot alk. KMnO₄.

Marks: 13

Section III **Physical Chemistry**

Marks: 25

Unit-I : **Kinetic Theory of gases**

Derivation of Kinetic gas equation., deduction of simple problems on – root mean square speed ,most probable speed ,collision frequency ,collision diameter ,mean free path heat capacity of gases, Maxwell distribution of molecular speed (Derivation not required). Deviation from ideal behavior, Vander Waals equation, Vander Waals constant, critical state of gas, critical constants, continuity of states, law of corresponding states, degree of freedom, law of equipartition of energy (derivation not required), viscosity of gases and effect of temperature and pressure on coefficient of viscosity).

Marks: 17

Unit – II:

Liquid state:

Qualitative treatment of the structure of liquids, Physical properties of liquids vapour pressure. Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald Viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment) Parachor - determination and application.

Marks: 8

SECOND SEMESTER
CHEMISTRY ELECTIVE PROGRAMME
NORTH LAKHIMPUR COLLEGE (AUTONOMOUS)
TOTAL CREDIT: 3 [L=70]
Paper Code: ET-3-CHE-202
Title: General Chemistry [B]

Section I: Inorganic Chemistry

[Marks 15]

Unit –I: Chemical Bonding and Molecular Structure

Covalent Bonding: VB Approach-Concept of hybridization, SP, SP², SP³, SP³d, SP³d² and dsp² VSEPR Theory. Resonance and Resonance energy: Study of some inorganic and organic compounds (O₃, NO₃⁻, CO₃²⁻, SO₄²⁻, RCOO⁻, C₆ H₆). Co-ordinate or Dative Bond. Molecular Orbital Approach: LCAO method, bonding and antibonding MOs and their characteristics for s-s, s -p and p-p combination of atomic orbitals non-bonding combination of orbitals, MO treatment of homonuclear diatomic molecules and heteronuclear diatomic molecules such as CO, NO and NO⁺

Marks: 8

Unit -II: Coordination Chemistry and Inorganic material chemistry

Review of werner's theory. Types of ligands, monodentate, bidentate ambidentate and polydentate ligands (including Acceptor and macrocyclic ligands. IUPAC (post 2005). Nomenclature of Co-ordination compounds. Isomerism of 4-and 6- coordinate compounds. Introduction to valence bond and crystal field theory. Application of dimethyl glyoxime, EDTA, 8-hydroxy quinoline, 2,2 bipyridyl, and ethylene diamine in analysis.

Marks: 7

Section -II Organic Chemistry **[Marks 15]**

Unit-I: Aromatic Hydrocarbons

Aromatic Hydrocarbons:

Preparation (only benzene) from phenol by decarboxylation, from acetylene, from benzene sulphonic acid. Reactions- Electrophilic substitution in benzene- nitration, halogenations,

sulphonation, Friedel Craft alkylation and acylation with mechanism.

Marks: 5

Unit-II: Stereochemistry:

Conformations w.r.t. ethane, butane and cyclohexane (axial and equatorial bonds) Interconversion of wedge formula, Newman, Sawhorse and Fischer projection representation. **Concept of symmetry**: Elements of symmetry (Centre of inversion, axis of rotation plane of reflection and improper axis of rotation) applied to organic molecules.

Optical isomerism: Concept of chirality (with two stereogenic centres) diastereomers, threo and erythro, meso compounds, enantiomerism CIP Rules: R/S Nomenclature (up-to two chiral carbon atoms) Resolution of enantiomers and Racemisation.

Geometrical isomerism: -diastereoisomerism, Determination of configuration of geometric isomers. E&Z system of Nomenclature.

Marks: 10

Section III Physical Chemistry [Marks 15]

Unit – I: Solid state:

Forms of solids, preliminary idea of symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of crystallography-Law of constancy of interfacial angles. Law of rational indices. Miller indices X-Ray diffraction by crystals. Bragg's law. Structure of NaCl, KCl and CsCl (qualitative treatment only). Defects in crystals. Liquid crystal .

Marks: 7

Unit - II Chemical Thermodynamics & First law

Thermal equilibrium and zeroth law of thermodynamics- concept of temperature, Mechanical work, SI sign convention. 1st law of thermodynamics, internal energy, enthalpy, reversible and irreversible processes, calculation of W, Q, U, H for expansion of ideal gas , isothermal work and enthalpy, relation between enthalpy change, and entropy change, molar heat capacities, relation between Cp and Cv, adiabatic processes- relation between P, V and T, Joule-Thomson effect, liquefaction of gases, conversion of heat into work, efficiency of heat engine.

Enthalpy of reaction, thermodynamical equation, variation of enthalpy of reaction with temperature-Kirchhoff's equation, enthalpy of different processes. Hess law, Bond dissociation energy, Born-Haber cycle, calculations based on Hess law.

Marks: 8

SECOND SEMESTER
CHEMISTRY ELECTIVE PROGRAMME
NORTH LAKHIMPUR COLLEGE (AUTONOMOUS)
TOTAL CREDIT: 2 [L=64]
Paper Code: EP-2-CHE-203
Title: LAB [INORGANIC]

Practical

- 1) Inorganic Qualitative Analysis
Analysis of samples containing 4 radicals including interfering radicals,
phosphate, borate and fluoride. **(Marks-15)**

- 2) Inorganic Preparation – Chrome alum, Potash alum, Mohr's Salt, Potassium –
trioxalato Chromate, Hexammine Cobalt Chloride, Cu-Thiourea Complex,
Potassium trialumino oxalate. **(Marks-10)**

- 3) Viva **(Marks: 5)**