



**NSCB Memorial Govt. Degree College
Hamirpur
District Hamirpur (H.P.)**



Tel No.: 01972-222227, FAX: 01972-222227, e-Mail: gchamirpur-hp@nic.in

Lesson Plan

Session (2022-2023)

Name of Teachers: 1) Dr Shashi K. Sharma Class: BSc 1st year
2) Anjna Kumari
3) Dr. Sapana Kumari

Subject: Chemistry

Courses: CHEM101TH: Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons.
CHEM102TH: States of Matter, Chemical Kinetics & Functional Organic Chemistry.

Course Code: CHEM101TH &
CHEM102TH

S. No.	Date	Topics to be covered
Admission of BSc 1 st Year		Admission/Orientation
Week 1	29.08.2022-03.09.2022	CHEM101TH: Section A: Atomic Structure: Review of Bohr's theory and its limitations, dual behaviour of matter and radiation, de Broglie's relation, Heisenberg Uncertainty principle. Hydrogen atom spectra. Need of a new approach to Atomic structure. Schrodinger wave equation and meaning of various terms in it. Significance of ψ and ψ^2 .
Week 2	05.09.2022-10.09.2022	Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to 1s and 2s atomic orbitals. Significance of quantum numbers, Shapes of s, p and d atomic orbitals, nodal planes. Rules for filling electrons in various orbitals, Electronic configurations of the atoms.
Week 3	12.09.2022-17.09.2022	Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations. Slater rules and applications. Section B: Chemical Bonding and Molecular Structure Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds.
Week 4	19.09.2022-24.09.2022	Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.
Week 5	26.09.2022-01.10.2022	Covalent bonding- VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements. Concept of resonance and

		resonating structures in various inorganic and organic compounds. MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules up to Ne (including idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO and NO ⁺ . Comparison of VB and MO approaches
Week 6	03.10.2022-08.10.2022	CHEM102TH:SECTION - A Kinetic Theory of Gases: Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation. Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of state for real gases. Boyle temperature (derivation not required). Critical phenomena, critical constants and their calculation from van der Waals equation. Andrews isotherms of CO ₂ .
Week 7	10.10.2022-15.10.2022	Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance. Temperature dependence of these distributions. Most probable, average and root mean square velocities (no derivation). Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules. Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only).
Week 8	17.10.2022-21.10.2022	Liquids: 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 only) SECTION – B: Solids: Forms of solids. 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.
	22.10.2022-26.10.2022	Diwali Break
Week 9	27.10.2022-29.10.2022	Miller indices. X– Ray diffraction by crystals, Bragg’s law. Structures of NaCl, KCl and CsCl (qualitative treatment only). Defects in crystals.
Week 10	31.10.2022-05.11.2022	Chemical Kinetics: The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation
Week 11	07.11.2022-12.11.2022	Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only). CHEM101TH: SECTION - C Fundamentals of Organic Chemistry Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis.
Week 12	14.11.2022-19.11.2022	Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Hückel’s rule.

Week 13	21.11.2022-26.11.2022	Stereochemistry: Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newman, Sawhorse and Fischer projections. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis - trans nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems).
Week 14	28.11.2022-03.12.2022	SECTION – D: Aliphatic Hydrocarbons: Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure. Alkanes: (Upto 5 Carbons). Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution: Halogenation. Alkenes: (Upto 5 Carbons) Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction).
Week 15	05.12.2022-10.12.2022	Reactions: cis-addition (alk. KMnO ₄) and trans-addition (bromine), Addition of HX (Markownikoff's and antiMarkownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation. Alkynes: (Upto 5 Carbons) Preparation: Acetylene from CaC ₂ and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. Reactions: Formation of metal acetylides, addition of bromine and alkaline KMnO ₄ , ozonolysis and oxidation with hot alkaline KMnO ₄ .
Week 16	12.12.2022-17.12.2022	CHEM102TH: SECTION – C: Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure. Aromatic hydrocarbons Preparation (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid. Reactions: (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene). Alkyl Halides (Upto 5 Carbons) Types of Nucleophilic Substitution (SN ₁ , SN ₂ and SN _i) reactions. Preparation: from alkenes and alcohols.
Week 17-18	19.12.2022-31.12.2022	House Examination
	01-01-2023-04.02.2023	Winter Vacations
Week 19	06.02.2023-11.02.2023	Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation, Williamson's ether synthesis. Aryl Halides Preparation: (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions. Reactions (Chlorobenzene): Aromatic nucleophilic substitution (replacement by –OH group) and effect of nitro substituent. Benzyne Mechanism: KNH ₂ /NH ₃ (or NaNH ₂ /NH ₃). Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides
Week 20	13.02.2023-18.02.2023	SECTION – D: Alcohols, Phenols and Ethers (Upto 5 Carbons)- Alcohols: Preparation: Preparation of 1 ^o , 2 ^o and 3 ^o alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters. Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. KMnO ₄ , acidic dichromate, conc. HNO ₃). Oppeneauer oxidation Diols: (Upto 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement. Phenols: (Phenol case) Preparation: Cumenehydroperoxide method, from

		<p>diazonium salts. Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer - Tiemann Reaction, Gattermann-Koch Reaction, Houben–Hoesch Condensation, Schotten – Baumann Reaction</p>
Week 21	20.02.2023-28.02.2023	<p>Ethers (aliphatic and aromatic): Cleavage of ethers with HI. Aldehydes and ketones (aliphatic and aromatic): (Formaldehyde, acetaldehyde, acetone and benzaldehyde) Preparation: From acid chlorides and from nitriles. Reactions: Reaction with HCN, ROH, NaHSO₃, NH₂-G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Meerwein-Ponndorf-Verley reduction</p>
Term End Practical/ Theory Examinations		

Lesson Plan

Session (2022-2023)

Name of Teacher: 1) Dr. Shashi K. Sharma

Class: BSc 1st year

2) Anjna Kumari

3) Dr. Sapana Kumari

Subject: Chemistry

Courses: CHEM101PR: Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons.

CHEM102PR: States of Matter, Chemical Kinetics & Functional Organic Chemistry.

Course Code: CHEM101PR&CHEM102PR Lab No. I, II, III

Month	List of Experiments
September	CHEM101PR Inorganic Chemistry - Volumetric Analysis <ol style="list-style-type: none">1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.2. Estimation of oxalic acid by titrating it with KMnO_4.3. Estimation of water of crystallization in Mohr's salt by titrating with KMnO_4.4. Estimation of Fe (II) ions by titrating it with $\text{K}_2\text{Cr}_2\text{O}_7$ using internal indicator.
October	5. Estimation of Cu (II) ions iodometrically using $\text{Na}_2\text{S}_2\text{O}_3$. Organic Chemistry <ol style="list-style-type: none">1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.2. Separation of mixtures by Chromatography: Measure of R_f value of a mixture of two organic compounds.
November	CHEM102PR Physical Chemistry Practicals <ol style="list-style-type: none">1 Surface tension measurement : a) Determination of the surface tension of a liquid or a dilute solution using a stalagmometer. b) Study of the variation of surface tension of a detergent solution with concentration.2. Viscosity measurement: a) Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer. b) Study of the variation of viscosity of an aqueous solution with concentration of solute.3 Chemical Kinetics Study the kinetics of the following reaction: i). Acid hydrolysis of methyl acetate with hydrochloric acid. ii). Saponification of ethyl acetate. iii). Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methyl acetate
December/February	Organic Chemistry Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative. and melting point determination.