ORGANIC CHEMISTRY
SYLLABUS
CHEMISTRY GENERAL

Semester I

Module - I

Introductory Concept &Stereochemistry (6-7L):

Inductive effect, electromeric effect, conjugation, resonance and resonance energy, hyperconjugation. Homolytic and heterolytic bond breaking,Electrophiles and nucleophiles; carbocations, carbanions and radicals (stability andreactivity).

Stereochemistry of carbon compounds: Different types of isomerism,enatiomers and diastereoisomers;Fischer,Sawhorse, and Newman Projection formulae of simple molecules containing one and twoasymmetric carbon atom (s).Asymmetric carbon atom, chirality, optical activity.Elements ofsymmetry, E and Z nomenclature, D and Lnomenclature (for carbohydrates and aminoacids only). R and S nomenclature of one stereogenic centre.

Aliphatic& Aromatic Hydrocarbons(4-5 L):

Electrophliic addition reactionsto C=C, mechanism of bromination and hydrohalogenation;Markownikoff's addition, peroxide effect. hydration, hydroboration, ozonide formation,epoxidation, hydroxylation,

General mechanism of electrophilic substitution reactions of benzene. Synthesisof aromatic compounds using nitration, suplhonation, Halogenation, Friedel-craftalkylations and acylation reactions.

Module – II

Alkyl and Aryl halides(4 L)::

Methods of synthesis, S_N1, S_N2, E1, E2 reactions (elementary mechanisticaspects).Saytzeff and Hofmann elimination reactions, reactivity of aromatic halides,nucleophilic aromatic substitution reactions(ArS_N2 only).

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Cabonyl compounds, Carboxylic acids & derivatives (10L):

The nature of carbonyl group, nucleophilic addition to C=O,Cannizzaro reaction,Reformatsky's reaction. Relative reactivities and distinction of aldehydes and ketones,Formation and reactions of enolates,aldol condensation, Perkinreaction, Benzoin Condensation, Claisen Condensation.

Phenols (8 L):

Synthesis. Acidic character and chemical reactions of phenols, Kolbe's reactions,Reimer- Tiemann reaction, Fries rearrangement, Claisen rearrangement, nitrophenols.

Module – III

Organic Compounds Containing Nitrogen (8 L):

Aromatic nitro compounds: Their synthesis and reduction under differentcondition.Methods of synthesis of aliphatic amines. Hofmann degradation,Gabriel's phthalimide synthesis.Hinsberg method of amineseparation distinction ofprimary, secondary and tertiary amines. Methods of synthesis of aromatic amines,Diazotisationand coupling reactions and theirmechanisms.Synthetic applications of diazonium salts.

Introduction to Biomolecules (8L):

Constitution of glucose, osazone formation by glucose, mutarotation of glucose, cyclic structure of aldose (arabinose).

Pyranose form of glucose, chain lengthening and chain shortening of glucose.

Strecker synthesis, zwitter ion structure, isoelectric point.

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Semester II

Module – 1

Atomic Structure & Periodicity – (14 L)

- Wave Nature of electrons, de Broglie equation, Schrödinger Wave Equation (preliminary idea), radial wave functions and radial distribution curves, s, p, d orbitals and their shape (qualitative idea).
- Exchange energy and extra stability of half-filled & full-filled orbitals; effective nuclear charge and its calculation using Slater's rules.
- Modern Periodic Table, trends in atomic & ionic radii, trends in Ionization Energy, Electron Affinity & Electronegativity (Pauling's scale only).
- Ionic potential & diagonal relationship in the Periodic Table, IUPAC Nomenclature (Z >100).

Module – 2

Bonding – (10 L)

- Radius ratio, its applications and limitations, lattice energy, Born-Lande equation (no deduction, application only), Born Haber cycle & its applications; polarization &Fajan's rules.
- VSEPR Theory, Hybridization, resonance, bond moment, dipole moment, Hydrogen bonding & its applications, Van der Waal's forces.
- MOT – simple MO energy level diagram of Li_2-N_2, O_2 &F_2 ; Band Theory & bonding in metals (qualitative idea only).

Module – 3

Acid – Base & Coordination Chemistry – (16 L)

- Bronsted – Lowry definition, Lewis definition, HSAB principle (all elementary ideas with examples)
- Acid Base equilibrium, Ostwald's Dilution Law, strength of weak acids and bases, K_w of water, pH – concept,salt hydrolysis (strong acid/weak base, weak acid/strong base, weak acid/weak base) Hendersen's equation (numerical problems), buffer capacity, acid – base titrations, indicators & choice of indicators in acid – base titrations.
- Double and complex salts, Werner's theory, type of ligands (mono, bi, tri….), chelates, macrocyclic ligands, applications of chelates in chemical analysis, applications of chelates in chemical analysis, role of macrocyclic ligands in biological systems, IUPAC nomenclature of coordination complexes.

PHYSICAL CHEMISTRY
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Semester III

Module – I (12 L)

Chemical Kinetics

a. Definition of rate of a chemical reaction in terms of degree of advancement.
b. Introduction of some methods to study a chemical reaction to find its rate.
c. Definition of order of a reaction.
d. Methods for determination of order of a reaction.
e. Dimension of rate and rate constants for reactions with different orders.
f. Integrated rate law for (i) zeroth, (ii) first, (iii) second and (iv) n'th order cases.
g. Nature of variation in concentration with time for reactions with different orders.
h. Use of the integrated rate laws in determining order of a chemical reaction.
i. Half- life period, its expression for reactions with different orders.
j. Usage of half- life period in determining order of a chemical reaction.
k. Expression of rate constant for binary reaction involving gases.
l. Variation of rate constant with temperature: Arrhenius equation.

Module – II (12 L)

Electrical conductance

a. Metallic and electrolytic conduction.
b. Ions as charge carrier.
c. Strong and weak electrolytes.
d. Solvation of ions in solution: effect of charge to radius ratio.
e. Interaction among ions in solution and its variation with concentration (qualitative idea of asymmetric and electrophoretic effect).
f. Definition of specific and equivalent conductance.
g. Variation in conductance, specific conductance and equivalent conductance with concentration.
h. Equivalent conductance at infinite dilution: Kohlrausch law of independent migration.
i. Interrelation among strength of current, specific conductance, ionic mobility and ion conductance.
j. Definition of transport number and expression.

Module III: **(24 L)**

Chemical Thermodynamics

a. Validity of thermodynamic system.
b. System, surrounding and boundary
c. Classification of systems
d. Mode of interaction between system and surrounding.
e. Reversible and irriversible path of transformation of the system.
f. Work as the path function.
g. Calculation of work in hydrostatic system (IUPAC convention).
h. Work as the area under the PV indicator diagram.
i. State functions.
j. Internal energy and its change.
k. Mathematical statement of first law of thermodynamics.
l. Calculation of heat transferred.
m. Enthalpy (state function and calculation of its change)
n. Heat capacities (at constant pressure, C_p and at constant volume, C_v).
o. Difference between the heat capacities for ideal and van der Waals gas.
p. Relation between the state parameters in case of reversible adiabatic processes involving ideal gases.
q. Need for the second law.
r. Definition of entropy.