**CHEMISTRY**

**MID SEMESTER – I SYLLABUS(2019-2020)**

**SEMESTER - I**

**UNIT –I**

p-block elements –I

Group-13: Synthesis and structure of diborane and higher boranes

(B4H10 and B5H9**),** boron-nitrogen compounds (B3N3H6 and BN) and carboranes

Group - 14: Preparation and applications of silanes, silicones and graphitic compounds.

Group - 15: Preparation and reactions of hydrazine, hydroxylamine and Phosphazenes.

**UNIT-IV**

l. **Acyclic Hydrocarbons**

Alkenes - Preparation of alkenes. Properties: Addition of hydrogen - heat of

hydrogenation and stability of alkenes. Addition of halogen and its mechanism. Addition

of HX, Markonikov's rule, addition of H2O, HOX, H2SO4 with mechanism and addition

of HBr in the presence of peroxide (anti - Markonikov's addition). Dienes - Types of

dienes, reactions of conjugated dienes - 1,2 and 1,4 addition of HBr to 1,3 - butadiene

and Diel's - Alder reaction.

Alkynes - Preparation by dehydrohalogenation of dihalides, dehalogenation of

tetrahalides, Properties; Acidity of acetylenic hydrogen (formation of Metal acetylides).

Preparation of higher acetylenes, Metal ammonia reductions, Physical properties.

Chemical reactivity - electrophilic addition of X2, HX, H2O (Tautomerism), Oxidation

with KMnO4, OsO4, reduction and Polymerisation reaction of acetylene.

2. **Alicyclic hydrocarbons (Cycloalkanes)**

Nomenclature, Preparation by Freunds method, Wislicenus method. Properties -

reactivity of cyclopropane and cyclobutane by comparing with alkanes, Stability of

cycloalkanes - Baeyer's strain theory, Sachse and Mohr predictions and Pitzer's strain

theory. Conformational structures of cyclobutane, cyclopentane, cyclohexane.

**UNIT-III**

**Structural theory in Organic Chemistry (HALF UNIT)**

Types of bond fission and organic reagents (Electrophilic, Nucleophilic, and free radical

reagents including neutral molecules like H2O,NH3& AlCl3).

Bond polarization: Factors influencing the polarization of covalent bonds, electro

negativity - inductive effect. Application of inductive effect (a) Basicity of amines (b)

Acidity of carboxylic acids (c) Stability of carbonium ions. Resonance or Mesomeric

effect, application to (a) acidity of phenol, and (b) acidity of carboxylic acids.

**SEMESTER - III**

**UNIT –I**

**1. Chemistry of d-block elements:**

Characteristics of d-block elements with special reference to electronic configuration,

variable valence, magnetic properties, catalytic properties and ability to form

complexes. Stability of various oxidation states.

**2. Theories of bonding in metals:**

Metallic properties and its limitations, Valence bond theory, Free electron theory,

Explanation of thermal and electrical conductivity of metals, limitations, Band

theory, formation of bands, explanation of conductors, semiconductors and

insulators.

**UNIT – III**

**1. Halogen compounds**

Nomenclature and classification of alkyl (into primary, secondary, tertiary), aryl, aryl

alkyl, allyl, vinyl, benzyl halides.

Nucleophilic aliphatic substitution reaction- classification intoSN1 andSN2 – reaction

mechanism with examples – Ethyl chloride, t-butyl chloride and optically active alkyl

halide 2-bromobutane.

2. **Hydroxy compounds**

Nomenclature and classification of hydroxy compounds.

Alcohols: Preparation with hydroboration reaction, Grignard synthesis of alcohols.

Phenols: Preparation i) from diazonium salt, ii) from aryl sulphonates, iii) from

cumene. Physical properties- Hydrogen bonding (intermolecular and intramolecular).

Effect of hydrogen bonding on boiling point and solubility in water.

Identification of alcohols by oxidation with KMnO4, Ceric ammonium nitrate, Luca’s

reagent and phenols by reaction with FeCl3.

Chemical properties:

a) Dehydration of alcohols.

b) Oxidation of alcohols by CrO3, KMnO4.

c) Special reaction of phenols: Bromination, Kolbe-Schmidt reaction, Riemer-Tiemann

reaction, Fries rearrangement, azocoupling, Pinacol-Pinacolone rearrangement.

**UNIT-IV**

**Carbonyl compounds (HALF UNIT)**

Nomenclature of aliphatic and aromatic carbonyl compounds, structure of the carbonyl

group. Synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones

using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids.

Physical properties: Reactivity of carbonyl group in aldehydes and ketones.

Nucleophilic addition reaction with a) NaHSO3, b) HCN, c) RMgX, d) NH2OH,

e)PhNHNH2, f) 2,4 DNPH, g) Alcohols-formation of hemiacetal and acetal. Base

catalysed reactions: a) Aldol, b) Cannizzaro’s reaction, c) Perkin reaction, d) Benzoin

condensation, e) Haloform reaction, f) Knoevenagel reaction.

**SEMESTER-V**

**Paper - Va (INORGANIC, ORGANIC & PHYSICAL CHEMISTRY)**

**UNIT- III**

**Nitro hydrocarbons**:

Nomenclature and classification-nitro hydrocarbons, structure -Tautomerism of

nitroalkanes leading to aci and keto form, Preparation of Nitroalkanes, reactivity -

halogenation, reaction with HONO (Nitrous acid),Nef reaction and Mannich reaction

leading to Micheal addition and reduction.

**UNIT – IV**

**Nitrogen compounds :**

Amines (Aliphatic and Aromatic): Nomenclature, Classification into 1°, 2°, 3° Amines

and Quarternary ammonium compounds. Preparative methods –

1. Ammonolysis of alkyl halides 2. Gabriel synthesis 3. Hoffman's bromamide reaction

(mechanism).

Reduction of Amides and Schmidt reaction. Physical properties and basic character -

Comparative basic strength of Ammonia, methyl amine, dimethyl amine, trimethyl amine

and aniline - comparative basic strength of aniline, N-methylaniline and N,N-dimethyl

aniline (in aqueous and non-aqueous medium), steric effects and substituent effects.

Chemical properties: a) Alkylation b) Acylation c) Carbylamine reaction d) Hinsberg

separation e) Reaction with Nitrous acid of 1°, 2°, 3° (Aliphatic and aromatic amines).

Electrophillic substitution of Aromatic amines – Bromination and Nitration. Oxidation of

aryl and Tertiary amines, Diazotization.

**UNIT- V**

**Thermodynamics (HALF UNIT)**

The first law of thermodynamics-statement, definition of internal energy and enthalpy.

Heat capacities and their relationship. Joule-Thomson effect- coefficient. Calculation of

w, for the expansion of perfect gas under isothermal and adiabatic conditions for

reversible processes. State function. Temperature dependence of enthalpy of formation-

Kirchoff s equation.

**SEMESTER-V**

**Paper - Vb (INORGANIC, ORGANIC & PHYSICAL CHEMISTRY)**

**UNIT- II**

**Heterocyclic Compounds**

Introduction and definition: Simple five membered ring compounds with one hetero atom

Ex. Furan. Thiophene and pyrrole - Aromatic character – Preparation from 1,4,-

dicarbonyl compounds, Paul-Knorr synthesis.

Properties : Acidic character of pyrrole - electrophillic substitution at 2 or 5 position,

Halogenation, Nitration and Sulphonation under mild conditions - Diels Alder reaction

in furan.

Pyridine – Structure - Basicity - Aromaticity - Comparison with pyrrole - one method of

preparation and properties - Reactivity towards Nucleophilic substitution reaction.

**UNIT-III**

**Carbohydrates**

Monosaccharides: (+) Glucose (aldo hexose) - Evidence for cyclic structure of glucose

(some negative aldehydes tests and mutarotation) - Proof for the ring size (methylation,

hydrolysis and oxidation reactions) - Pyranose structure (Haworth formula and chair

conformational formula).

(-) Fructose (ketohexose) - Evidence of 2 - ketohexose structure (formation of

pentaacetate, formation of cyanohydrin its hydrolysis and reduction by HI). Cyclic

structure for fructose (Furanose structure and Haworth formula) - osazone formation

from glucose and fructose – Definition of anomers with examples.

Interconversion of Monosaccharides: Aldopentose to Aldohexose (Arabinose to

D- Glucose, D-Mannose) (Kiliani - Fischer method). Epimers, Epimerisation - Lobry de

bruyn van Ekenstein rearrangement. Aldohexose to Aldopentose (D-Glucose to

D- Arabinose) by Ruff degradation. Aldohexose to Ketohexose

[(+) Glucose to (-) Fructose] and Ketohexose to Aldohexose (Fructose to

Glucose)

**UNIT- IV**

**Amino acids and proteins (HALF UNIT)**

Introduction: Definition of Amino acids, classification of Amino acids into alpha,

beta, and gamma amino acids. Natural and essential amino acids - definition and

examples, classification of alpha amino acids into acidic, basic and neutral amino

acids with examples. Methods of synthesis: General methods of synthesis of

alpha amino acids (specific examples - Glycine, Alanine, valine and leucine) by

following methods: a) from halogenated carboxylic acid b) Malonic ester

synthesis c) strecker's synthesis.