

# SYLLABUS FOR FOUR YEAR INTEGRATED B.Sc. B.Ed. COURSE

FIRST YEAR



2024-25

## PAPER -I INORGANIC CHEMISTRY

### UNIT: I

#### Chemical Bonding-Covalent bond

Valence bond theory and its limitation, Directional characteristics of covalent bond, Hybridizations- $sp$ ,  $sp^2$ ,  $sp^3$ ,  $dsp^2$ ,  $sp^3d$ ,  $dsp^3$  and  $d^2sp^3$  with suitable examples. Shapes of inorganic molecules and ions.

Valence shell electron pair repulsion (VSEPR) theory and its application to study the geometry of  $NH_3$ ,  $H_2O$ ,  $H_3O^+$ ,  $SF_4$ ,  $ICl_2$ ,  $ClF_3$ ,  $ICl_4$ ,  $XeF_4$ ,  $XeF_6$ , molecules. Molecular orbital theory and molecular orbital diagrams for homo and heterodiatomic molecules-  $H_2$ ,  $H_2^+$ ,  $He_2^+$ ,  $HHe^+$ ,  $Li_2$ ,  $Be_2$ ,  $B_2$ ,  $C_2$ ,  $N_2$ ,  $O_2$ ,  $F_2$ ,  $O_2^+$ ,  $O_2^-$ ,  $O_2^{2+}$ ,  $O_2^{2-}$ ,  $CO$  and  $NO$ .

Bonding in diborane ( $3c-2e$  bonding).

### UNIT: II

#### Chemical Bonding- Ionic Bond

Lattice energy and Born-Haber cycle. Solvation energy, solubility of ionic solids, Fajan's rule, polarizing power and polarizability of ions.

Structures of ionic solids, radius ratio effect and co-ordination number. Limitations of radius ratio rule.

Hydrogen bonding and vander-waal's forces of attractions.

### UNIT: III

#### s-Block elements

Periodicity in properties of alkali and alkaline earth metals. Complexation tendency, Solvation tendency, stability and solubilities of carbonates, bicarbonates and sulphates of Magnesium and Calcium, Synthesis and applications of important hydrides:  $NaH$ ,  $NaBH_4$ ,  $LiH$ ,  $LiBH_4$ ,  $LiAlH_4$  and  $CaH_2$ .

**Cement:** Composition and types of Cement, Manufacture of Portland cement.

**Lime:** Industrial preparation, Properties and Uses.

### UNIT: IV

#### p-Block elements

Periodicity in properties of III A, IV A, V A, VI A and VII A group elements.

Silicates, oxides of nitrogen, phosphorous and sulphur- their structure and preparations.

**Glass:** Types and properties of glasses, coloring agents, Industrial manufacturing of glass.

**Nitrogen fixation-** Natural and Artificial fixation. Role of nitrogenase in biological nitrogen fixation.

**UNIT: V**

**Qualitative Analysis**

Theoretical basis of qualitative analysis, Systematic analysis of Acidic and Basic radicals (including interfering radicals), Chemical reactions involved.

Common- ion effect, solubility product & their applications. Oxidizing and reducing agents and buffers used in analysis.

**Books Recommended:**

1. Inorganic Chemistry by Satya Prakash
2. Inorganic Chemistry by R.C. Agarwal
3. Inorganic Chemistry by B.R. Puri and L.R. Sharma
4. Inorganic Chemistry by P.L. Soni
5. Inorganic Chemistry by G.C. Shivhare and V.P. Lavanla
6. Inorganic Chemistry for B.Sc. I yr by Vikal Gupta
7. Practical Chemistry by Giri, Bajpai and Pandey

**PAPER -II**  
**Organic Chemistry**

**UNIT: I**

**Mechanism of Organic Reactions**

Classification of organic compounds their general characteristics. Types of reagents – electrophiles and nucleophiles. Types of organic reactions. Reactive intermediates – carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic species. Methods of determination of reactions mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).

**UNIT: II**

**Stereochemistry of Organic Compounds**

Concept of isomerism. types of isomerism

Optical isomerism – elements of symmetry, molecular chirality, enantiomers, stereogenic center, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature.

Geometric isomerism : Determination of configuration of geometric isomers. E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds.

Conformational isomerism :Newman projection and Sawhorse formulae, Fischer and flying wedge formulae. Difference between configuration and conformation.

conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives.

**UNIT: III**

**Alkanes , Cycloalkanes, Dienes and Alkynes**

Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity  
Cycloalkanes – nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring: banana bonds.

Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions – 1, 2-and 1, 4-additions, Diels-Alder reaction.

Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidic nature of 1-alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation, oxidation and polymerization.

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#### UNIT: IV

##### Arenes and Aromaticity

Nomenclature of benzene derivatives. Aryl group. Aromatic nucleus and side chain. Structure of benzene: molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure, MO picture.

Aromaticity: the Huckel rule, aromatic ions.

Aromatic electrophilic substitution – general pattern of the mechanism, role of  $\sigma$ - and  $\pi$ -complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Birch reduction.

Methods of formation and chemical reactions of alkylbenzenes, Structure, preparation and properties of naphthalene.

#### UNIT: V

##### Alkyl and Aryl Halides

Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides,  $S_N2$  and  $S_N1$  reactions with energy profile diagrams. Mechanism of elimination reactions of alkyl halides, regioselectivity in dehydrohalogenation, Saytzeff rule.

Methods of formation of aryl halides, nuclear and side chain reactions. The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions.

Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides towards nucleophilic substitution reactions. Synthesis and uses of DDT and BHC.

##### Books Recommended:

1. Advanced Organic Chemistry by Mukheri and Kapoor Vol. I & II
2. A Text Book of Organic Chemistry by M.K. Jain
3. A Text Book of Organic Chemistry by R.K. Bansal
4. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice-Hall
5. Organic Chemistry for B.Sc. I yr by Vikal Gupta

# Jai Narain Vyas University, Jodhpur

B.Sc. B.Ed. Four year Integrated Programme

Syllabus and marking scheme for chemistry practical exam

B.Sc. B.Ed. Part I

M.M.: 50

Min Pass marks: 20

#### Laboratory course I

##### 1. Inorganic Chemistry [25]

Qualitative analysis of inorganic mixture containing 5-radicals (anions and cations), separation and identification of (group 0, I, II, III, IV, V and VI) and anions including interfering radicals and special combination of acidic radicals ( $\text{CO}_3^{2-}$  and  $\text{SO}_3^{2-}$ ,  $\text{NO}_3^-$  and  $\text{NO}_2^-$ ;  $\text{NO}_3^-$  and  $\text{Br}^-/\text{I}^-$ ;  $\text{Cl}^-$ ,  $\text{Br}^-$  and  $\text{I}^-$ ;  $\text{S}^{2-}$ ,  $\text{SO}_3^{2-}$  and  $\text{SO}_4^{2-}$ )

##### 2. Organic Chemistry: [10]

(i) Organic models:

R and S configuration of optical isomers

E/Z configuration of geometrical isomers, Conformation isomerism of ethane and n-butane

(ii) Calibration of Thermometer:

The following compounds may be used for the calibration purpose  $80^\circ\text{--}82^\circ$  (Naphthalene),  $113.5^\circ\text{--}114^\circ$  (Acetanilide),  $132.5^\circ\text{--}133^\circ$  (Urea) and  $122^\circ$  (Benzoic acid).

##### 3. Viva [05]

##### 4. Sessional and Record [10]

##### Examination & Marking Scheme

| Time: 5 hours        | Max. Marks: 50 | Min. Pass Marks: 20 |
|----------------------|----------------|---------------------|
| Inorganic Chemistry  |                | 25                  |
| Organic Chemistry    |                | 10                  |
| Viva                 |                | 05                  |
| Sessional and Record |                | 10                  |
| Total                |                | 50                  |

Inorganic qualitative mixture for 5 radicals:  $5 \times 5 = 25$

- a) For Reporting each correct radical 3
  - b) For performing experiment 2
- Organic Chemistry: 5 marks reserved for correct writing.