

# Syllabus of Chemistry (Major & Minor) for 3-Year and 4-Year B.Sc. Course

## Chemistry Minor

### Semester III/IV

Paper Code: CHEMMN-2T (Minor A/B) (Credit:03)

Total lecture: 45

(Physical Chemistry -I + Inorganic Chemistry-II)

#### Physical Chemistry-I

##### 1. Kinetic Theory of Gases and Real Gases

(9L)

a. Concept of pressure and temperature; Collision of gas molecules; Collision diameter; Collision number and mean free path; Frequency of binary collisions (similar and different molecules); Rate of effusion

b. Nature of distribution of velocities, Maxwell's distribution of speed and kinetic energy; Average velocity, root mean square velocity and most probable velocity; Principle of equipartition of energy and its application to calculate the classical limit of molar heat capacity of gases

c. Deviation of gases from ideal behavior; compressibility factor; Boyle temperature; Andrew's and Amagat's plots; van der Waals equation and its features; its derivation and application in explaining real gas behaviour; Existence of critical state, Critical constants in terms of van der Waals constants; Law of corresponding states

d. Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only)

##### 2. Liquids

(4L)

Definition of Surface tension, its dimension and principle of its determination using stalagmometer; Viscosity of a liquid and principle of determination of coefficient of viscosity using Ostwald viscometer; Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only)

##### 3. Solids

(4L)

Forms of solids, crystal systems, unit cells, Bravais lattice types, Symmetry elements; Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices; Miller indices of different planes and interplanar distance, Bragg's law; Structures of NaCl, KCl and CsCl treatment only); Defects in crystals; Glasses and liquid crystals.

##### 4. Chemical Kinetics

(6L)

a) Introduction of qualitative rate law, order and molecularity; Extent of reaction; rate constants; Rates of First, second and nth order reactions and their Differential and integrated forms (with derivation);

Pseudo first order reactions; Determination of order of a reaction by half-life and differential method; Opposing reactions, consecutive reactions and parallel reactions

b) Temperature dependence of rate constant; Arrhenius equation, energy of activation; Collision theory; Lindemann theory of unimolecular reaction; outline of Transition State theory (classical treatment)

## **Inorganic Chemistry-II**

### **1. Chemical Bonding and Molecular Structure (14L)**

**a) 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. Statement of Born- Landé equation for calculation of lattice energy, Born-Haber cycle; Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

**b) Covalent bonding:** VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples from s and p block elements of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.

**c) 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 and heteronuclear diatomic molecules such as CO, NO. Comparison of VB and MO approaches.

### **2. Comparative study of p-block elements (8L)**

Group trends in electronic configuration, modification of pure elements, common oxidation states, inert pair effect, and their important compounds in respect of the following groups of elements:

- i. B-Al-Ga-In-Tl
- ii. C-Si-Ge-Sn-Pb
- iii. N-P-As-Sb-Bi
- iv. O-S-Se-Te
- v. F-Cl-Br-I

#### **Recommended Text Books:**

1. Lee, J. D. Concise Inorganic Chemistry, 5th Ed., Wiley India Pvt. Ltd., 2008.
2. Atkins, Overton, Rourke, Weller, Armstrong; Shriver & Atkins' Inorganic Chemistry, 5th Ed., Oxford University Press (2010).
3. Levine, I. N. Physical Chemistry, 6th Edition McGraw-Hill India, 2011
4. Castellan, G. W. Physical Chemistry, Narosa, 2004
5. Atkins, P. W. & Paula, J. de, Atkins' Physical Chemistry, 11th Edition, Oxford University Press, 2018
6. G. L. Miessler, D. A. Tarr, Inorganic Chemistry, 3rd Edition, Pearson India, 2008
7. R.P. Sarkar, General and Inorganic Chemistry (Part – I, 3<sup>rd</sup> Revised Edition; and Part-II), New Central Book Agency.
8. B. R. Puri, L. R. Sharma, M. S. Pathania, Principles of Physical Chemistry (48th Edition), Vishal Publishing Co.

**Paper Code: CHEMMN-2P (Minor A/B) Semester: III/IV  
(Physical Chemistry-1 + Inorganic Chemistry-2 Practical)**

**(Credit:01)**

**Physical Chemistry**

1. Surface tension measurement (use of organic solvents excluded)
  - (a) Determination of the surface tension of a liquid or a dilute solution using a Stalagmometer
2. Viscosity measurement (use of organic solvents excluded)
  - (a) Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.

**Inorganic Chemistry**

Qualitative semi-micro analysis of mixtures containing three radicals. Emphasis should be given to the understanding of the chemistry of different reactions.

Acid Radicals:  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ ,  $\text{NO}_2^-$ ,  $\text{NO}_3^-$ ,  $\text{S}^{2-}$ ,  $\text{SO}_4^{2-}$ ,  $\text{PO}_4^{3-}$ ,  $\text{BO}_3^{3-}$ .

Basic Radicals:  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{2+}$ ,  $\text{Sr}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Cr}^{3+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{NH}_4^+$

**Reference Books:**

1. Chemistry in Laboratory (New Revised Edition), S. Ghosh, M. Das Sarma, D. Majumdar, S. Manna; Santra Publication Pvt. Ltd.
2. A. K. Nad, B. Mahapatra & A. Ghosal, An Advanced Course in Practical Chemistry, New Central Book Agency (P) Ltd.
3. Advanced Practical Chemistry (3<sup>rd</sup> Edition), S.C. Das.