**INORGANIC CHEMISTRY I**

**23135**

**Theoretical**

**3 Credit units**

**Prerequisite: General Chemistry II**

**Syllabus**

**Chapter One: Introduction to Some Fundamental Concepts in Atomic Structure**

1.1 The wave-nature of electrons and de Broglie equation

1.2 The uncertainty principle

1.3 The Quantum Mechanics Postulates

1.4 The Schrodinger wave equation: its solution for Particle in one-and three-dimensional box

1.5 Determination of energy levels and the effect of the box dimensions

1.6 The definition of degeneracy

1.7 The Hydrogen wave function and its quantum numbers

1.8 The radial and angular parts of the wavefunction and orbital definition: their types and shapes

1.9 The spin quantum number and the magnetic spin quantum number

1.10 Magnetic properties and Gouy balance method

1.11 Many-electron atoms and hydrogen-like wave function

1.12 The aufbau principle and Diagrammatic representations of electronic configurations

1.13 Term symbol determination for free atoms and ions by Russell–Saunders coupling method

1.14 Hund’s and Pauli’s rules

1.15 Penetration and shielding

1.16 The quantum energy levels and the periodic table

1.17 Ionization energies and electron affinity

**Chapter Two: An introduction to molecular symmetry**

2.1 Symmetry

2.2 Symmetry operations and symmetry elements

2.3 Products of Symmetry Operations

2.4 Point groups: Definition and Determination

2.5 Matrix method in determination of symmetry operation products

2.6 Character Table – determination for C2v

2.7 Classes of Symmetry Operations

2.8 Reducible Representation

2.9 Derivation of irreducible representation from Reducible representations

**Chapter Three: Bonding in polyatomic** **molecules**

3.1 The valence bond (VB) model of bonding in diatomic molecules

3.2 Hybridization of atomic orbitals and shape of molecule

3.3 Hybrid orbitals

3.4 Resonance structures

3.5 Electronegativity -Pauling, Mulliken, Allred–Rochow electronegativity values

3.6 Formal charge

3.7 Dipole moments

3.8 Molecular Orbital (MO) Theory applied to the bonding in Homonuclear diatomic molecules

3.9 Molecular Orbital Theory applied to the bonding in Heteronuclear diatomic molecules

3.10 Molecular orbital theory: the ligand group orbital approach and application to multiatomic molecules

3.11 A comparison of the MO and VB bonding models

**Chapter Four: Structures and energetics of metallic and ionic solids**

4.1 Packing of spheres

4.2 Crystal structure, the unit cell and close-packing

4.3 Polymorphism: phase changes in the solid state

4.4 Metallic radii

4.5 Alloys

4.6 Bonding in metals and semiconductors

4.7 Band theory of metals and insulators

4.8 Electrical conductivity and Fermi levels

4.9 Band theory of semiconductors

4.10 Extrinsic (n- and p-type) semiconductors

4.11 Ionic lattices, Ionic radii and coordination number

4.12 Application of X-ray in crystal structures

4.13 The rock salt (NaCl) lattice

4.14 The caesium chloride (CsCl) lattice

4.15 The fluorite (CaF2) lattice

4.16 The antifluorite lattice

4.17 The zinc blende (ZnS) lattice: a diamond-type network

4.18 The b-cristobalite (SiO2) lattice

4.19 The wurtzite (ZnS) structure

4.20 The rutile (TiO2) structure

4.21 The CdI2 and CdCl2 lattices: layer structures

4.22 The perovskite (CaTiO3) lattice: a double oxide

4.23 Lattice energy: estimates from an electrostatic model

4.24 Born–Haber cycle

4.25 Estimation of Madelung constants

4.26 Born forces

4.27 The Born–Lande´ equation

4.28 Lattice energy: ‘calculated’ versus ‘experimental’ values

4.29 The Kapustinskii equation

4.30 Estimation of electron affinities

4.31 Defects in solid state lattices

4.32 Schottky defect 158

4.33 Frenkel defect 158

4.34 Fajan’s rule

**Chapter Five: oxidation and Reduction**

5.1 Oxidation and reduction

5.2 Oxidation states

5.3 Oxidation states and Stock nomenclature

5.4 Standard reduction potentials, Eo, and relationships between Eo, Go and K

5.5 Defining and using standard reduction potentials, Eo

5.6 Disproportionation and Comproportionation reactions

5.7 Potential diagrams

5.8 Frost–Ebsworth diagram

5.9 Ellingham diagram

5.10 Latimer diagram

5.11 Pourpaix diagram

**Chapter Six: Acid and Base** Acids, bases and ions in aqueous solution 162

6.1 Hydrogen bonding

6.2 The self-ionization of water

6.3 Brønsted acid or base and their conjugated ones

6.4 Some Brønsted acids and bases

6.5 Factor affecting on the acid and base strength

6.6 Solvent leveling

6.7 Inorganic acids

6.8 Trends within a series of oxoacids EOn(OH)m

6.9 Aquated cations: formation and acidic properties

6.8 Amphoteric oxides

6.9 Lewis definition of acid and base

6.10 Hard and soft acid and Base

6.11 Drago-Wayland equation

**References**

1. **C.E. Houscroft, and A.G. Sharpe, “Inorganic Chemistry”, Pearson Education Limited, Printice Hall, the latest edition.**
2. **J.E. House, “Inorganic Chemistry”, Academic Press, the latest edition.**
3. **D. F. Shriver, A.W. Atkins, and C.H. Langford, “Inorganic Chemistry”, Oxford University Press, the latest edition.**