Department of Chemistry
University of Lucknow
Lucknow
B.Sc. Syllabus

Inorganic Chemistry

Semester VI **Paper 9** **Max Marks: 100 (80 + 20)**

Unit - I

I. Metal-ligand bonding in Transition Metal Complexes: Limitation of valence bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors effecting the crystal field parameters. Effect of CFSE on lattice energy, Ionic radii.

Unit - II

II. Magnetic Properties of Transition Metal Complexes: Types of magnetic behaviour, methods of determining magnetic susceptibility, spin only formula, L-S coupling, Spectroscopic ground state, Correlation of ε_S and ε_{eff} values. Orbital contribution to magnetic moments. Application of magnetic moment data for 3d metal complexes.

Unit - III

III. Silicones and phosphazenes as examples of inorganic polymers. Nature of bonding in triphosphazenes. Pseudohalogens and pseudohalides: Preparation, properties and reactions. Structure and bonding of NO, ligand behaviour of NO. Preparation of nitrosyl complexes, effective atomic number (EAN) as applied to nitrosyls.

Unit - IV

IV. Hard and Soft Acids and bases (HSAB) : Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness. Applications of HSAB principle, limitations of HSAB principle.

Text Books (Theory Courses):

a. Concise Inorganic Chemistry, J.D. Lee, Blackwell Science Ltd.
b. Inorganic Chemistry, Puri, Sharma, Kalia and Kaushal.
c. Pradeep's Inorganic Chemistry, K.K. Bhasin, Pradeep Publication.
d. Chemistry for degree students, R. L. Madan

Reference Books:

a. Inorganic Chemistry, J.E.Huheey, Ellen A. Keiter, Richard L. Keiter, Addison Wesley Longman (Singapore) Pvt. Ltd.
b. Inorganic Chemistry, D.E.Shriver, P W. Atkins and C.H.L. Langford, Oxford.
c. Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson and P.L. Gaus, Wiley.
d. Concepts of Models of Inorganic Chemistry, B.Douglas, D.McDaniel and J Alexander, John Wiley.
e. Inorganic Chemistry, WW. Porterfield, Addison - Wesley.
f. Inorganic Chemistry, A.G. Sharpe, ELBS
g. Inorganic Chemistry, G.L. Meissler and D.A. Tarr, Prentice-Hall.

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Inorganic Chemistry

Semester VI **Paper 10** **Max Marks: 100 (80 + 20)**

Unit – I

I. Thermodynamic and Kinetic Aspects of Metal Complexes: A brief outline of thermodynamic stability of metal complexes and factors affecting the stability. Substitution reaction of square planar complexes. Trans effect.

Unit - II

II. Electronic spectra of Transition Metal Complexes:

Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series, Orgel-energy level diagram for d^1 and d^9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion.

Unit - III

III. Organometallic Chemistry: Definition, types of organometallic compound and their general methods of preparation of alkyls and aryls of Li, Hg and Sn. Applications of organometallic compounds. Metal carbonyls. 18 electron rule, preparation, structure and nature of bonding in carbonyls.

Unit - IV

IV. Bioinorganic Chemistry: Introduction, metalloenzyme/carboxypeptidase, carboxy-anhydrase. Metalloporphyrens with special reference to haemoglobin and myoglobin (structure, cooperative effect, Bohr's effect). Inorganic complexes in cancer treatment, anti-arthritis drugs, chelation therapy, imaging agents.

Text Books (Theory Courses):

a. Concise Inorganic Chemistry, J.D. Lee, Blackwell Science Ltd.
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e. Inorganic Chemistry, W.W. Porterfield, Addison - Wesley.
f. Inorganic Chemistry, A.G. Sharpe, ELBS
g. Inorganic Chemistry, G.L. Meissler and D.A. Tarr, Prentice-Hall.
h. Bioinorganic Chemistry, K.H. Reddy, New Age

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Organic & Physical Chemistry

Semester VI **Paper 11** **Max Marks: 100 (80 + 20)**

UNIT I

I. Spectroscopy:

a. Rotational Spectroscopy of Diatomic Molecules: Energy level of a rigid rotor (semi classical principles) selection rules, spectral intensity, distribution using population distribution (Maxwell ï Boltzman distribution) determination of bond length, isotope effect.

b. Vibrational Spectrum-Infrared Spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of an harmonic motion and isotope on the spectrum.

c. Raman Spectrum: Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.

UNIT II

II. Elementary Quantum Mechanics: de Broglie's hypothesis, the Heisenberg's uncertainty principle, Hamiltonian operator. Statement of Born-oppenheimer approximation. Schrodinger wave equation and its importance. Physical interpretation of wave function, postulates of quantum mechanics, particle in one dimensional box. Schrodinger wave equation for H ï atom and its separations into three equations (without derivation), quantum numbers, wave function, angular wave functions.

III. Basic idea of molecular orbital theory, criteria for forming M.Oûs from A.Oûs, construction of M.O's by LCAO-H^{2+} ion, calculation of energy levels from wave functions, physical picture of bonding and antiboding wave functions, Hybrid Orbitals-sp, sp^2, sp^3, calculation of coefficients of A.O's used in sp and sp^2 hybrid orbital only. Introduction to valence bond model of H_2, comparison of M.O. and V.B. models.

UNIT III

I. Electromagnetic Spectrum Absorption Spectra:

a. Ultraviolet (UV) absorption spectroscopy -absorption laws (Beer-Lambert law); molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and Auxochrome, Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. U.V.spectra of conjugated enes and enones, woodward fieser rule

b. Infrared (I.R.) absorption spectroscopy- Molecular vibrations, Hook's law, Selection rules, intensity and position of I.R. bands, fingerprint region, characteristic absorptions of various functional groups and interpretation of I.R. spectra of simple organic

Organic & Physical Chemistry

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compounds-hydrocarbons, aldehydes & ketones in IR spectrum (positions only)

UNIT IV

II. Spectroscopy: Nuclear magnetic resonance (NMR): Spectroscopy, proton magnetic resonance (1H NMR) spectroscopy, nuclear shielding and deshielding. Chemical shifts and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of 'H NMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1, 1, 2 tribromoethane, ethyl acetate, toluene and acetophenones. Problems pertaining to the structure elucidation of simple organic compounds using 1H NMR spectroscopy techniques.

Book Suggested

a. Physical Chemistry G.M. Barrow. International Student Edition IMC Graw Hill.
b. Principles of Physical Chemistry Volume III, B.R.Puri,L.P.Sharma,and M.S.Pathania,Vishal Publication ,Jallandhar
c. Graduate Physical Chemistry,Volume III, L.R.Sharma and M.S .Pathania,2017
d. Fundamentals of Molecular spestroscopy,C.N .Banwell IV edition ,Mc Graw hill education
e. Quantum Chemistry by R.K.Prasad
f. Fundamental Principles of Spectroscopy, B.K.Sharma,Krishna Publication.