

B.Sc. Semester IV
Chem. – 204 [Inorganic Chemistry]

Unit:- I Wave –Mechanics [14 marks]

Basic postulates of quantum mechanics (Postulates 1,2,3 and 4); Operators: their addition, subtraction and multiplication; Commutators; Particle in a box (One dimensional); Zero potential energy; Characteristics of the wave functions; Electron in a ring.

Unit:-II Coordination Compounds [14 marks]

Application of valence bond theory to some complexes; Shortcoming of valence bond theory; Crystal Field Theory; Orientation of d-orbitals and Crystal Field Splitting of Energy levels; Crystal Field Splitting in Octahedral complexes; Crystal Field Stabilization Energy (CFSE); Crystal Field Splitting in Tetrahedral Complexes; Crystal Field Splitting in Tetragonal and square Planar Complexes; Magnetic Properties of Metal Complexes and Crystal Field Theory; Factors influences the magnitude of Crystal Field Splitting; Color of Transition Metal Complexes; Crystal Field Effects on Ionic Radii; Crystal Field Effects on Lattice Energies; Jahn- Teller Effect.

Unit:- III Chemical Bonding [14 marks]

Molecular orbital Theory; LCAO Molecular Orbital Theory; Energy Level Diagram for Molecular Orbitals; Mixing of Orbitals; Filling up of Molecular Orbitals; Electronic Configuration of Heteronuclear Diatomic molecules (CO, NO, HF, HCl); Molecular orbitals of Polyatomic Species (BeH_2 , CO_2 , NH_3) (Excluding Walsh diagram); M.O. Theory of $[\text{Co}(\text{NH}_3)_6]^{3+}$ and $[\text{CoF}_6]^{3-}$; Molecular orbital or Band Theory for metals.

Unit:- IV

[A] Non Aqueous Solvents

[08 marks]

Introduction; Classification of Solvents; General Properties of Ionising Solvents

(a) Liquid Ammonia (NH_3): Physical Properties, Auto-ionization, Acid-Base reactions, Ammonia as a proton –acceptor, Precipitation reactions, Complex formation reaction, Ammonolysis reactions, Reactions of Metal-Ammonia solution, Reduction –Oxidation (Redox) reactions; Advantages and disadvantages of using liquid Ammonia as a solvent.

(b) Liquid SO_2 : Physical Properties, solubility of Inorganic materials and Organic Compounds, Electrolytic conductance behavior of solutions, Acid-Base reactions, Solvolysis, Precipitation reactions, Complex formation reactions, Reduction –Oxidation (Redox) reactions

(c) Liquid HF: Physical Properties, Solvent effect, Amphoteric behavior, Precipitation reactions, Reduction –Oxidation (Redox) reactions, Solutions of Compounds of Biological Interest.

[B] Physico chemical principles

[06 marks]

Physico chemical principles of Sodium carbonate (Na_2CO_3); Sodium bicarbonate (NaHCO_3); Sodium hydroxide (NaOH)

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1. Gurdeep Raj, *“Advanced Inorganic Chemistry”*, Goel Publishing House, Meerut, Volume –I, 24th Revised Edition, 1998.
2. R.D. Madan, *“Modern Inorganic Chemistry”*, S. Chand & Co. Ltd., New Delhi, 2nd Edition, 2006.
3. J.D. Lee, *“Concise Inorganic Chemistry”*, Wiley India Publication, 5th Edition, 1996, Reprint 2011.
4. W.V. Malik, G.D. Tuli, R.D. Madan, *“Selected Topics in Inorganic Chemistry”*, S.Chand & Co. Ltd., New Delhi, 7th Edition, 2007.
5. A.K. Chandra, *“Introductory Quantum Chemistry”*, Tata- McGraw Hill Pub. Co. Ltd., New Delhi, 4th Edition.
6. Puri, Sharma, Kalia, *“Principles of Inorganic Chemistry”*, Milestone Publishers & Distributors, New Delhi, 3rd Edition, 2006.
7. R.K.Prasad, *“Quantum chemistry”*, New Age International (P) Ltd., Publishers, 4th Edition, 2010.
8. Peter Atkins, Tina Overton, Jonathan Rourke, Mark Weller, Fraser Armstrong, *“Shriver & Atkins’ Inorganic Chemistry”*, Oxford University Press, 2011.

B.Sc. Semester IV
Chem. – 205 [Analytical Chemistry]

Unit:- I

[A] Basic concepts of Qualitative and Quantitative Analysis [8 marks]

Introduction, Solubility product principle, Common ion effect, Separation of cations of each groups and separation of anions (acid radicals), Introduction of volumetric titration based on normality and morality of the solution, Conditions for volumetric analysis and types of titrimetric analysis.

[B] Redox titration [6 marks]

Theory of redox titration, study of redox titration by electrochemical potential method, Ways of locating the end point for redox titration

Unit:- II Acid Base Titration [14 marks]

Theory of acid-base titration, Ways of locating the end point of an acid-base titration, Titration of strong acid with strong base, Titration of weak acid with strong base, Titration of weak base with strong acid, Titration of weak base with weak acid, Factors determining the exact form of a pH curve.

Unit:- III

[A] Complexometric Titrations [8 marks]

Theory of complexometric titration involving EDTA, Study of EDTA complex formation taking disodium salt of EDTA and effect of pH, Ways of locating the end point, Estimation of calcium and magnesium by complexometric titration by EDTA

[B] Precipitation Titration [6 marks]

Titration curves, Feasibility, Indicators, Mohr, Volhard and Fajans' Methods, Factors affecting solubility

Unit:- IV Precipitation Gravimetric [14 marks]

Introduction, Precipitation, Digestion, Filtration, Washing of the precipitate, Drying and/or incineration of the precipitate, Weighing, Specific and selective precipitation, Organic precipitants, Masking or sequestering agent, Problems involved in precipitation gravimetry.

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1. Dhruva Charan Dash, "*Analytical Chemistry*", PHI Learning Pvt. Ltd., New Delhi, 2011.
2. R.A.Day, A.L.Underwood, "*Quantitative Analysis*", Prentice-Hall of India Pvt.Ltd., New Delhi, 2004. (Sixth edition)
3. Gary D. Christian, "*Analytical Chemistry*", John Wiley & Sons, INC, New York, 1994. (Fifth edition)
4. Douglas A. Skoog, Donald M. West, F.James Holler, "*Analytical Chemistry An Introduction*", Saunders College Publishing, Harcourt Brace College Publishers, Philadelphia, 1994. (Sixth edition)
5. Y.Anjaneyulu, K.Chandrasekhar, Valli Manickam, "*A Textbook of Analytical Chemistry*", Pharma Book Syndicate, Hyderabad, India, 2006.

B Sc Semester IV
Chem.Pract. – 206 [Organic & Analytical Practicals]

[A] Organic Spotting and Estimation

Organic spotting minimum eight compounds (5 solids and 3 liquids)

Acids: Salicylic acid, Cinnamic acid, Anthranilic acid, Sulfanilic acid

Phenols: p-Nitrophenol, β -Naphthol

Bases: m and p – Nitroanilines, p-Toludine

Neutral : Solids:- Acetanilide, Glucose

Liquids:- Acetophenone, Carbon tetrachloride (CCl_4), Methylacetate

Estimations: 1) Glucose

2) Acetamide

3) Phenol/Aniline

[B] Volumetric and Gravimetric Analysis

Volumetric Analysis :

(a) Nitrite by back titration.

(b) Hardness of Water , Ca & Mg (Total Hardness) by EDTA

(c) Estimation of Ni by using EDTA , MgCl_2 and Eriochrome Black – T (Back Titration)

Gravimetric Analysis :

(a) Fe as Fe_2O_3

(b) Ba as BaSO_4

(c) Al as Al_2O_3

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1. I Vogel, "*Elementary Practical Organic Chemistry Part-II, Qualitative Organic Analysis*", CBS Publishers & Distributers, New Delhi, Second Edition, 2004.
2. I Vogel, "*Elementary Practical Organic Chemistry Part III Quantitative Organic Analysis*", CBS Publishers & Distributers, New Delhi, Second Edition, 2004.
3. V.K. Ahluwalia, Sunita Dhingra, "*Comprehensive Practical Organic Chemistry – Qualitative Analysis*", University Press (India) Private Limited, Hyderabad, First Indian Edition, 2010.
4. Mohan Jag, "*Organic Analytical Chemistry theory and Practice*", Narosa Publication, New Delhi, 2003.
5. J Leonard, B Lygo, G Procter, "*Advanced Practical Organic Chemistry*", Stanley Thornes (Publishers) Ltd., First Indian Edition, 2004.
6. John H. Kennedy, "*Analytical Chemistry : Practice*", Saunders College Publishing, New York, Second Edition, 1990.
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