Koyana Education Society's

Balasaheb Desai College,Patan

Department of Chemistry

Annual Teaching Plan

Academic Year -2023-2024

Semester – I ,V, IV & VI

Class: B.Sc. I, B.Sc.-II & B.Sc.-III Paper No.: I, IX , VII &XIII (Theory& Practical)

Month	No. of Teaching Days	Periods Allotted	Unit / Topic	Subunits Planned
July	21	13	**Paper I :** **Unit II: Chemical Bonding and Molecular Structure: Ionic Bonding (6 hours)**	1. Types of Chemical Bonds: a) Ionic Bond b) Covalent Bond c) Co-ordinate bond 2. d) metallic bond e) Hydrogen Bond f) Van-der walls force. 3. Definition and formation of ionic bond. General characteristics of ionic bonding 4. Energetic in Ionic bond formation. 5. Born-Haber cycle for NaCl and its applications. 6. Fajan's Rule, Applications of Fajan's rule for, i) Polarizing power and polarizability 7. ii) Ionic character in covalent compounds iii) Bond moment, dipole moment and percentage ionic character.
			Unit III: Chemical Bonding and Molecular structure :Valence bond theory (VBT).	1.VSEPR Theory. 2. Concept of hybridization, different types of hybridization and geometry of following molecules, i) Linear geometry- BeCl2 (sp hybridization) 3. ii) Planer trigonal geometry- BF3 (sp2 hybridization) 4. iii) Tetrahedral geometry- SiCl4 (sp3 hybridization)

August	20	12		5. iv) Trigonal bipyramidal geometry- PCl5 (sp3d hybridization) 6.v) Octahedral geometry- SF6 (sp3d2 hybridization) vi) Pentagonal bipyramidal geometry –IF7 (sp3d3 hybridization).
			Unit IV: Acids and Bases (4 hours)	1. Theories of Acids and Bases – Arrhenius concept, Bronsted – Lowry concept, Lewis concept, Lux-Flood concept. (Definition and examples only). 2. i. Hard and Soft Acids and Bases (HSAB concept). ii. Classification of Acids and Bases as hard soft and borderline. 3. Pearson's HSAB concept. 4. Acid –Base strength and hardness-softness. 5. Application and limitations of HSAB concept.
			Unit V: P-Block Elements (Group 13, 14, 15)	1. Position of elements in periodic table. 2. Characteristics of group 13th, 14th and 15th elements with special reference to electronic configuration and periodic properties.
			B.Sc.-III	
	24	12+5	**Unit 1. Acids, Bases and Non aqueous Solvents**	1. Introduction to theories of Acids and Bases-Arrhenius concept, Bronsted-Lowry 2. concept, Lewis Concept, Lux-Flood Concept (definition and examples) 3. Hard and Soft Acids and Bases. (HSAB Concept) 4. Classification of acids and bases as hard, soft and borderline. Pearson's HSAB concept.

				5. Acid–Base strength and hardness-softness. Applications and limitations of HSAB principle. 6. Chemistry of Non aqueous Solvents. 7. Introduction, definition and characteristics of solvents. 8. Classification of solvents. 9. Physical properties and Acid-Base reactions in Liquid Ammonia (NH3) and Liquid Sulphur Dioxide (SO2).
			Unit 2. Metal Ligand bonding in Transition Metal Complexes	1.Crystal field theory (CFT) Introduction: Shapes of d-orbitals, Basic assumptions of CFT. 2. Crystal field splitting of d-orbitals of metal ion in octahedral, tetrahedral, square planar complexes 3. John-Teller distortion.
		10	**B.Sc.-II Practical**	
			B.Sc.-I	
September	**21**	**13**		3.Characteristics of group 13th, 14th and 15th elements with special reference to electronic configuration and periodic properties. 4. Compounds of group13th, 14th and 15th elements. 5. Boron –diborane (only structure). 6. Classification of solids as conductor, insulators and semiconductors on the basis of band theory. 7. Allotropes of carbon and phosphorus. 8. Oxyacids of Nitrogen (HNO2, HNO3). 9. Oxyacids of Nitrogen (HNO2, HNO3).

			Unit I: Atomic Structure and Periodicity of Elements (8 hours)	1. Bohr's theory of hydrogen atom and its limitations 2. Wave particle duality 3. Heisenberg uncertainty principle 4. Quantum numbers and their significance 5. Shapes of s, p and d atomic orbitals
			B.Sc.-III	
	25	**13+10**		4.Factors affecting the Crystal field splitting. 5 High spin and low spin octahedral complexes w.r.t. Co (II).. 6. Crystal Field stabilization energy (CFSE), Calculation with respect to octahedral complexes only. 7. Limitations of CFT. 8. Molecular orbital theory (MOT). Introduction. 9. MOT of octahedral complexes with sigma bonding such as [Ti(H2O)6]3+, 10. [CoF6]3– , [Co(NH3)6]3+. 11. Merits and demerits of MOT.
			Unit 3. Metals, Semiconductors and Superconductors.	1. Introduction. Properties of metallic solids. 2.Theories of bonding in metal. i.Free electron theory. ii.Molecular orbital theory (Band theory).
		10	**B.Sc.-II Practical**	
			B.Sc.-I	
October	**23**	**15**		6. Electrons filling rules in various orbitals: a) Aufbau's principle b) Hunds rule of maximum multiplicity c) Pauli's exclusion principle. 7. Electronic configuration of elements. Stability of empty, half-filled and completely filled orbitals. 8. Periodicity of the elements: General discussion of the following properties of the elements with reference to s block elements: a) electronic configuration 9. b) atomic radii c) ionic radii

				d) ionization energy e) electron affinity f) electronegativity g) metallic characters 10. h) reactivity i) oxidation state j) melting and boiling points k) chemical properties.
			B.Sc.-III	
	27	**15+10**		3. Semiconductors- Types - intrinsic and extrinsic and applications of semiconductors. Superconductors: Ceramic superconductors - Preparation and structures of mixed oxide YBa2Cu3O7-x. 4. Applications of superconductors.
			Unit.4. Organometallic Chemistry.	1. Definition, Nomenclature of organometallic compounds. 2. Synthesis and structural study of alkyl and aryl compounds of Be and Al. 3.Mononuclear carbonyls - Nature of bonding in simple mononuclear carbonyls.:[Ni(CO)4], [Fe(CO)5], [Cr(CO)6]. 4. Mononuclear carbonyls - Nature of bonding in simple mononuclear carbonyls.:[Ni(CO)4], [Fe(CO)5], [Cr(CO)6].
		8	**B.Sc.-II Practical**	
November	**-**	**-**	**-**	**-**
			Semester – IV & VI	
			B.Sc.-II	
December	**26**	**14+8**	**Unit 1: Co-ordination Chemistry (8 hours)**	1.1 Introduction-Definition and formation of co-ordinate covalent bond in BF3– NH3, [NH4]+ and H2O 1.2 Terminology- Description of the terms- ligand, co-ordination

				number, co-ordination sphere 1.3 Effective atomic number rule. 1.4 Distinguish between double salt and complex salt. 1.5 Werner's theory 1.5.1 Postulates. 1.5.2 The theory as applied to cobalt amines viz. CoCl3.6NH3, CoCl3.5NH3, CoCl3.4NH3, CoCl3. 3NH3 1.6 IUPAC nomenclature of coordination compounds. 1.7 Isomerism in complexes with C.N. 4 and 6 1.7.1 Geometrical Isomerism, 1.7.2 Optical Isomerism 1.7.3 Structural Isomerism- Ionization Isomerism, Hydrate Isomerism, Coordination Isomerism, Linkage Isomerism and Co-ordination position Isomerism 1.8 Valance bond theory of transition metal complexes with respect to, C.N. = 4, complexes of Cu and Ni, C.N. = 6 complexes of Fe and Co 1.8 Valance bond theory of transition metal complexes with respect to, C.N. = 4, complexes of Cu and Ni, C.N. = 6 complexes of Fe and Co 1.8 Valance bond theory of transition metal complexes with respect to, C.N. = 4, complexes of Cu and Ni, C.N. = 6 complexes of Fe and Co
			B.Sc.-III	
	26	**14+8**	**Unit 1. Coordination Chemistry [12]** **A. Inorganic Reaction mechanism [8]**	A. Inorganic Reaction mechanism 1.1 Introduction. 1.2 Classification of

				Mechanism: Association, dissociation, interchange and the rate determining steps. 1.3 SN1 and SN2 reactions for inert and labile complexes. 1.4 Mechanism of substitution in cobalt (III) octahedral complexes. 1.5 Trans effect and its theories. 1.6 Applications of trans effect in synthesis of Pt (II) complexes.
			B. Thermodynamic and Kinetic aspects of metal complexes.	B. Thermodynamic and Kinetic aspects of metal complexes. 1.7 Introduction. 1.8 Thermodynamic stability. 1.9 Kinetic Stability. 1.10 Relation between thermodynamic and kinetic stability. 1.11 Stepwise stability constant. 1.12 Factor affecting the stability of complexes.
			B.Sc.-II	
January	**27**	**15+8**	**Unit 3: Chemistry of Elements of 3d Series Elements (6 hours)**	3.1 Position of elements in periodic table 3.2 Characteristics of d-block elements with special reference to i) Electronic structure ii) Oxidation states, stability of oxidation states of Fe with respective to Latimer diagram iii) Magnetic characteriv) Colored ions v) Complex formation.
			Unit-4. Chemistry of 4f Elements (Lanthanides) (5 hours)	4.1 Position of lanthanides in periodic table 4.2 Occurrence 4.3 Characteristics of 4f elements with special reference to 4.3.1 Electronic configuration 4.3.2 Oxidation states

				4.3.3 Magnetic properties 4.3.4 Lanthanide contraction 4.4 Separation of lanthanides by ion exchange method.
			B.Sc.-III	
				1.13 Determination of Stability constant by Job variation, Mole ratio and Slope ratio method.
	27	**15+8**	**Unit 2. Nuclear Chemistry [05]**	2.1 Nuclear reactions and energetic of nuclear reactions. 2.2 Types of nuclear reactions i. Artificial transmutation. ii. Artificial radioactivity. iii. Nuclear fission and its application in heavy water nuclear reactor. iv. Nuclear fusion. 2.3 Use of Thorium, Uranium and Plutonium in atomic energy 2.4 Applications of radio-isotopes as tracers. i. Chemical investigation – Esterification ii. Structural determination – Phosphorus pentachloride. iii. Analytical Chemistry – Isotopic dilution method for determination of volume of blood. iv. Age determination – Dating by C14.
			Unit 3. Chemistry of f-Block Elements [09] **A] Lanthanides**	3.1 Introduction. 3.2 Occurrence. 3.3 Electronic Configuration. 3.4 Oxidation State. 3.5 Lantahnide contraction. 3.6 Separation of Lanthanides by Ion exchange method.
			B] Actinides	3.7 Position in periodic table. 3.8 Electronic configuration. 3.9 General methods of preparation of transuranic elements. i. Neutron capture – followed by

				β decay. ii. Accelerated projectile bombardment. iii. Heavy ion bombardment. 3.10 IUPAC nomenclature of the super heavy elements with atomic number (Z) greater than 100.
			Unit 4. Iron and Steel. [07]	4.1 Occurrence and ores of iron. 4.2 Definition of the Terms- Ore , Mineral, Slag, Flux, Gangue , Matrix, Calcinations, Reduction, Roasting, Smelting and Leaching.
			B.Sc.-II	
February	**20**	**15+8**	**Unit 2: Chelation (4 hours)**	2.1 A brief introduction with respect to ligands, chelating agent, chelation and metal chelates. 2.2 Structural requirements of chelate formation 2.3 Difference between metal chelate and metal complex 2.4 Classification of chelating agents (with specific illustration of bidentate chelating agents) 2.5 Application of chelation with respect to chelating agents - EDTA and DMG
			Unit-5. Inorganic Semi-micro Qualitative Analysis (7 hours)	5.1 Theoretical principles involved in qualitative analysis. 5.2 Applications of solubility product and common ion effect in separation of cations into groups. 5.3 Applications of complex formation in a) Separation of II group into IIA and IIB sub-groups. b) Separation of Copper from Cadmium. c) Separation of Cobalt from Nickel. d) Separation of Cl-, Br -, I -. e) Detection of NO2-, NO3-

				(Brown ring test). 5.4 Application of oxidation and reduction in a) Separation of Cl-, Br-, I - in mixture b) Separation of NO2– and NO3– in mixture. 5.5 Spot test analysis.
			B.Sc.-III	
	20	**15+8**		4.3 Extraction of iron by Blast furnace. 4.4 Steel: Definition and types 4.5 Conversion of cast iron into steel by i. Bessemer process. ii. L.D. process. 4.6 Heat treatment on steel.
			Unit 5. Bio-inorganic Chemistry. [05]	5.1 Introduction. . 5.2 Essential and trace elements in biological process. 5.3 Metalloporphyrins with special reference to hemoglobin and myoglobin. 5.4 Biological role of alkali and alkaline earth metal ions with special referenc to Na+, K+ and Ca2+ . 5.4 Biological role of alkali and alkaline earth metal ions with special referenc to Na+, K+ and Ca2+ 5.4 Biological role of alkali and alkaline earth metal ions with special referenc to Na+, K+ and Ca2+

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