Satyaniketan's

Adv. M. N. Deshmukh Arts, Science and Commerce College,
Rajur, Tal. Akole, Dist. Ahilyanagar

Department of Chemistry

ANNUAL TEACHING PLANNING

2026-2027

Class- **S. Y. B. Sc**.

(As Per National Education Policy-2020)

Semester- III

Subject-

CHE-202-MJ-T: Inorganic Chemistry-I

Month	Chapter	Number of Periods
July	**Chapter 1 :** **Introduction to Coordination Compounds** • Introduction • Double salt and coordination compound. • Basic definitions: coordinate bond, ligand, types of ligands, chelate, central metal ion, charge on complex ion. • Calculation of oxidation state of central metal ion, metal ligand ratio. • Werner's work and theory. • Effective atomic number, equilibrium constant. • Chelate effect. • IUPAC nomenclature.	06
August	**Chapter 2 :** **Isomerism in coordination complexes** • Introduction. • Polymerization isomerism. • Ionization isomerism.	

	• Hydrates isomerism. • Linkage isomerism. • Coordination isomerism. • Coordination position isomerism. • Geometric isomerism. • Optical isomerism.	03
	Chapter 3 : **Valance Bond Theory of Coordination Compounds** • Introduction • Paramagnetic and diamagnetic nature coordination complexes • Calculation of magnetic moment from number of unpaired electrons. • Aspects and assumptions of VBT.	02
September	• Applications of VBT on the basis of hybridization to explain the structure and bonding in [Ag(NH3) 2+], [Ni(Cl4)]2- , [MnCl4] 2- , [Ni(CN)4] 2- , [PtCl4] 2- , [Cr(H2O6)]3+, [Co(NH3)6] 3+, [Fe(CN)6] 3- (Inner orbital complex) and 16 [FeF6] 3- (outer orbital complex). • Use of observed magnetic moment in deciding the geometry in complexes with C.N.4. • Limitations of VBT	05
October	**Chapter 4 :** **Crystal Field Theory** • Shapes of d-orbitals. • Crystal field Theory (CFT): Assumptions, Application of CFT to - i) Octahedral complexes: splitting of 'd' orbitals in Oh ligand field, effect of weak and strong ligand fields, low spin and high spin complexes, spin only magnetic moment of low spin and high spin complexes, colour absorbed and spectrochemical series, crystal splitting energy, Crystal field stabilization energy	15

	and factors affecting it, tetragonal distortion in Cu(II) complexes. ii) Square planar complexes – Formation of Sq. Pl. complexes from distorted Oh complex, examples and spin only magnetic moments of Cu(II), Ni(II), Pt(II) square planar complexes; iii) Tetrahedral complexes: Splitting of d orbitals in tetrahedral ligand field, Crystal field splitting parameter (Δt), spin only magnetic moment, CFSE in Td complexes, Comparison of Δt and Δo	
November	**Revision**	

Semester- III

CHE-241-MN-T: Physical and Inorganic Chemistry

Month	Chapter	Number of Periods
July	**Chapter 1:** **Chemical Thermodynamics** • (Recapitulation: Introduction, terminology of thermodynamics, thermodynamic equilibrium, properties, thermodynamic processes). • First law of thermodynamics, Enthalpy, Heat capacity. • Relation between Cp and Cv, • Expansion of ideal gas and changes in thermodynamic properties: Isothermal process, Adiabatic process. • Limitations of the first law: Need for the second law, Cyclic process, Carnot cycle. • Second law of thermodynamics. Concept of entropy, Entropy change in isothermal expansion. • Reversible and irreversible processes, Phase change and entropy of mixing of ideal gases. • Work and free energy function.	08
August	**Chapter 2:** **Electrolytic Conductance** • (Recapitulation: Electrolytes, Ohm's law and Electrical units, electrolytic conductance, resistance and specific resistance) • Electrolytic Conductance, Specific and equivalent conductance, Variation of equivalent conductance with concentration.	08

	• Kohlrausch's law and its applications to determine: Equivalent conductance at infinite dilution of a weak electrolyte. • The ionic product of water & Solubility of sparingly soluble salts, Migration of ions, ionic mobilities & Absolute velocity of ions. • Transport number determination by: – Hittorf's method & – Moving boundary method.	
September	**Chapter 3 :** **Introduction to Coordination Compounds** • Introduction • Double salt and coordination compound. • Basic definitions: coordinate bond, ligand, types of ligands, chelate, central metal ion, charge on complex ion. • Calculation of oxidation state of central metal ion, metal ligand ratio. • Werner's work and theory. • Effective atomic number, equilibrium constant. • Chelate effect. • IUPAC nomenclature.	06
October	**Chapter 4 :** **Valance Bond Theory of Coordination Compounds** • Introduction • Paramagnetic and diamagnetic nature coordination complexes • Calculation of magnetic moment from number of unpaired electrons. • Aspects and assumptions of VBT. • Applications of VBT on the basis of hybridization to explain the structure and bonding in [Ag(NH3)	

	2+], [Ni(Cl4)]2- , [MnCl4] 2- , [Ni(CN)4] 2- , [PtCl4] 2- , [Cr(H2O6)]3+, [Co(NH3)6] 3+, [Fe(CN)6] 3- (Inner orbital complex) and 16 [FeF6] 3- (outer orbital complex). • Use of observed magnetic moment in deciding the geometry in complexes with C.N.4. • Limitations of VBT	08
November	**Revision**	

Class- **T. Y. B. Sc**.

(As Per National Education Policy-2020)

Semester- V

Subject-

CHE-302-MJ-T: INORGANIC CHEMISTRY II

Month	Chapter	Number of Periods
July	**Chapter 1:** **Molecular Orbital Theory of Covalent Compounds** • Limitations of Valence Bond Theory(VBT). • Concept of molecular orbitals. • Linear Combination of Atomic Orbitals (LCAO) principle and rules. • Bonding combinations of AOs: s-s, s-p, p-p and d-d. • Types of molecular orbitals: Bonding, antibonding, non-bonding. • MO Energy level diagrams for homonuclear diatomic molecules, Bond order, existence, energy (β). • Magnetic behaviour of molecules or ions: H2, H2+, He2 +, Li2, Be2, B2, C2, N2, O2, O2 +, O2 - , O2 2- , F2 and Ne2. • MO energy level diagrams for heteronuclear diatomic molecules: CO and HF.	05
August	**Chapter 2:** **Molecular Orbital Theory for Coordination Complexes** • Electroneutrality principle.	

	• Nephelauxetic effect and need of MOT over VBT and CFT for explaining M-L bonding. • Assumptions of MOT for coordination complexes. • Formation of MOs w.r.t. bonding, antibonding, and non-bonding MOs, MO energy level diagrams for octahedral complexes with σ-bond: $[Ti(H_2O)_6]^{3}$, $[Co(NH_3)_6]^{3}$, $[Fe(H_2O)_6]^{2}$, $[CoF_6]^{4-}$ & $[Co(CN)_6]^{4-}$ and $[Fe(F)_6]^{3-}$ & $[Fe(CN)_6]^{3}$. • H.S. and L.S. complexes, and effect of π bonding on MO diagram. • Charge transfer transitions.	05
September	**Chapter 3:** **Chemistry of d and f-block Elements** ❖ d-Block elements: • Position in periodic table, occurrence, electronic configuration. • Trends in properties w.r.t.(a) size of atoms and ions (b) reactivity (c) catalytic activity (d) oxidation state (e) complex formation ability (f) colour (g) magnetic property (h) non-stoichiometry (i) density, melting & boiling points. ❖ f-Block elements: • Introduction on the basis of electronic configurations, occurrence and reactivity, f-block elements as Lanthanide and Actinide series I. Lanthanides: Position in periodic table, Name and electronic configuration of lanthanides and Oxidation States. Atomic and ionic radii, Lanthanide contraction: its causes and consequences. Occurrence and separation: Bulk separation, Individual	10

	separation by modern methods viz., Ion exchange method and solvent extraction method, and applications of lanthanides. II. Actinides: Position in periodic table, names and their electronic configurations. Oxidation States, Occurrence and general methods of preparation of transuranic elements viz., Neutron Bombardment, Accelerated projectile bombardment and Heavy ion bombardment. Nuclear Fuels-Nuclear fission and fusion fuels in brief, comparison between Lanthanides and Actinides.	
October	**Chapter-4:** **Organometallic Chemistry and Homogeneous Catalysis** • Definition of Organometallic compounds and Organometallic chemistry, CO as a π-acid donor ligand, binary metal carbonyls. • Synthesis of metal carbonyls; (a) Direct reaction (b)Reductive carbonylation (c) Photolysis and thermolysis. • Hepticity, Molecular and electronic structures of binary metal carbonyls, Electron count in complexes (18 electron rule). • Chemistry of ferrocene; Introduction, synthesis and physical properties of ferrocene. Reactions of ferrocene such as Friedel-Craft Acylation, Friedel-Craft Alkylation, Mannich reaction, Nitration and Halogenation Applications of organometallic compounds in industrial catalysis (list of examples).	10

	• Introduction to Catalysis, basic principles, activity and selectivity in catalysis, Types of catalysis. • Homogeneous catalysis: importance of catalysis in the synthesis of high value chemicals. • Catalytic cycles for: a) Hydrogenation of olefins using Wilkinson's complex, b) Hydroformylation of olefins using Co and Rh complexes, c) Carbonylation of methanol – • Monsanto processes and d) C-C coupling reaction: Heck reaction.	
November	**Revision**	

Semester- VI

CHE-352-MJ-T: INORGANIC CHEMISTRY III

Month	Chapter	Number of Periods
December	**Chapter 1:** **Inorganic Reaction Mechanism** • Introduction of stability and lability, stability or formation constant, factors affecting lability, chelate effect. • Types of inorganic reactions, ligand substitution reactions and mechanisms in brief, • Substitution Reactions in square planar complexes: Trans effect, Trans effect series and its applications.	03
January	**Chapter 2:** **Heterogeneous catalysis** • Introduction, Classification of heterogeneous catalysts, supported metal catalyst, Role of support, Promoters and Poisons. • Catalytic processes viz., a) Hydrogenation of Olefins using Raney Nickel catalyst, b) Zeolites in catalysis: Catalytic Cracking, c) Biodiesel Synthesis using Heteropolyacids(HPAs) and d) Automotive Exhaust Catalysts: The catalytic converters.	05
February	**Chapter 3:** **Bioinorganic Chemistry** • Introduction, definition, scope and importance of metal ions in biological systems.	

	• Classification of biological metals: a) Enzymatic and non-enzymatic metals and b) Redoxactive and non-redox-active metals. • Role of non-enzymatic metals with one example (Na, K, Ca, and Mg). • Metals in enzymatic processes in brief: a) Enzymatic redox metals (Cu in superoxide dismutase), b) Enzymatic non-redox metals (Zn in hydrolases), and c) Redoxactive transition-metal enzymes (catalase, peroxidase, nitrogenase). • Metalloproteins: a) Iron– Sulphur proteins and electron-transfer systems, b) Iron transport and storage proteins: transferrin and ferritin. c) Bioinorganic chemistry of iron: hemoglobin and myoglobin and d) Bioinorganic chemistry of cobalt: Vitamin B12 (cobalamin).	06
March	**Chapter 4:** **Metals, Semiconductors and Superconductors** • Metals: Introduction, Metallic bonding, Band theory in metals with respect to Na along with n(E) and N(E) curves/diagrams, Electrical conductivity of metals (Na, Mg, Al), Valence electrons and conductivity of metals, Effect of temperature and impurity on electrical conductivity of metals and insulators. • Semiconductors: Types of Semiconductors: a) Intrinsic and Extrinsic, b) n and p type semiconductors and c) Non-stoichiometry and semiconductivity w.r.t. ZnO and NiO/FeO. • Superconductivity: Discovery, property, models, structure and	08

	superconductivity, low and high temperature superconductors, applications of superconductors.	
April	**Chapter 5:** **Introduction to Advanced topics in Inorganic Chemistry** **A. Introduction to Nanomaterials** • Definition and concept of nanomaterials, Difference between bulk and nanomaterials, Size scale and surface-to-volume ratio. • Classification of Nanomaterials: A) Based on dimensions: 1) 0D: nanoparticles and quantum dots, 2) 1D: nanowires and nanotubes, 3) 2D: graphene and thin films, and 4) 3D: nanocomposites and B) Based on composition: 1) Metals, 2) Metal oxides, 3) Semiconductors and 4) Carbon-based nanomaterials. • Methods for Synthesis of Nanomaterials: a) Top-Down Methods, b) Bottom-Up Methods, c) Sol–gel method, d) Chemical vapor deposition (CVD), e) Hydrothermal and f) Solvothermal methods. • Properties and Applications of Nanomaterials **B. Introduction to Metal–Organic Frameworks** • Definition and basic concept of MOFs. • Comparison of MOFs with coordination polymers, zeolites, and porous materials.	07

	• Building Blocks of MOFs, Synthesis of MOFs: Solvothermal and hydrothermal methods. • Advantages and significance of MOFs. • Applications of MOFs in Gas storage (H2, CO2, CH4), Gas separation and capture (CO2 capture, air purification), MOFs in catalysis (heterogeneous catalysis concept).	