Satyaniketan's

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

Department of Chemistry

ANNUAL TEACHING PLANNING

2024-2025

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

(Choice Based Credit System [CBCS]

2019 Pattern)

Semester- III

Subject-

CH-302: Inorganic and Organic Chemistry

Month	Chapter	Number of Periods
July	**Chapter 1 :** **Molecular Orbital Theory of Covalent Bonding** • Introduction to Molecular Orbital Method (MOT) and postulates of MO theory. • LCAO approximation, s-s combination of orbitals, s-p combination of orbitals, p-p combination of orbitals, p-d combination of orbitals, d-d combination of orbitals, nonbonding combination of orbitals. • Rules for linear combination of atomic orbitals, example of molecular orbital treatment for homonuclear diatomic molecules: Explain following molecules with respect to MO energy level diagram. • Bond order and magnetism: H_2^+ molecule ion, H_2 molecule, He_2^+ molecule ion, He_2 molecule, Li_2	13

	molecule, Be2 molecule, B2 molecule, C2 molecule, N2 molecule, O2 molecule, O2 - and O2 2- ion, F2 molecule, Heteronuclear diatomic molecules: NO, CO, HF	
August	**Chapter 2 :** **Introduction to Coordination Compounds** • 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.	05
September	**Revision**	

Semester- IV

CH-402: Inorganic and Organic Chemistry

Month	Chapter	Number of Periods
January	**Chapter 1:** **Isomerism in coordination complexes** • Introduction. • Polymerization isomerism. • Ionization isomerism. • Hydrates isomerism. • Linkage isomerism. • Coordination isomerism. • Coordination position isomerism. • Geometric isomerism. • Optical isomerism.	02
February	**Chapter 2:** **Valance Bond Theory of Coordination Compounds** • 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- , [Ni(CN)4] 2- , [Cr(H2O6)]3+ , [Fe(CN)6] 3- (Inner orbital complex) and [FeF6] 3- (outer orbital complex). • Use of observed magnetic moment in deciding the geometry in complexes with C.N.4, limitations of VBT.	04
March	**Chapter 3:** **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, colour absorbed and spectrochemical series, crystal splitting energy, Crystal field stabilization energy and factors affecting it, tetragonal distortion in Cu(II) complexes) • ii) Square planar complexes and • iii) Tetrahedral complexes; spin only magnetic moment of Oh and Td complexes.	12
April	**Revision**	

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

(Choice Based Credit System [CBCS]

2019 Pattern)

Semester- V

Subject-

DSEC-II: CH-504: Inorganic Chemistry - I

Month	Chapter	Number of Periods
July	**Chapter 1:** **Molecular Orbital Theory of Coordination Compounds** • Electro-neutrality principle, multiple bonding (dπ-pπ and dπ-dπ). • Nephelauxetic effect and Nephelauxetic series (Recapulation from VBT and CFT). • Need and introduction of MOT, Assumptions. • MO treatment to octahedral complexes with sigma bonding, Formation of MO's from metal orbitals and Composite Ligand Orbitals (CLO). • MO correlation diagram for octahedral complexes with sigma bonding, effect of π bonding on MO correlation diagram. • Charge transfer spectra, Advantages of MOT over VBT and CFT.	08
August	**Chapter 2:** **Inorganic Reaction Mechanism** • Basic concepts of stability and lability, stability constants, Factors affecting lability, chelate effect.	

	• Classification of inorganic reactions, ligand substitution reactions: Intimate and stoichiometric mechanism of ligand substitution. • Substitution Reactions in Four Coordinated square planar complexes: Trans effect and Trans effect series, applications of trans effect, stereochemistry of substitution.	06
September	**Chapter 3:** **Chemistry of Transition elements** • Position in periodic table, 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 properties (h) non-stoichiometry (i) density, melting & boiling points.	06
October	**Chapter-4:** **Chemistry of f-block elements** • Introduction of f-block elements- 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, Oxidation States, atomic and ionic radii, Lanthanide contraction, its causes and consequences on chemistry of Lanthanides and post lanthanide elements, Occurrence and separation: Bulk separation, Individual separation by modern methods viz., Ion exchange and	08

	solvent extraction method, applications of lanthanides. • II. Actinides: Position in periodic table, names and their electronic configurations. IUPAC nomenclature system for super heavy elements, 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, comparison between Lanthanides and Actinides.	
November	**Chapter 5:** **Metals, Semiconductors and Superconductors** • Introduction, Metallic bonding, Band theory in metals with respect to Na along with n (E) and N(E) diagrams. • Electrical conductivity of metals (Na, Mg, Al), Valence electrons and conductivity of metals. • Effect of temperature and impurity on electrical conductivity of metals. • Semiconductors, types of Semiconductors: I. Intrinsic II. Extrinsic, effect of temperature and impurity on semiconductivity, n & p type semiconductors ZnO and NiO. • Superconductivity: Discovery, property, models, structure and superconductivity, low and high temperature superconductors, applications of superconductors.	08

Semester- V

CH-511 (A) : Environmental Chemistry

Month	Chapter	Number of Periods
July	**Chapter 1:** **Concepts and Scope of Environmental Chemistry** • Introduction. • Environmental Pollution and Classification. • Units of concentration. • Segments of Environment. • Biogeochemical cycles of C, N, P, S and O system	06
August	**Chapter 2:** **Hydrosphere and Water Pollution** • Water resources. • Hydrological Cycle: stages of hydrological cycle and chemical composition of water bodies. • Microbially mediated aquatic reactions. • Classification of water pollutants Organic and Inorganic pollutants, Sewage and Domestic waste, Sediments, Detergents, Pesticides, Eutrophication. • Sampling and monitoring water quality parameters: pH, D.O. (Winkler Method), COD, TOC, Total hardness, free chlorine.	10
September	**Chapter 3:** **Analytical Techniques in water Analysis** • Water quality parameters and standards.	

	• Domestic water quality parameters, surface water, sampling, preservation. • Monitoring techniques and methodology (pH, conductance, DO, ammonia, nitrate and nitrite, Cl, F, CN, Sulfide, sulphate, phosphate, total hardness, boron, metals and metalloids- As, Cd, Cr, Cu, Fe, Pb, Mn, Hg (Exclude polarographic and AAS methods), COD, BOD, TOC, phenols, pesticides, surfactants, tannis and lignins, E. Coli, Case studies of water pollution.	10
October	**Chapter 4:** **Water pollution and treatment methods** • Water pollutants. • Eutrophication. • Waste water treatment (domestic waste water, aerobic treatment, anaerobic treatment, upflow aerobic sludge bed, industrial waste water treatment, drinking water supplies. • Trace elements in water, chemical speciation (Cu, Pb, Hg, As, Se, Cr)	10
November	**Revision**	

Semester-VI

DSEC-V: CH-604 : Inorganic Chemistry -II

Month	Chapter	Number of Periods
December	**Chapter 1 :** **Organometallic Chemistry** • Definition of Organometallic compounds and Organometallic chemistry, CO as a π-acid donor ligand, binary metal carbonyls, classification of 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). • Applications of organometallic compounds in industrial catalysis (list of examples). • 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	08
January	**Chapter 2 :** **Homogeneous and Heterogeneous catalysis** • Introduction to Catalysis, basic principles, activity and selectivity in catalysis. • Types of catalysis, homogeneous vs. heterogeneous catalysis, importance of catalysis in the synthesis of high value chemicals. • Homogeneous catalysis: catalytic cycles for following reactions: a) Hydrogenation of olefins using Wilkinson complex, b)	10

	Hydroformylation of olefins using Cobalt and Rhodium complexes, c) Carbonylation reaction: methanol to acetic acid process i.e. Monsanto processes and d) C-C coupling reactions: Heck reaction. • Heterogeneous catalysis: History of the development of industrial heterogeneous catalysis, 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) d) Automotive Exhaust catalysts: The catalytic converters	
February	**Chapter 3:** **Bioinorganic Chemistry** • I. Introduction, Role of metals in bioinorganic chemistry, Classification as enzymatic and nonenzymatic metals, enzymatic redox metals such as Cu (SOD) and enzymatic non-redox metals such as Zn (Hydrolase). Role of metal ions in non-enzymatic processes-Na, K, Ca, Mg (one example of each and brief discussion). Role of metals in enzymatic processes-Transition metalsCatalase, peroxidase and nitrogenase (Redox active). • II. Metalloproteins-Iron proteinsIntroduction of Fe-S proteins, Electron transfer proteins (Fe-S, Fe2S2, Fe3S4, Fe4S4). Transport protein (transferrin) and Storage protein (ferritin) • III. Bioinorganic Chemistry of Fe: Hemoglobin and myoglobin, its structure and functions and IV.	08

	Bioinorganic Chemistry of Co: Vitamin-B12, its structure and function.	
March	**Chapter 4 :** **Inorganic Polymers** • Introduction. • Types of inorganic polymers. • Comparison with organic polymers, synthesis, structural aspects and applications of silicates, silicones, siloxanes, borazines, and phosphazenes.	05
April	**Chapter 5:** **Inorganic solids/ionic liquids of technological importance** • Inorganic solids. • Preparation of inorganic solids: Conventional heat and beat methods. • Coprecipitation method, Sol-gel method and Hydro-thermal method. • Introduction to Solid electrolytes, inorganic liquid crystals and their examples. • Ionic liquids, synthesis and application of imidazolium and phosphonium based ionic liquids.	05

Semester-VI

DSEC-V: CH-605: Inorganic Chemistry -III

Month	Chapter	Number of Periods
December	**Chapter 1 :** **Acid–Base and Donor–Acceptor Chemistry** • Acid–Base Models as Organizing Concepts, Arrhenius Concept, Brønsted–Lowry Concept, solvent system concept, Lux Flood concept, Lewis Concept. • Frontier Orbitals and Acid–Base Reactions, Hard and soft acids and bases, theory of hard and soft acids bases. • Acid and base strength (proton affinity, acidity and basicity of binary hydrogen compounds, inductive effects, steric effect, strength of oxy acids, acidity of cations in aqueous solutions, non-aqueous solvents and acid and base strengths, super acids).	08
January	**Chapter 2 :** **Ionic Solids** • Crystalline and amorphous solids, crystal structures simple cubic, body centered cubic and face centered cubic. • Properties of ionic solids, packing arrangements of anions in an ionic solids, Voids in crystal structure- tetrahedral and octahedral Ionic radius. • Palings univalent and crystal radii. • Conversion of univalent radii to crystal radii, problems based on conversion of radii. • Radius ratio effect. • Lattice energy. • Born-Lande equation. • Born Haber cycle and its applications.	10

	• Schottky and Frenkel defect.	
February	**Chapter 3:** **Chemistry of Zeolites** • 1. Historical Background, Natural and artificial Zeolites. • 2. Zeolite Framework Types: Classification, Nomenclature, Database of Zeolite Structures, Channels, Building Units, Natural Tiles, Framework Density, Coordination Sequences. • 3. Zeolite Structures: Framework Composition, Extra-framework Species, Stacking Faults and Disorder. • 4. Synthesis of Zeolites: Introduction, Basic Zeolite Synthesis, Mineralizing Agents, Effects of water concentration, Gel preparation and crystallization, Structure Directing Agents (SDA). • 5. Applications 1.Zeolites as Heterogeneous Catalysts: Critical Properties for Catalysis, Catalytic Applications, Zeolites for Fine Chemistry: Acylation and Alkylation Aromatic Hydrocarbons, 2. Zeolites for Adsorption and Separations	08
March	**Chapter 4 :** **Introduction to Nanochemistry** • Synthesis and Stabilization of Nanoparticles by Chemical Reduction, Reactions in Micelles, Emulsions, and Dendrimers. • Photochemical and Radiation Chemical Reduction, Cryochemical Synthesis, Physical Methods. • Particles of Various Shapes and Films, Properties and Application of Nanoparticles in Science and Technology (in bief). • Applications of CNTs	05
April	**Chapter 5:**	

	Chemical Toxicology • Toxic chemicals in the environment. • Impact of toxic chemistry on enzymes. • Biochemical effect of Arsenic, Cadmium, Lead and Mercury. Biological methylation	05