Govt. C.L.C College Patan, Dist. – Durg
2023-24

DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY** CLASS: **1st YEAR**

Name of Teacher – **MR. JAGRIT KUMAR/ DR. POKHRAJ SHARMA**

Course type: Theory/Practical/Both

Course Title: **INORGANIC AND PHYSICAL CHEMISTRY**

Month	Title Unit	Topic of Lecture	No. of Lectures	Methods of Delivery
August/ September	Unit – 1	**A. ATOMIC STRUCTURE** Bohr's theory, its limitation and atomic spectrum of hydrogen atom. General idea of de-Broglie matter-waves, Heisenberg uncertainty principle, Schrödinger wave equation, significance of Ψ and Ψ2, radial & angular wave functions and probability distribution curves, quantum numbers, Atomic orbital and shapes of s, p, d orbitals, Aufbau and Pauli exclusion principles, Hund's Multipli-city rule, electronic configuration of the elements. **B**. **PERIODIC PROPERTIES** Detailed discussion of the following periodic properties of the elements, with reference to s and p block. Trends in periodic table and applications in predicting and explaining the chemical behavior. a) Atomic and ionic radii, b) Ionization enthalpy, c) Electron gain enthalpy, d) Electronegativity, Pauling's, Mulliken's, Allred Rochow's scales. e) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.	15	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
September	Unit – 2	**CHEMICAL BONDING I** **Ionic bond:** Ionic Solids - Ionic structures, radius ratio & co-ordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy Born-Haber cycle, Solvation energy and solubility of ionic solids, polarising power & polarisabilitry of ions, Fajans rule, Ionic character in covalent compounds: Bond moment and dipole moment, Percentage ionic character from dipole moment and electronegatiity difference, Metallic bond-free electron, Valence bond & band theories.	15	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
October / November	Unit –3	**CHEMICALBONDING II** **Covalent bond**: Lewis structure, Valence bond theory and its limitations, Concept of hybridization, Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Valence shell electron pair repulsion theory (VSEPR), shapes of the following simple molecules and ions containing lone pairs and bond pairs of electrons: H_2O, NH_3, PCl_3, PCl_5, SF_6. H_3O^+, SF_4, ClF_3, and ICl_2 - Molecular orbital theory. Bond order and bond strength, Molecular orbital diagrams of diatomic and simple polyatomic molecules N_2, O_2, F_2, CO, NO.	15	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
November/ December	Unit –4	**A. S-BLOCK ELEMENTS** General concepts on group relationships and gradation properties, Comparative study, salient features of	15	1. Lecture 2. Chalk and talk method

		hydrides, solvation & complexation tendencies including their function in biosystems and introduction to alkyl & aryls, Derivatives of alkali and alkaline earth metals **B. P-BLOCK ELEMENTS** General concepts on group relationships and gradation properties. Halides, hydrides, oxides and oxyacids of Boron, Aluminum, Nitrogen and Phosphorus. Boranes, borazines, fullerenes, grapheme and silicates, interhalogens and pseudohalogens. **C. Metallurgical extraction of Fe, Al, and Cu** Principle of extraction of metal, The occurrence, Extraction and Isolationof Fe, Al, and Cu		3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
December / January	Unit – 5	**A. MATHEMATICAL CONCEPTS FOR CHEMIST** Basic Mathematical Concepts: Logarithmic relations, curve sketching, linear graphs, Properties of straight line, slope and intercept, Functions, Differentiation of functions, maxima and minima; integrals; ordinary differential equations; vectors and matrices; determinants; Permutation and combination and probability theory, Significant figures and their applications. **B. COMPUTER FOR CHEMIST** Introductions of computer, Introduction of Operating System, Like Dos, Windows, Linux. **C. UTILIZATION OF COMPUTER PROGRAMME** Operating the slandered programmed and packaging programmed, Like M.S.WORD, M.S. PowerPoint, M.S. PowerPoint, Utilization of Software for structural and molecular drawing.	15	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
January/ February	Unit – 6	**A. CHEMICAL KINETICS** Rate of reaction, Factors influencing rate of reaction, rate law, rate constant, Order and molecularity of reactions, rate determining step, Zero, First and Second order reactions, Rate and Rate Law, methods of determining order of reaction, Chain reactions. Temperature dependence of reaction rate, Arrhenius theory, Physical significance of Activation energy, collision theory, demerits of collision theory, non mathematical concept of transition state theory. **B. CATALYSIS** Homogeneous and Heterogeneous Catalysis, types of catalyst, characteristic of catalyst, Enzyme catatysed reactions, Micellar catatysed reactions, Industrial applications of Catalysis.	15	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT

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Govt. C.L.C College Patan, Dist. – Durg
2023-24

DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY** CLASS: **1st YEAR**
Name of Teacher – **MR. JAGRIT KUMAR/ DR. POKHRAJ SHARMA**
Course type: Theory/Practical/Both
Course Title: **ORGANIC AND PHYSICAL CHEMISTRY**

Month	Title Unit	Topic of Lecture	No. of Lectures	Methods of Delivery
August/ September	Unit – 1	**BASICS OF ORGANIC CHEMISTRY** Hybridization, Shapes of molecules, Influence of hybridization on bond properties. Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment. Electrophiles and Nucleophiles; Nucleophilicity and basicity; Homolytic and Heterolytic cleavage, Generation, shape and relative stability of Carbocations, Carbanions, Free radicals, Carbenes and Nitrenes. Introduction to types of organic reactions: Addition, Elimination and Substitution reactions.	15	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
September	Unit – 2	**INTRODUCTION TO STEREOCHEMISTRY** Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Diastereoisomers, meso compounds, Relative and absolute configuration: Fischer, Newmann and Sawhorse Projection formulae and their interconversions; Erythrose and threose, D/L, d/l system of nomenclature, Cahn-Ingold-Prelog system of nomenclature (C.I.P rules), R/S nomenclature. Geometrical isomerism: cis–trans, synanti and E/Z notations.	15	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
October / November	Unit –3	**ACYCLIC HYDROCARBONS** Alkenes Preparation of alkenes Properties Addition of hydrogen heat of hydrogenation and stability of alkenes Addition of halogen and its mechanism. Addition of HX. Markonikov's rule. addition of HQ (Osymercuration-reduction and hydroboration - oxidation), HOX, H,SO, with mechanism and addition of HBr in the presence of peroxide (anti-Markonikov's addition). Dienes - Types of dienes, reactions of conjugated dienes 1.2 and 1.4 addition of HBr to 1,3-butadiene and Diel's Alder reaction. Alkynes: Preparation by dehydrohalogenation of dihalides, dehalogenation of tetrahalides, Properties: Acidity of acetylenic hydrogen (formation of Metal acetylides). Preparation of higher acetylenes, Metal ammonia reductions, Physical properties Chemical reactivity electrophilic addition of X, HX. HO (Tautomerism), Oxidation with KMnO OsO,, reduction and Polymerization, reaction of acetylene.	15	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
November/ December	Unit –4	**A. ALICYCLIC HYDROCARBONS** Nomenclature, Preparation by Freunds method, Wislicenus method. Properties-reactivity of cyclopropane and cyclobutane by comparing with alkanes. Stability of cycloalkanes Baeyer's strain theory, Sachse and Mohr predictions and Pitzer's strain theory. Conformational structures of cyclobutane.	15	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion

		cyclopentane. cyclohexane. Confirmers in substituted cyclohexane, decalins **B. AROMATIC HYDROCARBONS** Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/ carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directive effects of the groups.		5. Test 6. Notes 7. Use of ICT
December / January	Unit – 5	**A. GASEOUS STATE CHEMISTRY** Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path; Maxwell distribution and its use in evaluating molecular velocities (average, moot mean square and most probable) and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities. Joule Thomson effect, Liquification of Gases. **B. BEHAVIOR OF REAL GASES** Deviations from ideal gas behavior, compressibility factor (Z), and its variation with pressure and temperature for different gases Causes of deviation from ideal behavior. Vander Waals equation of state, its derivation and application in explaining real gas behavior. calculation of Boyle temperature. Isotherms of real gases and their comparison with Vander Waals isotherms, continuity of states, critical state. relation between critical constants and Vander Waals constants, law of corresponding states	15	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
January/ February	Unit – 6	**A. LIQUID STATE CHEMISTRY** Intermolecular forces, magnitude of intermolecular force, structure of liquids. Properties of liquids, viscosity and surface tension **B. COLLOIDS AND SURFACE CHEMISTRY** Classification, Optical. Kinetic and Electrical Properties of colloids. Coagulation, Hardy Schulze law. flocculation value, Protection, Gold number, Emulsion, micelles and types Gel, Syneresis and thisotropy. Application of colloids Physical adsorption chemisorption, adsorption isotherms (Langmuir and Freundlich). Qualitative discussion of BET **C. SOLID STATE CHEMISTRY** Nature of the solid state law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, seven crystal systems and fourteen Bravais lanices: X-ray diffraction. Bragg's low, a simple accoum of rotating crystal method and powder pattern method Crystal defects	15	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT

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Govt. C.L.C College Patan, Dist. – Durg
2023-24

DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY** CLASS**: 2nd YEAR**
Name of Teacher – **MR. JAGRIT KUMAR / DR. FOOLESHWAR VERMA**
Course type: **Theory/Practical/Both**
Course Title: **INORGANIC CHEMISTRY**

Month	Title Unit	Topic of lecture	No. of Lectures	Methods of Delivery
September	Unit – 1	**CHEMISTRY OF TRANSITION SERIES ELEMENTS** Transition Elements: Position in periodic table, electronic configuration, General Characteristics, *viz*., atomic and ionic radii, variable oxidation states, ability to form complexes, formation of coloured ions, magnetic moment μso (spin only) and μ eff and catalytic behaviour. General comparative treatment of 4d and 5d elements with their 3d analogues with respect to ionic radii, oxidation states and magnetic properties.	18	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
October / November	Unit – 2	**A. OXIDATION AND REDUCTION**: Redox potential, electrochemical series and its applications, Principles involved in extraction of the elements. **B. COORDINATION COMPOUNDS:** Werner's theory and its experimental verification, IUPAC nomenclature of coordination compounds, isomerism in coordination compounds. Stereochemistry of complexes with 4 and 6 coordination numbers. Chelates, polynuclear complexes.	20	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
November/ December	Unit –3	**COORDINATION CHEMISTRY** Valence bond theory (inner and outer orbital complexes), electroneutrality principle and back bonding. Crystal field theory, Crystal field splitting and stabilization energy, measurement of 10 Dq (Δo), CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of 10 Dq (Δo, Δt). Octahedral vs. tetrahedral coordination.	24	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
December / January	Unit –4	**A. CHEMISTRY OF LANTHANIDE ELEMENTS** Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds. **B. CHEMISTRY OF ACTINIDES** General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from uranium, similarities between the latter actinides and the latter lanthanides	20	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
January/ February	Unit – 5	**A. ACIDS BASES :** Arrhenius, Bronsted-Lowry, conjugate acids and bases, relative strengths of acids and bases, the Lux-flood, Solvent system and Lewis concepts of acids and bases. **B. NON-AQUEOUS SOLVENTS** Physical properties of a solvent, types of solvents and their general characteristics, reaction in non-aqueous solvents with reference to liquid ammonia and liquid sulphur	16	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test

		dioxide, HF, H_2SO_4, Ionic liquids.		6. Notes 7. Use of ICT

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DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY** CLASS**: 2nd YEAR**
Name of Teacher – **MR. JAGRIT KUMAR / DR. FOOLESHWAR VERMA**
Course type: **Theory/Practical/Both**
Course Title: **ORGANIC CHEMISTRY**

Month	Title Unit	Topic of lecture	No. of Lectures	Methods of Delivery
September	Unit – 1	**CHEMISTRY OF ORGANIC HALIDES** Alkyl halides: Methods of preparation, nucleophilic substitution reactions – SN_1, SN_2 and SNi mechanisms with stereochemical aspects and effect of solvent etc.; nucleophilic substitution, elimination reactions. Aryl halides: Preparation, including preparation from diazonium salts, Nucleophilic Aromatic Substitution; SNAr, Benzyne mechanism. Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.	18	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
October / November	Unit – 2	**ALCOHOLS** **A.** Alcohols: Nomenclature, preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouvaelt-Blanc Reduction for the preparation of alcohols, Dihydric alcohols – methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$ and HIO_4] and pinacol-pinacolone rearrangement. **B.** Trihydric alcohols - Nomenclature, methods of formation, chemical reactions of glycerol. **PHENOLS** **A.** Structure and bonding in phenols, physical properties and acidic character, Comparative acidic strength of alcohols and phenols, acylation and carboxylation. **B.** Mechanism of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben-Hoesh reaction, Lederer-Manasse reaction and Reimer-Tiemann reaction.	20	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
November/ December	Unit –3	**ALDEHYDES AND KETONES** **A.** Nomenclature, structure and reactivity of carbonyl group. General methods of preparation of aldehydes and ketones. Mechanism of nucleophilic addition to carbonyl groups: Benzoin, Aldol, Perkin and Knoevenagel condensation. Condensation with ammonia and its derivatives, Wittig reaction, Mannich reaction, Beckmann and Benzil- Benzilic rearrangement. **B.** Use of acetate as protecting group, Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction, MPV, Clemmensen reduction, Wolf-Kishner reaction, $LiAlH_4$ and $NaBH_4$ reduction. Halogenation of enolizable ketones, An introduction to α,β-unsaturated aldehydes and ketones.	22	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
December / January	Unit –4	**A. CARBOXYLIC ACIDS** Preparation, Structure and bonding, Physical and chemical properties including, acidity of carboxylic acids, effects of substituents on acid strength, Hell-Volhard Zeilinsky reaction. Reduction of carboxylic groups, Mechanism of decarboxylation. Di carboxylic acids: Methods of formation and effect of heat and dehydrating agents,	20	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion

		Hydroxyacids. **B. CARBOXYLIC ACID DERIVATIVES** Structure of acid chlorides, esters, amides and acid anhydrides, Relative stability of acyl derivatives. Physical properties, inter-conversion of acid derivatives by nucleophilic acyl substitution. Mechanism of acid and base catalyzed esterification and hydrolysis.		5. Test 6. Notes 7. Use of ICT
January/ February	Unit – 5	**ORGANIC COMPOUNDS OF NITROGEN** **A.** Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanism of nucleophilic substitution in nitroarenes and their reduction in acidic, neutral and alkaline medium. **B.** Reactivity, structure and nomenclature of amines, physical properties. Stereochemistry of amines. Separation of mixture of primary, secondary and tertiary amines. Structural features affecting basicity of amines. Preparation of alkyl and aryl amines (reduction of nitro compounds and nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel-Phthalimide reaction, Hofmann- Bromamide reaction, Reactions of amines, electrophilic aromatic substitution of aryl amines, Reaction of amines with nitrous acid. Synthetic transformations of aryl diazonium salts, Azo coupling.	24	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT

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DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY** CLASS**: 2nd YEAR**
Name of Teacher – **MR. JAGRIT KUMAR / DR. FOOLESHWAR VERMA**
Course type: **Theory/Practical/Both**
Course Title: **PHYSICAL CHEMISTRY**

Month	Title Unit	Topic of lecture	No. of Lectures	Methods of Delivery
September	Unit – 1	**A. THERMODYNAMICS-I** Intensive and extensive variables; state and path functions; isolated, closed and open systems; Zeroth law of thermodynamics. First law: Concept of heat, work, internal energy and statement of first law; enthalpy, Relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases under isothermal and adiabatic conditions. Joule-Thomson expansion, inversion temperature of gases, expansion of ideal gases under isothermal and adiabatic condition **B. THERMO CHEMISTRY** Thermochemistry, Laws of Thermo-chemistry, Heats of reactions, standard states; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions, Adiabatic flame temperature, explosion temperature.	22	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
October / November	Unit – 2	**A. THERMODYNAMICS-II** Second Law of Thermodynamics: Spontaneous process, Second law, Statement of Carnot cycle and efficiency of heat engine, Carnot's theorem, thermodynamic state of temperature. Concept of entropy: Entropy change in a reversible and irreversible process, entropy change in isothermal reversible expansion of an ideal gas, entropy change in isothermal mixing of ideal gases, physical signification of entropy, Molecular and statistical interpretation of entropy. **B.** Gibbs and Helmholtz free energy, variation of G and A with pressure, volume, temperature, Gibbs-Helmholtz equation, Maxwell relations, Elementary idea of Third law of Thermodynamics, concept of residual entropy, calculation of absolute entropy of molecule.	20	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
November/ December	Unit –3	**A CHEMICAL EQUILIBRIUM** Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases. Concept of Fugacity, Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Coupling of exergonic and endergonic reactions. Equilibrium constants and their quantitative dependence on temperature, pressure and concentration. Thermodynamic derivation of relations between the various equilibrium constants Kp, Kc and Kx. Le Chatelier principle (quantitative treatment). Equilibrium between ideal gas and a pure condensed phase. **B IONIC EQUILIBRIA**	24	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT

		Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono protic acids (exact treatment). Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its applications. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.		
December / January	Unit –4	**PHASE EQUILIBRIUM** **A.** Phase rule, Phase, component and degree of freedom, derivation of Gibbs phase rule, Clausius-Claperon equation and its applications to Solid-Liquid, Liquid-Vapor and Solid- Vapor, limitation of phase rule, applications of phase rule to one component system: Water system and sulphur system. Application of phase rule to two component system: Pb-Ag system, desilverization of lead, Zn-Mg system, Ferric chloride-water system, congruent and incongruent melting point and eutectic point. Three component system: Solid solution liquid pairs. **B.** Nernst distribution law, Henry's law, application, solvent extraction	18	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
January/ February	Unit – 5	**PHOTOCHEMISTRY** Characteristics of electromagnetic radiation, Interaction of radiation with matter, difference between thermal and photochemical processes, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws of photochemistry: Grothus-Drapper law, Stark-Einstein law, quantum yield, actinometry, examples of low and high quantum yields, Photochemical equilibrium and the differential rate of photochemical reactions, Quenching, Role of photochemical reaction in biochemical process. Jablonski diagram depicting various process occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), photosensitized reactions, energy transfer processes {simple examples), photostationary states, Chemiluminescence.	18	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT

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DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY** CLASS**: 3rd YEAR**
Name of Teacher – **MR. JAGRIT KUMAR / DR. YAMAN KUMAR SAHU**
Course type: **Theory/Practical/Both**
Course Title: **INORGANIC CHEMISTRY**

Month	Title Unit	Topic of lecture	No. of Lectures	Methods of Delivery
August/ September	Unit – 1	**METAL-LIGAND BONDING IN TRANSITION METAL COMPLEXES** (A) Limitations of valence bond theory, Limitation of Crystal Field Theory, Application of CFSE, tetragonal distortions from octahedral geometry, Jahn–Teller distortion, square planar geometry. Qualitative aspect of Ligand field and MO Theory. (B) Thermodynamic and kinetic aspects of metal complexes. A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes, Trans- effect, theories of trans effect. Mechanism of substitution reactions of square planar complexes.	18	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
October / November	Unit – 2	**MAGNETIC PROPERTIES OF TRANSITION METAL COMPLEXES** Types of magnetic behavior, methods of determining magnetic susceptibility, spin only formula, L-S coupling, correlation of μso (spin only) and μeff. values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes. Electronic spectra of Transition Metal Complexes. Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectro-chemical series. Orgel-energy level diagram for d_1 and d_2 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion.	22	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
November/ December	Unit –3	**ORGANOMETALLIC CHEMISTRY** Definition and classification of organometallic compounds on the basis of bond type. Concept of hapticity of organic ligands. Metal carbonyls: 18-electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation (direct combination, reductive carbonylation, thermal and photochemical decomposition) of mono and binuclear carbonyls of 3d series. Structures of mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co and Ni using VBT. Π acceptor behavior of CO (MO diagram of CO to be discussed), Zeise's salt: Preparation and structure. **Catalysis by Organometallic Compounds –** Study of the following industrial processes and their mechanism : 1. Alkene hydrogenation (Wilkinsons Catalyst) 2. Polymeration of ethane using Ziegler – Natta Catalyst	20	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
December / January	Unit –4	**BIOINORGANIC CHEMISTRY** Essential and trace elements in biological processes, Excess and deficiency of some trace metals, Toxicity of some metal ions (Hg, Pb, Cd and As), metalloporphyrins with special reference to hemoglobin and myoglobin. Biological role of alkali and alkaline earth metals with special reference to	16	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group

		Ca^{2+} and Mg^{2+}, nitrogen fixation.		discussion 5. Test 6. Notes 7. Use of ICT
January/ February	Unit – 5	**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, Applications of HSAB principle. **INORGANIC POLYMERS** Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones. Silicates, phosphazenes and polyphosphate.	16	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT

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2023-24

DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY** CLASS**: 3rd YEAR**
Name of Teacher – **MR. JAGRIT KUMAR / DR. YAMAN KUMAR SAHU**
Course type: **Theory/Practical/Both**
Course Title: **ORGANIC CHEMISTRY**

Month	Title Unit	Topic of lecture	No. of Lectures	Methods of Delivery
August/ September	Unit – 1	**HETEROCYCLIC COMPOUNDS** Classification and nomenclature, Structure, aromaticity in 5-membered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Indole (Fischer indole synthesis and Madelung synthesis), Quinoline and isoquinoline, (Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner- Miller synthesis, Bischler-Napieralski reaction, Pictet- Spengler reaction, Pomeranz-Fritsch reaction).	20	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
October / November	Unit – 2	**A. ORGANOMETALLIC REAGENT** Organomagnesium compounds: Grignard reagents formation, structure and chemical reactions. Organozinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions. **B. ORGANIC SYNTHESIS VIA ENOLATES** Active methylene group, alkylation of diethylmalonate and ethyl acetoacetate, Synthesis of ethyl acetoacetate: The Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate. Robbinson annulations reaction.	22	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
November/ December	Unit –3	**BIOMOLECULES** **A. CARBOHYDRATES** Occurrence, classification and their biological importance. Monosaccharides: relative and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani Fischer synthesis and Ruff degradation; Disaccharides – Structural comparison of maltose, lactose and sucrose. Polysaccharides – Elementary treatment of starch and cellulose. **B. AMINO ACIDS, PROTEINS AND NUCLEIC ACIDS** Classification and Nomenclature of amino acids, Configuration and acid base properties of amino acids, Isoelectric Point, Peptide bonds, Protein structure, denaturation/ renaturation, Constituents of nucleic acid, DNA, RNA nucleoside, nucleotides, double helical structure of DNA.	18	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
December / January	Unit –4	**SYNTHETIC POLYMERS** **A.** Addition or chain growth polymerization, Free radical vinyl polymerization, Ziegler-Natta polymerization, Condensation or Step growth polymerization, polyesters, polyamides, phenols- formaldehyde resins, urea-formaldehyde resins, epoxy resins and polyurethanes, natural and synthetic rubbers.	18	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion

		B. SYNTHETIC DYES Colour and constitution (Electronic Concept). Classification of Dyes. Chemistry of dyes. Chemistry and synthesis of Methyl Orange, Congo Red, Malachite Green, Crystal Violet, phenolphthalein, fluorescein, Alizarine and Indigo.		5. Test 6. Notes 7. Use of ICT
January/ February	Unit – 5	**A. INFRA-RED SPECTROSCOPY** Basic principle, IR absorption Band their position and intensity, IR spectra of organic compounds. **B. UV-VISIBLE SPECTROSCOPY** Beer Lambert's law, effect of Conjugation, Types of electronic transitions λ max, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption Visible spectrum and colour. **C. NMR SPECTROSCOPY** Basic principles of Proton Magnetic Resonance, Tetramethyl silane (TMS) as internal standard, chemical shift and factors influencing it; Spin – Spin coupling and coupling constant (J); Anisotropic effects in alkene, alkyne, aldehydes and aromatics, Interpretation of NMR spectra of simple organic compounds. ^{13}CMR spectroscopy: Principle and applications.	24	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT

Signature of Teacher Signature of H.O.D

Signature of Principal

Govt. C.L.C College Patan, Dist. – Durg
2023-24

DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY** CLASS**: 3rd YEAR**
Name of Teacher – **MR. JAGRIT KUMAR / DR. YAMAN KUMAR SAHU**
Course type: **Theory/Practical/Both**
Course Title: **PHYSICAL CHEMISTRY**

Month	Title Unit	Topic of lecture	No. of Lectures	Methods of Delivery
August/ September	Unit – 1	**QUANTUM MECHANICS–I** Black-body radiation, Planck's radiation law, photoelectric effect, Compton effect. Operator: Hamiltonian operator, angular momentum operator, Laplacian operator, postulate of quantum mechanics, eigen values, eigen function, Schrodinger time independent wave equation, physical significance of ψ & $\psi 2$, application of Schrodinger wave equation to particle in a one dimensional box, hydrogen atom (separation into three equations) radial and angular wave functions.	18	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
October / November	Unit – 2	**A. QUANTUM MECHANICS–II** Quantum Mechanical approach of Molecular orbital theory, basic ideas-criteria for forming M.O. and A.O., LCAO approximation, formation of H^{2+} ion, calculation of energy levels from wave functions, bonding and antibonding wave functions, Concept of σ, σ^*, π, π^* orbitals and their characteristics, Hybrid orbitals-sp,sp2,sp3 Calculation of coefficients of A.O.'s used in these hybrid orbitals. Introduction to valence bond model of H_2, comparison of M.O. and V.B. models. Huckel theory, application of Huckel theory to ethene, propene, etc.	18	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
November/ December	Unit –3	**SPECTROSCOPY** **Introduction**: Characterization of Electromagnetic radiation, regions of the spectrum, representation of spectra, width and intensity of spectral transition, Rotational Spectrum of Diatomic molecules. Energy levels of a rigid rotor, selection rules, determination of bond length, qualitative description of non-rigid rotator, isotopic effect. **Vibrational Spectroscopy:** Fundamental vibration and their symmetry vibrating diatomic molecules, Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, determination of force constant, anharmonic oscillator **Raman spectrum:** Concept of polarizability, quantum theory of Raman spectra, stokes and antistokes lines, pure rotational and pure vibrational Raman spectra. Applications of Raman Spectra. **Electronic Spectroscopy:** Basic principles, Electronic Spectra of diatomic molecule, Franck-Condon principle, types of electronic transition, application of electronic spectra.	22	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
December / January	Unit –4	**ELECTROCHEMISTRY-I** **A. Electrolytic conductance:** Specific and equivalent conductance, measurement of equivalent conductance, effect of dilution on conductance, Kohlrausch law, application of Kohlrausch law in determination of dissociation constant of weak electrolyte, solubility of sparingly soluble electrolyte, absolute velocity of ions, ionic product of water,	18	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion

		conductometric titrations. **B. Theories of strong electrolyte:** limitations of Ostwald's dilution law, weak and strong electrolytes, Elementary ideas of Debye – Huckel - Onsager's equation for strong electrolytes, relaxation and electrophoretic effects. **C. Migration of ions:** Transport number, Determination by Hittorf method and moving boundary method, ionic strength.		5. Test 6. Notes 7. Use of ICT
January/ February	Unit – 5	**ELECTROCHEMISTRY-II** **A. Electrochemical cell and Galvanic cells –** reversible and irreversible cells, conventional representation of electrochemical cells, EMF of the cell and effect of temperature on EMF of the cell, Nernst equation Calculation of ΔG, ΔH and ΔS for cell reactions. **B. Single electrode potential :** standard hydrogen electrode, calomel electrode, quinhydrone electrode, redox electrodes, electrochemical series **C. Concentration cell with and without transport, liquid** - junction potential, application of concentration cells in determining of valency of ions , solubility product and activity coefficient **D.** Corrosion-types , theories and prevention	18	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT

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