Govt. C.L.C College Patan, Dist. – Durg

2022-23

DEPARTMENT OF CHEMISTRY

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

Name of Teacher – JAGRIT KUMAR/ DR. FOOLESWAR VERMA/ DHARMENDRA KUMAR

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	**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.	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	**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.	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	**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.	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	**A. s-BLOCK ELEMENTS** General concepts on group relationships and gradation properties, Comparative study, salient features of hydrides, solvation & complexation tendencies including their function in biosystems and introduction to alkyl & aryls, Derivatives of alkali and alkaline earth metals	20	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group

		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.		discussion 5. Test 6. Notes 7. Use of ICT
January/ February	Unit – 5	**A CHEMISTRY OF NOBLE GASES** Chemical properties of the noble gases, chemistry of xenon, structure, bonding in xenon compounds **B. THEORETICAL PRINCIPLES IN QUALITATIVE ANALYSIS (H2S SCHEME)** Basic principles involved in the analysis of cations and anions and solubility products, common ion effect. Principles involved in separation of cations into groups and choice of group reagents. Interfering anions (fluoride, borate, oxalate and phosphate) and need to remove them after Group II.	20	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
2022-23
DEPARTMENT OF CHEMISTRY

Name of Department – CHEMISTRY CLASS: 1st YEAR BSc
Name of Teacher – JAGRIT KUMAR/ DR. FOOLESWAR VERMA/ TIKESHWARI VERMA
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	**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.	21	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	**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.	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	**CONFORMATIONAL ANALYSIS OF ALKANES** Conformational analysis of alkanes, ethane, butane, cyclohexane and sugars. Relative stability and Energy diagrams. Types of cycloalkanes and their relative stability, Baeyer strain theory: Theory of strainless rings, Chair, Boat and Twist boat conformation of cyclohexane with energy diagrams; Relative stability of mono-substituted cycloalkanes and disubstituted cyclohexane.	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	**CHEMISTRY OF ALIPHATIC HYDROCARBONS** **A. Carbon-Carbon sigma (σ) bonds** Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reaction, Free radical substitutions: Halogenation-relative reactivity and selectivity. **B. Carbon-Carbon Pi (л) bonds:** Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations. Reactions of alkenes: Electrophilic additions and mechanisms (Markownikoff/Anti –Markownikoff addition), mechanism of oxymercuration-demercuration, hydroboration-oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). 1,2-and 1,4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination and mechanism, e.g.	22	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT

		propene, 1-butene, toluene, ethyl benzene. Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds. Alkylation of terminal alkynes.		
January/ February	Unit – 5	**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.	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: 1st YEAR BSc
Name of Teacher – DHARMENDRA KUMAR/ DR. POKHRAJ SHARMA
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	**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.	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	**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, root 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. Behaviour of real gases: Deviations from ideal gas behaviour, compressibility factor (Z), and its variation with pressure and temperature for different gases. Causes of deviation from ideal behaviour. van der Waals equation of state, its derivation and application in explaining real gas behaviour, calculation of Boyle temperature. Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state, relation between critical constants and van der Waals constants, law of corresponding states.	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	**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 thixotrophy, Application of colloids. Physical adsorption, chemisorption, adsorption isotherms (Langmuir and Freundlich). Nature of adsorbed state. Qualitative discussion of BET.	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	**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, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Crystal defects.	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. 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.	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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2022-23

DEPARTMENT OF CHEMISTRY

Name of Department – CHEMISTRY CLASS: 2nd YEAR BSc

Name of Teacher – JAGRIT KUMAR/ DR. FOOLESWAR VERMA/ DHARMENDRA KUMAR

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	**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.	21	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 dioxide, HF, H_2SO_4, Ionic liquids.	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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DEPARTMENT OF CHEMISTRY

Name of Department – CHEMISTRY CLASS: 2nd YEAR BSc
Name of Teacher – JAGRIT KUMAR/ DR. FOOLESWAR VERMA/ TIKESHWARI VERMA
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	**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.	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	**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, Hydroxyacids. **B. CARBOXYLIC ACID DERIVATIVES** Structure of acid chlorides, esters, amides and acid anhydrides, Relative stability of acyl derivatives. Physical	20	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT

		properties, inter-conversion of acid derivatives by nucleophilic acyl substitution. Mechanism of acid and base catalyzed esterification and hydrolysis.		
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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2022-23

DEPARTMENT OF CHEMISTRY

Name of Department – CHEMISTRY CLASS: 2nd YEAR BSc

Name of Teacher – DHARMENDRA KUMAR/ DR. POKHRAJ SHARMA

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	**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** 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	24	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT

		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 BSc
Name of Teacher – JAGRIT KUMAR/ DR. FOOLESWAR VERMA
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.	21	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 Ca^{2+} and Mg^{2+}, nitrogen fixation.	16	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	**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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2022-23

DEPARTMENT OF CHEMISTRY

Name of Department – CHEMISTRY CLASS: 3rd YEAR BSC

Name of Teacher – JAGRIT KUMAR/ TIKESHWARI VERMA/ DR. FOOLESWAR VERMA

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. **B. SYNTHETIC DYES** Colour and constitution (Electronic Concept), Classification of Dyes. Chemistry of dyes. Chemistry and synthesis of	18	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT

		Methyl Orange, Congo Red, Malachite Green, Crystal Violet, phenolphthalein, fluorescein, Alizarine and Indigo.		
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

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2022-23
DEPARTMENT OF CHEMISTRY

Name of Department – CHEMISTRY CLASS: 3rd YEAR BSc
Name of Teacher – DHARMENDRA KUMAR/ DR. POKHRAJ SHARMA
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 & ψ2, application of Schrodinger wave equation to particle in a one dimensional box, hydrogen atom (separation into three equations) radial and angular wave functions.	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. 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, conductometric titrations. **B.** Theories of strong electrolyte: limitations of Ostwald's dilution law, weak and strong electrolytes, Elementary ideas	18	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT

		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.		
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 **REFERENCE**	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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2022-23
DEPARTMENT OF CHEMISTRY

Name of Department – CHEMISTRY CLASS: M.Sc I[st] SEM
Name of Teacher – JAGRIT KUMAR/ Tikeshwari Verma
Course type: Theory/Practical/Both Course Title:

GROUP THEORY AND CHEMISTRY OF METAL COMPLEXES

Month	Title unit	Topic of Lecture	No. of Lectures	Methods of Delivery
September	Unit – 1	**SYMMETRY AND GROUP THEORY IN CHEMISTRY:** Symmetry elements and symmetry operation- Centre of Symmetry- Plane and its types of Symmetry-Proper and Improper axis of Symmetry- Principal axis and subsidiary axes- The concept of groups- Assigning Point groups with illustrative examples- Symmetry operations and order of a group - Group theoretical rules (Group postulates) - Reducible and Irreducible representations- Matrix representations of symmetry operations. Definitions of group, subgroup, relation between orders of a finite group and its subgroup. Conjugacy relation and classes. Point symmetry group. Schoen flies symbols, representations of groups by matrices (representation for the Cn, Cnv, Cnh, Dnh etc. groups to be worked out explicitly). Character of a representation. The great orthogonality theorem (without proof) and its importance. Character tables of C_2v, C_2h, C_3v and their use in spectroscopy.	10	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. METAL-LIGAND BONDING:** Limitation of crystal field theory, molecular orbital theory, octahedral, tetrahedral and square planar complexes. π-bonding and molecular orbital theory. **B. METAL-COMPLEXES:** Metal carbonyls, structure and bonding, vibrational spectra of metal carbonyls for bonding and structural elucidation, important reactions of metal carbonyls. Preparation, bonding, structure and important reactions of transition metal nitrosyl, Dinitrogen and dioxygen complexes: Tertiary phosphine as ligand.	15	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
November	Unit – 3	**A. METAL–LIGAND EQUILIBRA IN SOLUTION:** Stepwise and overall formation constants and their interaction, trends in stepwise constants, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand, chelate effect and its thermodynamic origin, determination of binary formation constants by pH- metry and spectrophotometry. **B. ISOPOLY ACID AND HETEROPOLYACID:** Isopoly and heteropoly acids of Mo and W. Preparation, properties and structure. Classification, preparation, properties and structures of borides, carbides, nitrides and silicides. **SILICATES-** Classification and structure. **SILICONES** - Preparation, properties and application.	15	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes 7. Use of ICT
December	Unit – 4	**A. METAL CLUSTERS:** Higher boranes, carboranes, metalloboranes and metallocarboranes. Metalcarbonyl and halide cluster, compounds with metalmetal multiple bonds. **B. CHAINS:** Catenation, heterocatenation, intercatenation. **C. RINGS:** Borazines, phosphazines.	14	

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2022-23
DEPARTMENT OF CHEMISTRY

Name of Department – CHEMISTRY CLASS: M.Sc -I[st] SEM
Name of Teacher – Tikeshwari Verma
Course type: Theory/Practical/Both Course Title:
CONCEPTS IN ORGANIC CHEMISTRY

Month	Title unit	Topic of Lecture	No. of Lectures	Methods of Delivery
September	Unit – 1	**A. NATURE OF BONDING IN ORGANIC MOLECULES:** Localized and delocalized chemical bond, conjugation and cross-conjugation, Bonding in Fullerenes, Bonds weaker than covalent, Addition compounds, Crown ether complexes and cryptands. Inclusion compounds, Cyclodextrins, Catenanes and rotaxanes. **B. AROMATICITY:** Aromaticity in benzonoid and non-benzenoid compounds, Huckel's rule anti-aromaticity, homo-aromaticity. PMO approach for Aromaticity, Annulenes.	10	1. Use of ICT 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
October / November	Unit – 2	**A. CONFORMATIONAL ANALYSIS**: Conformational analysis of cycloalkanes, decalins, effect of conformation on reactivity, conformation of sugars, steric strain due to unavoidable crowding. **B. STEREOCHEMISTRY:** Elements of symmetry, chirality, molecules with more than one chiral center, methods of resolution, optical purity, stereospecific and stereoselective synthesis. Asymmetric synthesis. Optical activity in the absence of chiral carbon (Biphenyls, allenes and spiranes), chirality due to helical shape.	15	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
November	Unit – 3	**A. REACTION INTERMEDIATES:** Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes and nitrenes. Sandmeyer reaction, Free radical rearrangement and Hunsdiecker reaction. **B. ELIMINATION REACTIONS:** The E_2, E_1 and E_1CB mechanisms. Orientation of the double bond. Reactivity, effects of substrate structures, attacking base, the leaving group and the medium.	10	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
December	Unit – 4	**PERICYCLIC REACTIONS:** Classification of pericyclic reactions. Woodward-Hoffmann correlation diagrams. FMO and PMO approach. Electrocyclic reactions - conrotatory and disrotatory motions, 4n, 4n+2 and allyl systems. Cycloadditions -antarafacial and suprafacial additions, 4n and 4n+2 system, 2+2 addition of ketenes,1, 3 dipolar cycloadditions and cheleotropic reactions. Sigmatropic rearrangements -suprafacial and antarafacial shifts of H, sigmatrophic shifts involving carbonmoieties, 3, 3- and 5, 5- sigmatropic rearrangements. Claisen, Cope and Aza-Cope rearrangements. Ene reaction.	15	1. Use of ICT 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes

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2022-23
DEPARTMENT OF CHEMISTRY

Name of Department – CHEMISTRY CLASS M.Sc – I[st] SEM
Name of Teacher – Dharmendra Kumar
Course type: Theory/Practical/Both Course Title : **QUANTUM CHEMISTRY, THERMODYNAMICS AND CHEMICAL DYNAMICS – I**

Month	Title unit	Topic of Lecture	No. of Lectures	Methods of Delivery
September	Unit – 1	**A. MATHEMATICAL CONCEPT IN QUANTUM CHEMISTRY:** Vector quantities and their properties. Complex numbers and Coordinate transformation. Differential and Integral Calculus, Basic rules of differentiation and Integration Applications. **B.** The Schrodinger equation and postulates of quantum mechanics. Discussion of solutions of the Schrodinger equation to some model systems viz Particle in a box the harmonic oscillator, the rigid rotator, the hydrogen atom.	12	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
October / November	Unit – 2	**BASICS OF THERMODYNAMICS:** Maxwell's thermodynamic relations isotherm, vant's Hoff hypothesis. Partial molar volume and partial molar heat content. Chemical potential, Gibbs Duhem equation, variation of chemical potential with temperature and pressure. Chemical potential of ideal gases, pure solids, liquids and mixture of ideal gases. Activity and Fugacity, Determination of Fugacity, Variation of Fugacity with temperature and pressure.	16	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
November	Unit – 3	**ELECTROCHEMISTRY–I:** Electrochemistry of solutions. Debye-Huckel Onsager treatment and its extension, ion solvent interactions. Debey-Huckel-Limiting Law. Debye-Huckel theory for activity coefficient of electrolytic solutions. Determination of activity and activity coefficient, Ionic strength, Thermodynamics of electrified interface. Derivation of electro-capillarity, Lippmann equation (surface excess), Methods of determination.	14	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
December	Unit – 4	**CHEMICAL DYNAMICS –I:** Methods of determining rate laws, consecutive reactions, collision theory of reaction rates, steric factor, Activated complex theory, kinetic salt effects, steady state kinetics, and thermodynamic and kinetic control of reactions. Dynamic chain (Hydrogen-bromine and Hydrogen- chlorine reactions) and Oscillatory reactions (Belousov - Zhabotinsky reaction)	16	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes

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2022-23
DEPARTMENT OF CHEMISTRY

Name of Department – CHEMISTRY CLASS: I[st] SEM – MSc
Name of Teacher – Dharmendra Kumar/ Tikeshwari Verma
Course type: Theory/Practical/Both Course Title :

THEORY AND APPLICATIONS OF SPECTROSCOPY- I

Month	Title unit	Topic of Lecture	No. of Lectures	Methods of Delivery
September	Unit – 1	**UNIFYING PRINCIPLES:** Electromagnetic radiation, interaction of electromagnetic radiation with matter absorption, emission, transmission, reflection, dispersion, polarization and scattering, Uncertainty relation and natural line width and natural line broadening, transition probability, selection rules, intensity of spectral lines, Born-Oppenheimer approximation, rotational, vibrational and electronic energy levels.	12	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
October / November	Unit – 2	**MICROWAVE SPECTROSCOPY:** Classification of molecules in term of their internal rotation mechanism, determination of rotation energy of diatomic and polyatomic molecules, effect of isotopic substitution on diatomic and polyatomic molecules. Intensities of rotational spectral lines and parameters of rotational and the transition frequencies, non-rigid rotors, Linear and symmetric top polyatomic molecules. Application in determination of bond length.	12	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
November	Unit – 3	**SCATTERING SPECTROSCOPY:** **A. Electron Diffraction Spectroscopy** :Principle, instrumentations and application of Auger spectroscopy and Scanning Electron Microscopy for chemical characterization, electron diffraction of gases and vapours, The Wierl equation and co-related method, application of electron diffraction. **B.** Theory, instrumentation and application of turbidimetry, nephelometry and fluorometry, Fluoroscence and phosphorescence and factors affecting them.	14	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
December	Unit – 4	**RAMAN SPECTROSCOPY:** Classical and quantum theories of Raman effect, pure rotational, vibrational and vibrational-rotational Raman spectra, selection rules, mutual exclusion principle, Resonance Raman spectroscopy, Coherent anti Stokes Raman spectroscopy (CARS), Instrumentation, Application of Raman effect in molecular structures, Raman activity of molecular vibration, structure of CO_2, N_2O, SO_2, NO_2, ClF_3.	15	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes

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Govt. C.L.C College Patan, Dist. – Durg
2022-23
DEPARTMENT OF CHEMISTRY

Name of Department – CHEMISTRY CLASS: II[nd] SEM – M.Sc
Name of Teacher – JAGRIT KUMAR
Course type: Theory/Practical/Both Course Title:
TRANSITION METAL COMPLEXES

Month	Title unit	Topic of Lecture	No. of Lectures	Methods of Delivery
January	Unit – 1	**REACTION MECHANISM OF TRANSITION METAL COMPLEXES:** Energy profile of a reaction, reactivity of metal complexes, inert and labile complexes, kinetic application of valence bond and crystal field theories, kinetics of octahedral substitution, anation reactions and reactions without metal ligand bond cleavage. Substitution reactions in square planar complexes, the trans effect. Redox reactions, electron transfer reactions, mechanism of one electron transfer reactions, outer sphere type reactions, cross reactions and Marcus-Hush theory, inner sphere type reactions.	14	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
February / March	Unit– 2	**ELECTRONIC SPECTRA AND MAGNETIC PROPERTIES OF TRANSITION METAL COMPLEXES:** Spectroscopic ground states, Selection rules, mechanism for breakdown of the selection rules, intensity of absorption, band width correlation, Orgel and Tanabe- Sugano diagram for transition metal complexes (d1-d9 states), spectra of d-d metal complexes of the type $[M(H_2O)_6]$ n+, spin free and spin paired ML_6 complexes of other geometries, Calculations of Dq, B and β parameters, spin forbidden transitions, effect of spin-orbit coupling, Spectrochemical and Nephelouxetic series. Magnetic properties of complexes of various geometries based on crystal field model, spin free-spin paired equillibria in octahedral stereochemistry.	12	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
March/ April	Unit– 3	**A. TRANSITION METAL COMPLEXES:** Tranisition metal complexes with unsaturated organic molecules, alkanes, allyl, diene dienyl, arene and trienyl complex, preparations, properties, nature of bonding and structure features. Important reaction relating to nucleophilic and electrophilic attack on ligands and organic synthesis. **B.** Transition Metal Complexes with Bond to hydrogen.	16	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
April	Unit– 4	**A. ALKYLS AND ARYLS OF TRANSITION METALS:** Types, routes of synthesis, stability and decomposition pathways, organocopper in organic synthesis. **B. COMPOUNDS OF TRANSITION METAL - CARBON MULTIPLE BONDS :** Alkylidenes, low valent carbenes, nature of bond and Structural characteristics. **C. FLUXIONAL ORGANOMETALLIC COMPOUNDS:** Fluxionality and dynamic equilibria in compounds such as olefin, allyl and dienyl complexes.	10	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes

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2022-23
DEPARTMENT OF CHEMISTRY

Name of Department – CHEMISTRY CLASS: II[nd] SEM – M.Sc
Name of Teacher – Dr. Fooleswar Verma
Course type: Theory/Practical/Both Course Title:
REACTION MECHANISMS

Month	Title unit	Topic of Lecture	No. of Lectures	Methods of Delivery
January	Unit – 1	A. **ALIPHATIC NUCLEOPHILIC SUBSTITUTION**: The S_N^2 and S_N^1 mechanisms. The neighboring group mechanism, neighboring group participation by π and σ bonds, anchimeric assistance. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, phase transfer catalysis, ambident nucleophile and regioselectivity. B. **AROMATIC NUCLEOPHILIC SUBSTITUTION:** The SNAr, SN^1 and benzyne mechanisms. Reactivity -effect of substrate structure, leaving group and attacking nucleophile. The von Richter, Sommelet-Hauser, and Smiles rearrangements.	14	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
February	Unit – 2	A. **ALIPHATIC ELECTROPHILIC SUBSTITUTION:** Mechanisms of – SE^1, SE^2 electrophilic substitution accompanied by double bond shifts. Effect of substrates, leaving group and the solvent polarity on the reactivity. B. **AROMATIC ELECTROPHILIC SUBSTITUTION:** The arenium ion mechanism, Orientation and reactivity. Theortho/para ratio, ipso attack, orienation in other ring systems. Reactivity-Effect of substrates and electrophiles. Vilsmeir reaction and Gattermann-Koch reaction.	16	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
March	Unit – 3	**ADDITION TO CARBON-CARBON MULTIPLE BONDS:** Mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regio- and chemoselectivity. Addition to cyclopropane ring, Hydrogenation of double and triple bonds, hydrogenation of aromatic rings, Hydroboration, Micheal reaction. Sharpless asymmetric epoxidation.	17	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
April	Unit – 4	**ADDITION TO CARBON-HETERO MULTIPLE BONDS:** Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acids, esters and nitriles.Addition of Grignard Reagents, Organo-Zinc and Organolithium to carbonyls and unsaturated carbonyl compounds, Wittig reaction. Mechanism of condensation reactions involving enolates–Perkins, Aldol, Claisen, benzoin, Mannich, Knoevengel, Stobbereactions. Hydrolysis of esters and amides, ammonolysis of esters.	19	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes

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2022-23
DEPARTMENT OF CHEMISTRY

Name of Department – CHEMISTRY CLASS: II[nd] SEM – MSc
Name of Teacher – Dr. Pokhraj Sharma
Course type: Theory/Practical/Both Course Title:
QUANTUM CHEMISTRY, THERMODYNAMICS AND CHEMICAL DYNAMICS - II

Month	Title unit	Topic of Lecture	No. of Lectures	Methods of Delivery
January	Unit – 1	**A. APPLICATION OF MATRICES IN QUANTUM CHEMISTRY:** Addition and multiplication, inverse and transpose of matrices. Determinants in Quantum Chemistry. **B. ANGULAR MOMENTUM IN QUANTUM CHEMISTRY:** Angular momentum, angular momentum Operators. Eigen functions and Eigen values for Angular momentum, Ladder operators. **C. APPROXIMATE METHODS** The variation theorem, linear variation principle. Perturbation theory (first order and non-degenerate). Applications of variation method and perturbation theory to the Helium atom.	13	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
February	Unit – 2	**STATISTICAL THERMODYNAMICS:** Probability, permutations and combinations, concepts of probability, Maxwell Boltzmann distribution. Different ensembles and Partition functions-translational, rotational, vibrational and Electronic partition functions. Thermodynamic function using appropriate Partition functions. Fermi- Dirac and Bose-Einstein Statistics and statistical basis of entropy. Heat capacity of solids, Debye and Einstein Models.	18	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
March	Unit – 3	**ELECTROCHEMISTRY –II:** Structure of electrified interfaces. Gouy-Chapman and Stern models. Over potentials and exchange current density, Derivation of Butler–Volmer equation, Tafelplot. Semiconductor interfaces, Theory of double layer at semiconductor- electrolyte. Solution interfaces, structure of double layer interfaces. Effect of light at semiconductor solution interfaces. Electro catalysis influence of various parameters.	18	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
April	Unit-4	**CHEMICAL DYNAMICS –II:** General features of fast reactions by flow method, relaxation method, flash photolysis and the nuclear magnetic resonance method. Dynamics of molecular motions, probing the transition state, dynamics of barrier less chemical reactions in solutions, dynamics of unimolecular reaction. [Lindemann –Hinshelwood, RRK and Rice-Ramsperger-Kassel-Marcus {RRKM}] theories of unimolecular reactions.	16	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes

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Govt. C.L.C College Patan, Dist. – Durg
2022-23
DEPARTMENT OF CHEMISTRY

Name of Department – CHEMISTRY CLASS: II[nd] SEM – M.Sc
Name of Teacher – Dr. Yaman Kumar Sahu
Course type: Theory/Practical/Both Course Title:

THEORY AND APPLICATIONS OF SPECTROSCOPY –II

Month	Title unit	Topic of Lecture	No. of Lectures	Methods of Delivery
January	Unit – 1	**ULTRAVIOLET AND VISIBLE SPECTROSCOPY:** Introduction, Intensity of vibrational – electronic spectra, Frank-Condon principle, dissociation energy, Rotational fine structure of electronic – vibrational transitions, shape of molecular orbitals of some molecules viz., H_2, He_2, N_2, O_2. Electronic spectra of organic molecules, chromophores, Applications of electronic spectroscopy and identification of organic molecules. Spectrophotometric studies of complex ions, determination of ligand/metal ratio in a complex, determination of stability constants.	14	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
February	Unit – 2	**INFRA RED SPECTROSCOPY:** Introduction, simple and enharmonic oscillators in vibrational spectroscopy, diatomic-vibrating rotor, Modes of vibration in polyatomic molecules, vibration coupling, Fourier Transform IR spectroscopy: instrumentation, interferometric spectrophotometer, sample handling, Factors influencing vibrational frequencies, Application of IR spectroscopy: Interpretation of IR spectra of normal alkanes, aromatic hydrocarbons, alcohols and phenols aldehydes and ketones, ethers, esters, carboxylic acids, amines and amides.	16	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
March	Unit – 3	**MASS SPECTROMETRY:** Introduction, basic principles, separation of the ions in the analyzer, resolution, molecular ion peak, mass spectral fragmentation of organic compounds, factors affecting fragmentation, McLafferty rearrangement. Instrumentation, Characteristics of mass spectra of Alkanes, Alkenes, Aromatic hydrocarbons, Alcohols, Amines. Nitrogen rule, ring rule, Molecular weight and formula determination. Gas chromatography-Mass spectrophotometry: Introduction.	14	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
April	Unit – 4	**NUCLEAR RESONANCE SPECTROPHOTOMETRY:** Theory of NMR spectroscopy, interaction of nuclear spin and magnetic moment, chemical shift, processional motion of nuclear particles in magnetic field, spin-spin splitting, coupling constants, factor affecting the chemical shift, shielding effect, effect of chemical exchange, hydrogen bonding, instrumentation of Fourier transform NMR spectrophotometer, structure determination of organic compounds, Carbon-^{13} NMR spectroscopy, Multiplicity-proton (^{1}H) decoupling noise decoupling, off resonance decoupling, selective proton decoupling. Chemical shift (aliphatic, olephinic, alkyne, aromatic and carbonyl carbon)	17	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes

Remark – Teaching will be offline according to government/university/local administration instruction.

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Govt.C.L.C Arts and Science College Patan, Dist-Durg (C.G.)

Govt. C.L.C College Patan, Dist. – Durg
2022-23
DEPARTMENT OF CHEMISTRY

Name of Department – CHEMISTRY CLASS: III[rd] SEM - M.Sc
Name of Teacher – JAGRIT KUMAR/ Dharmendra Kumar
Course type: Theory/Practical/Both Course Title:
RESONANCE SPECTROSCOPY, PHOTOCHEMISTRY AND ORGANOCATALYSIS

Month	Title unit	Topic of Lecture	No. of Lectures	Methods of Delivery
September	Unit – 1	**A. ELECTRON SPIN RESONANCE SPECTROSCOPY:** Introduction, principle, Hyperfine coupling, spin polarization for atoms and transition metal ions, spin-orbit coupling and significance of g-tensors, application to transition metal complexes (having one unpaired electron). **B. NUCLEAR QUADRUPOLE RESONANCE SPECTROSCOPY:** Quadrupole nuclei, quadrupole moments, electric field gradient, coupling constant, splittings, applications.	12	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
October/ November	Unit – 2	**A. PHOTOELECTRON SPECTROSCOPY:** Basic principle for atoms and molecules; Photo-electric effect, ionization process, Koopman's theorem, Auger electron spectroscopy, Determination of Dipolemoment. Photoelectron spectra of simple molecules-ESCA. **B. PHOTOACOUSTIC SPECTROSCOPY:** Basic principle of Photo acoustic Spectroscopy (PAS), PAS –gases and condensed system. Chemical and Surface applications.	14	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
November	Unit – 3	**A. PHOTOCHEMICAL REACTIONS:** Interaction of electromagnetic radiation with matter, Stern Volmer equation, types of excitations, fate of excited molecule, quantum yield, transfer of excitation energy, Actinometry. **B. DETERMINATION OF REACTION MECHANISM:** Classification, rate constants and life times of reactive energy states , determination of rate constants of reactions. Effect of light intensity on the rate of photo chemical reactions. **C. MISCELLANEOUS PHOTOCHEMICAL REACTIONS:** Photo-Fries reactions of anilides, Photo-Fries rearrangement. Barton reaction. Singlet molecular oxygen reactions. Photochemical formation of smog. Photo degradation of polymers, Photochemistry of vision.	16	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
December	Unit – 4	**A. ORGANOCATALYSIS** General Principles: Energetics, Catalytic cycles, catalytic efficiency and life time, selectivity. Type of organometallic reactions: Ligand substitution, Oxidative addition, reductive elimination and insertion and de-insertion. Homogeneous catalysis: Hydrogenetion of alkenes, Hydroformylation, Monosubstituted acetic acid synthesis, Wacker oxidation of alkenes. Alkenes metathesis, Palladium-Catalysed CC bond forming reactions, asymmetric oxidation. Heterogenous catalysis: The nature of heterogenous catalysts, Fischer-Tropsch synthesis, alkene polymerization.	12	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes

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Govt. C.L.C College Patan, Dist. – Durg
2022-23
DEPARTMENT OF CHEMISTRY

Name of Department – CHEMISTRY CLASS: III[rd] SEM - MSc
Name of Teacher – Tikeshwari Verma
Course type: Theory/Practical/Both Course Title:
CHEMISTRY OF BIOMOLECULES

Month	Title unit	Topic of Lecture	No. of Lectures	Methods of Delivery
September	Unit – 1	**A. BIOENERGETICS:** Standard free energy change in biochemical reactions, exergonic, endergonic. Hydrolysis of ATP, synthesis of ATP from ADP. **B. ELECTRON TRANSFER IN BIOLOGY**: Structure and function of metalloproteins in electron transport processes– cytochromes and Ion-sulphur proteins, synthetic models. **C. TRANSPORT AND STORAGE OF DIOXYGEN:** Heme proteins and oxygen uptake, structure and function of haemoglobin, myoglobin, haemocyanins and haemerythrin, model synthetic complexes of iron, cobalt and copper.	13	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
October/ November	Unit – 2	**A. METALLOENZYMES**: Zinc enzymes – carboxypeptibase and carbonic anhydrase. Iron enzymes – catalase, peroxidase and cytochrome P-450. Copper enzymessuperoxide dismutase. Molybdenum oxatransferase enzymes –xanthineoxidase. **B. ENZYME MODELS**: Host-guest chemistry, chiral recognition and catalysis, molecular recognition, molecular asymmetry and prochirality. Biomimetic chemistry, Cyclodextrin-based enzyme models, calixarenes, ionophores, synthetic enzymes orsynzymes.	15	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
November	Unit – 3	**A. ENZYMES:** Nomenclature and classification of Enzyme. Induced fit hypothesis, concept and identification of active site by the use of inhibitors. **B. CO-ENZYME CHEMISTRY:** Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD+, NADP+, FMN, FAD, lipoic acid, vitamin B^{12}. **C. BIOTECHNOLOGICAL APPLICATIONS OF ENZYMES:** Techniques and Methods of immobilization of enzymes, effect of immobilization on enzyme activity, application of immobilization enzymes in medicine and industry. Enzymes and Recombinant DNA Technology.	14	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
December	Unit- 4	**A. BIOPOLYMER INTERACTIONS:** Forces involved in biopolymer interaction. Electrostatic charges and molecular expansion, hydrophobic forces, dispersion force interactions. Multiple equilibria and various types of binding processes in biological systems. Hydrogen ion titration curves. **B. THERMODYNAMICS OF BIOPOLYMER SOLUTIONS**: Thermodynamics of biopolymer solution, osmotic pressure, membrane equilibrium, muscular contraction and energy generation in mechnochemical system. **C. CELL MEMBRANE AND TRANSPORT OF IONS**: Structure and functions of cell membrane, ion transport through cell membrane, irreversible thermodynamic treatment of membrane transport and Nerve conduction.	14	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes

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Govt. C.L.C College Patan, Dist. – Durg
2022-23
DEPARTMENT OF CHEMISTRY

Name of Department – CHEMISTRY CLASS: III[rd] SEM – M.Sc
Name of Teacher – Dharmendra Kumar
Course type: Theory/Practical/Both Course Title:

CATALYSIS, SOLID STATE AND SURFACE CHEMISTRY

Month	Title unit	Topic of Lecture	No. of Lectures	Methods of Delivery
September	Unit – 1	**ACIDS, BASES, ELECTROPHILES, NUCLEOPHILES AND CATALYSIS :** Acid-base dissociation, Electronic and structural effects, acidity and basicity. Acidity function and their applications. Hard and soft acids and bases. Nucleophilicity scales. Nucleofugacity. The alpha effect. Ambivalent Nucleophilies. Acid base catalysis-specific and general catalysis. Bronsted catalysis, Enzyme Catalysis.	12	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
October/ November	Unit – 2	**MICELLES AND ADSORPTION:** Micelles: Classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of Surfactants. Thermodynamics of micellization - phase separation and massaction models. Reverse micells, micro-emulsion. Micellar Catalysis, Surfacetension capillary action, pressure difference across curved surface (Laplace equation), vapour pressure of droplets (Kelvin equation), Gibbs adsorption isotherm.	14	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
November	Unit – 3	**SOLID STATE CHEMISTRY - I:** Crystal defects and Non-stoichiometry - Perfect and imperfect crystals, intrinsic and extrinsic defects - point defect, line and plane defects, vacancies – Schotty defects and Frankel defects. Thermodynamics of Schotty and Frenkel defect, formation of color centres, non-stoichiometry and defects. Electronic properties and Band theory of semiconductors.	15	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
December	Unit- 4	**MACROMOLECULES:** Polymer – Definition, types of polymers, electrically conducting, fire resistant, liquid crystal polymers, kinetics of polymerization, mechanism of polymerization. Molecular mass, average molecular mass, molecular mass determination (Osmometry, Viscometry, diffusion and light scattering Methods), Sedimentation, chain configuration of macromolecules, calculation of average dimensions of various chain structures.	13	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes

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Govt. C.L.C College Patan, Dist. – Durg
2022-23
DEPARTMENT OF CHEMISTRY

Name of Department – CHEMISTRY CLASS: III[rd] SEM - MSc
Name of Teacher – Dharmendra Kumar/ Tikeshwari Verma
Course type: Theory/Practical/Both Course Title:
ANALYTICAL TECHNIQUES AND DATA ANALYSIS

Month	Title unit	Topic of Lecture	No. of Lectures	Methods of Delivery
September	Unit – 1	**SAMPLE PREPARATION, DIGESTION AND STATISTICAL ANALYSIS** **A.** Sampling - Collection, Preservation and preparation of sample, Techniques of sampling solids, liquids and gases, Operation of drying and preparing a solution of the analyte. Principle, methodology and application of different types of digestions such as acid digestion, base digestion, enzymatic and microwave digestion for liquid and solid materials. **B.** Evolution and procession of Analytical Data, Precision and Accuracy, Types of Errors, Propagation of errors, Normal Distribution Curve, Standard deviation, Confidence limit, Graphical presentation of result-Method of average, Method of Linear least square, Significant figures, Statistical aid to hypothesis testing-t-test, F-test, Correlation coefficient, Rejection of data.	14	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
October / November	Unit – 2	**SEPARATION TECHNIQUES** **A.** Efficiency of extraction, Selectivity of extraction, Extraction system, Method of Extraction, applications. **B.** Principle, classification of chromatographic techniques, Technique and applications of paper chromatography, Thin-layer chromatography, HPLC, Column chromatography. Gas Chromatography	18	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
November	Unit – 3	**THERMAL AND AUTOMATED METHODS** **A.** Principle, Instrumentation, Application of TGA, DTA and DSC Methods. **B.** Automated Methods, Principle, instrumentation and application of flow injection analysis.	12	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
December	Unit – 4	**A. ELECTROCHEMISTRY** Principles and instrumentation of pH potentiometry, coulometry and conductometry. **B. POLAROGRAPHY** Basic principles, Diffusion current, polarized electrode, Micro electrode, Dropping Mercury Electrode, Ilkovic equation, Polarographic wave, Qualitative analysis Stripping Methods, Cyclic Voltammetry, Amperometric titration:- curves, Differential pulse polarography and Squarewave polarography.	14	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes

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Govt. C.L.C College Patan, Dist. – Durg
2022-23
DEPARTMENT OF CHEMISTRY

Name of Department – CHEMISTRY CLASS: IV[th] SEM – M.Sc
Name of Teacher – JAGRIT KUMAR/ Dr. Yaman Kumar Sahu
Course type: Theory/Practical/Both Course Title:
INSTRUMENTAL METHODS OF ANALYSIS

Month	Title unit	Topic of Lecture	No. of Lectures	Methods of Delivery
January	Unit – 1	**ADVANCED CHROMATOGRAPHY:** **A.** Ion chromatography: Ion exchange equilibrium, Ion-exchange packing and Inorganic Applications. **B.** Size exclusion chromatography: Column packing, Theory and applications. **C.** Supercritical fluid chromatography: Properties of supercritical fluid, SFC Instrumentation and operating variables, comparison with other types of chromatography, applications. **D.** Capillary Electrophoresis and capillary electrochromategraphy: overviews and applications	13	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
February/ March	Unit – 2	**X-RAY AND PROTON INDUCED SPECTROSCOPY:** **A.** X-Ray fluorescent method: Principles, Characteristics x-ray emission. Instrumentation, X-ray tube, radioactive sources. Wave length dispersive instruments. Energy dispersive instruments. Analytical Applications-Qualitative Analysis. **B.** Proton Induced X-Ray Spectroscopy: Theory, instrumentation and applications.	16	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
March	Unit – 3	**ATOMIC EMISSION SPECTROSCOPY** **A.** Selectivity, sensitivity and interferences of atomic spectroscopy. **B.** Theory, instrumentation and application of flame photometry, AES, ICP-AES and AFS.	16	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
April	Unit – 4	**ATOMIC ABSORPTION SPECTROSCOPY AND HYPHENATED TECHNIQUES** **A.** Theory, instrumentation and applications of flame and graphite furnace AAS, cold vapour and hydride generation AAS. **B.** Theory, instrumentation and application of hyphenated techniques i.e. GC/HPLC/MS-GC/IC/HPLC- ICP-MS.	20	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes

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Govt. C.L.C College Patan, Dist. – Durg
2022-23
DEPARTMENT OF CHEMISTRY

Name of Department – CHEMISTRY CLASS: IVth SEM -M.Sc
Name of Teacher – Dr. Fooleswar Verma
Course type: Theory/Practical/Both Course Title:

NATURAL PRODUCTS AND MEDICINAL CHEMISTRY

Month	Title unit	Topic of Lecture	No. of Lectures	Methods of Delivery
January	Unit – 1	A. **Terpenoids and Carotenoids**: Classification, nomenclature, occurrence, isolation, general Methods of structure determination of Citral, Geraniol, α- Terpeneol, Menthol, Farnesol, Zingiberene, Santonin, Phytol, Abietic acid and β – Carotene. B. **Alkaloids:** Definition, nomenclature and physiological action, occurrence, isolation, general Methods of structure elucidation, degradation, classification based on Nitrogen heterocyclic ring, role of alkaloids in plant. Synthesis and biosynthesis of the following: Ephedrine, (+) - Conine, Nicotine, Atropine, Quinine and Morphine.	14	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
February	Unit – 2	A. **Steroids:** Isolation, structure determination and synthesis of Cholesterol, Bile acids, Androsterone, Testosterone, Esterone, Progestrone, Aldostrone and Biosythesis of cholesterol. B. **Plant Pigments**: Occurrence, nomenclature and general method of structure determination. Isolation and synthesis of Apigenin, Luteolin, Quercetin, Myrcetin, Quercetin-3-glucoside, Vitexin, Diadzine, Butein, Aureusin, Cyanidin, Hirsutidin.	18	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion
March	Unit – 3	A. Drug Design Development of new drugs procedures followed in drug design, concepts of lead compound and lead modification, concepts of prodrugs and soft drugs, Structure-Activity Relationship (SAR), Factors affecting bioactivity, resonance, inductive effect. Theories of drug activity: occupancy theory, rate theory, induced fit theory. Quantitative Structure Activity Relationship (QSAR)-Hansch approach-free Wilson model, relationship between free Wilson and Hans analysis B. Concepts of drug receptors, lipophilicity, pharmacophore, pharmacological activity and typical range of parameters related to drug likeness. C. General introduction of pharmacokinetics and pharmacodynamics.	16	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
April	Unit – 4	A. **Antineoplastic Agents**: Introduction, Alkylating agents, antimetabolites, carcinolytic antibiotics, mitotic inhibitors. B. **Antibiotics**: Constitution and synthesis of penicillins, chloramphenicol, tetracycline and streptomycin. C. **Antimalarials**: Synthesis and properties of the following Antimalarial drug: 8-amino quinoline derivatives- Pamaquine, Primaquine, Pentaquine, Isopentaquine. D. **aminoquinoline derivatives**- Santoquine, Camaquine, Acridine derivatives- Mepacrine, Azacrin, Pyrimidine and Biguanidine derivatives-Paludrine, Pyremethamine.	17	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes

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Govt. C.L.C College Patan, Dist. – Durg
2022-23
DEPARTMENT OF CHEMISTRY

Name of Department – CHEMISTRY CLASS: IV[th] SEM -M.Sc
Name of Teacher – Dr. Pokhraj Sharma
Course type: Theory/Practical/Both Course Title:
MATERIAL AND NUCLEAR CHEMISTRY

Month	Title unit	Topic of Lecture	No. of Lectures	Methods of Delivery
January	Unit – 1	**NON EQUILIBRIUM THERMODYNAMICS:** Fundamental concepts, Forces and Fluxes, Entropy production, Phenomenological Laws and Onsager's theory for biological systems, coupled reactions.	15	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
February	Unit – 2	**MATERIAL CHEMISTRY:** Preparation and Properties of Nanoparticles, Materials-Metals, Ceramics (Oxide, carbides, sulphides, nitrides). Physical and Chemical Methods, Size and Shape controlled Synthesis, Sol-gel Methods, Optical Properties, Electrical and Magnetic Properties, Application of Nanoparticles.Characterization of Nanoparticles(SEM, TEMetc.)	16	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
March	Unit – 3	**SUPRAMOLECULAR CHEMISTRY:** Properties of covalent bonds, bond length, inter bond angles, Force constant, bond and molecular dipole moment, molecular and bond polarizability. Intermolecular Forces, hydrophobic effects, Electrostatic, induction, dispersion and resonance energy, Hydrogen bond, Magnetic interactions. Principles of molecular association and organization. Biological marcomolecules, Molecular receptors and design principle, cryptands, Cyclophanes, calixarenes and cyclodextrins. Supramoleular reactivity and catalysis.	20	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
April	Unit – 4	**NUCLEAR AND RADIOCHEMISTRY NUCLEAR THEORY:** Nuclear cross section and nuclear radii, nuclear shells and magic numbers, theory of nuclear shell model, nuclear potentials, square well and simple harmonic oscillator potentials, application, liquid drop model, semiempirical mass equation, application and limitations. **NUCLEAR FISSION:** Mass, energy and charge distribution of fission products, decay chains, prompt and delayed neutrons, liquid drop model of nuclear fission. **NUCLEAR ENERGY:** Nuclear fission, chain reaction, multiplication factor, nuclear reactors **APPLIED RADIOCHEMISTRY:** Radioactive isotopes, purity and strength of radioisotopes. Radiochemical principle in the use of tracers, Application of Tracers in Chemical investigations, Physico-chemical Methods, Analytical applications, Age determinations, Medical applications, Agricultural application.	18	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes

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Govt. C.L.C College Patan, Dist. – Durg
2022-23
DEPARTMENT OF CHEMISTRY

Name of Department – CHEMISTRY CLASS: IVth SEM -MSc
Name of Teacher – Dr. Yaman Kumar Sahu/ JAGRIT KUMAR
Course type: Theory/Practical/Both Course Title:
ENVIRONMENTAL & APPLIED CHEMICAL ANALYSIS

Month	Title unit	Topic of Lecture	No. of Lectures	Methods of Delivery
January	Unit – 1	**AIR POLLUTION MONITORING AND ANALYSIS** Classification of air pollution monitoring levels, air quality, standards and index, monitoring and analysis of selected air borne pollutants: SO_2, NOx, SPM, Volatile organic compounds, Pb, CO_2, Persistent organic compounds, Hg, carbon and ozone. Air pollution control devices Viz ESP, scrubber technique, baghouse filters etc. Atmospheric chemistry of acid rains, photochemical smog, greenhouse effect, global warming, ozone hole.	15	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
February	Unit – 2	**SOIL AND WATER POLLUTION** Soil and water quality standards, monitoring and analysis of selected soil and water contaminants: COD, pesticides, heavy metals, POP's, fluoride, cyanide, nitrate, phosphate, oil & grease, Geobiochemical impact of municipal solid waste, steel plants effluent, domestic sewage. Control devices of water pollutants.	16	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
March	Unit – 3	**FOOD ANALYSIS** **1.** Introduction to general constituents of food- Proximate Constituents and their analysis, Additives- Introduction, types, study of preservatives colors and antioxidants and Methods of estimation, adulteration - Introduction, types, and test for adulterants. **2.** Introduction of standards composition and analysis of following foods: Wheat, Bread, Biscuits, Jam, Jelly, Honey, Milk, Ice Cream, Butter, Cheese, Milk Powder, Oils and Fats, Tea, Coffee, Soft drinks, Alcoholic beverages, Cereal and pulses, Confectionery, Fruits, Vegetables, Egg, Fish, Meat.	16	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
April	Unit – 4	**COSMETICS, CLINICAL AND DRUG ANALYSIS** **A.** Introduction of Cosmetics, evaluation of cosmetics materials, raw material and additives, Cosmetics colors, Perfumes in cosmetics, Cosmetics formulating, introduction, standards and Methods of analysis- Creams, Face powders, Makeup, Shaving preparations, Bath preparations. **B.** Concepts and principles of analytical Methods commonly used in the clinical species: i.e. ammonia, Nitrogen, Ca, Cl, CO2, Fe, K, Li, Mg, Na, P, urea, glucose. Method for analysis of proteins (i.e. albumin, bilirubin, creatinine, cholesterol, HDL-cholesterol, triglycerides) and Enzymes (i.e. Alanine Aminotransferase, acid phosphatase, alkaline phosphatase, amylase, aspartate, aminotransferase, cholinesterase, lactate, and lipase).	14	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes

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