

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

2023-24

DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY**

CLASS: **Ist SEM**

Name of Teacher – **MR. JAGRIT KUMAR**

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 C_n , C_{nv} , C_{nh} , D_{nh} 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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Govt. C.L.C College Patan, Dist. – Durg
2023-24

DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY**

CLASS: **Ist SEM**

Name of Teacher – **DR. FOOLESHWARVERMA**

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 benzenoid 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 ₁ CB 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 cheletropic reactions. Sigmatropic rearrangements -suprafacial and antarafacial shifts of H, sigmatropic 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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2023-24

DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY** CLASS: **Ist SEM**

Name of Teacher – **DR. POKHRAJ SHARMA**

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. Debye-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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2023-24

DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY**

CLASS: **Ist SEM**

Name of Teacher – **DR. YAMAN KUMARSAHU**

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, Fluorescence 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 ₂ O, SO ₂ , NO ₂ , CIF ₃ .	15	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes

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2023-24

DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY**

CLASS: **IInd SEM**

Name of Teacher – **MR. 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 ₂ O) 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 Nephelouxic series. Magnetic properties of complexes of various geometries based on crystal field model, spin free-spin paired equilibria 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: Transition 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. ALKYL AND ARYL 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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DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY**

CLASS: **IInd SEM**

Name of Teacher – **DR. FOOLSWAR 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	<p>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.</p> <p>B. AROMATIC NUCLEOPHILIC SUBSTITUTION: The S_NAr, S_N^1 and benzyne mechanisms. Reactivity -effect of substrate structure, leaving group and attacking nucleophile. The von Richter, Sommelet-Hauser, and Smiles rearrangements.</p>	14	<ol style="list-style-type: none"> 1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
February	Unit – 2	<p>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.</p> <p>B. AROMATIC ELECTROPHILIC SUBSTITUTION: The arenium ion mechanism, Orientation and reactivity. Theortho/para ratio, ipso attack, orientation in other ring systems. Reactivity-Effect of substrates and electrophiles. Vilsmeier reaction and Gattermann-Koch reaction.</p>	16	<ol style="list-style-type: none"> 1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
March	Unit – 3	<p>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.</p>	17	<ol style="list-style-type: none"> 1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
April	Unit – 4	<p>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, Knoevenagel, Stobber reactions. Hydrolysis of esters and amides, ammonolysis of esters.</p>	19	<ol style="list-style-type: none"> 1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes

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DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY**

CLASS: IInd SEM

Name of Teacher – **DR. POKHRAJ SHARMA**

Course type: **Theory/Practical/Both**

Course Title: **QUANTUM CHEMISTRY, THERMODYNAMICS AND CHEMICAL DYNAMICS**

Month	Title unit	Topic of Lecture	No. of Lectures	Methods of Delivery
January	Unit – 1	<p>A. APPLICATION OF MATRICES IN QUANTUM CHEMISTRY: Addition and multiplication, inverse and transpose of matrices. Determinants in Quantum Chemistry.</p> <p>B. ANGULAR MOMENTUM IN QUANTUM CHEMISTRY: Angular momentum, angular momentum Operators. Eigen functions and Eigen values for Angular momentum, Ladder operators.</p> <p>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.</p>	13	<ol style="list-style-type: none"> 1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
February	Unit – 2	<p>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.</p>	18	<ol style="list-style-type: none"> 1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
March	Unit – 3	<p>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.</p>	18	<ol style="list-style-type: none"> 1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
April	Unit-4	<p>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.</p>	16	<ol style="list-style-type: none"> 1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes

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2023-24

DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY**

CLASS: **IInd SEM**

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, precessional 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, olefinic, alkyne, aromatic and carbonyl carbon)	17	1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes

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2023-24

DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY**

CLASS: **IIIrd SEM**

Name of Teacher – **MR. JAGRIT 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: Hydrogenation 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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2023-24

DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY**

CLASS: IIIrd SEM

Name of Teacher – **DR. FOOLESHWAR 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	<p>A. BIOENERGETICS: Standard free energy change in biochemical reactions, exergonic, endergonic. Hydrolysis of ATP, synthesis of ATP from ADP.</p> <p>B. ELECTRON TRANSFER IN BIOLOGY: Structure and function of metalloproteins in electron transport processes–cytochromes and Ion-sulphur proteins, synthetic models.</p> <p>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.</p>	13	<ol style="list-style-type: none"> 1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
October/ November	Unit – 2	<p>A. METALLOENZYMES: Zinc enzymes – carboxypeptidase and carbonic anhydrase. Iron enzymes – catalase, peroxidase and cytochrome P-450. Copper enzymes superoxide dismutase. Molybdenum oxatransferase enzymes –xanthineoxidase.</p> <p>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.</p>	15	<ol style="list-style-type: none"> 1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
November	Unit – 3	<p>A. ENZYMES: Nomenclature and classification of Enzyme. Induced fit hypothesis, concept and identification of active site by the use of inhibitors.</p> <p>B. CO-ENZYME CHEMISTRY: Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD⁺, NADP⁺, FMN, FAD, lipoic acid, vitamin B¹².</p> <p>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.</p>	14	<ol style="list-style-type: none"> 1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
December	Unit- 4	<p>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.</p> <p>B. THERMODYNAMICS OF BIOPOLYMER SOLUTIONS: Thermodynamics of biopolymer solution, osmotic pressure, membrane equilibrium, muscular contraction and energy generation in mechanochemical system.</p> <p>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.</p>	14	<ol style="list-style-type: none"> 1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes

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2023-24

DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY**

CLASS: **IIIrd SEM**

Name of Teacher – **DR.POKHRAJ SHARMA**

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, Surface tension 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 – Schottky defects and Frankel defects. Thermodynamics of Schottky 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

2023-24

DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY**

CLASS: **IIIrd SEM**

Name of Teacher – **DR. YAMAN KUMAR SAHU**

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	<p>SAMPLE PREPARATION, DIGESTION AND STATISTICAL ANALYSIS</p> <p>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.</p> <p>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.</p>	14	<ol style="list-style-type: none"> 1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
October / November	Unit – 2	<p>SEPARATION TECHNIQUES</p> <p>A. Efficiency of extraction, Selectivity of extraction, Extraction system, Method of Extraction, applications.</p> <p>B. Principle, classification of chromatographic techniques, Technique and applications of paper chromatography, Thin-layer chromatography, HPLC, Column chromatography. Gas Chromatography</p>	18	<ol style="list-style-type: none"> 1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
November	Unit – 3	<p>THERMAL AND AUTOMATED METHODS</p> <p>A. Principle, Instrumentation, Application of TGA, DTA and DSC Methods.</p> <p>B. Automated Methods, Principle, instrumentation and application of flow injection analysis.</p>	12	<ol style="list-style-type: none"> 1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
December	Unit – 4	<p>A. ELECTROCHEMISTRY Principles and instrumentation of pH potentiometry, coulometry and conductometry.</p> <p>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.</p>	14	<ol style="list-style-type: none"> 1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes

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2023-24

DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY**

CLASS: IVth SEM

Name of Teacher – **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 electrochromatography: 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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2023-24

DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY**

CLASS: IVth SEM

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	<p>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.</p> <p>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.</p>	14	<ol style="list-style-type: none"> 1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
February	Unit – 2	<p>A. Steroids: Isolation, structure determination and synthesis of Cholesterol, Bile acids, Androsterone, Testosterone, Esterone, Progesterone, Aldostrone and Biosynthesis of cholesterol.</p> <p>B. Plant Pigments: Occurrence, nomenclature and general method of structure determination. Isolation and synthesis of Apigenin, Luteolin, Quercetin, Myrcetin, Quercetin-3-glucoside, Vitexin, Diazine, Butein, Aureusin, Cyanidin, Hirsutidin.</p>	18	<ol style="list-style-type: none"> 1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion
March	Unit – 3	<p>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</p> <p>B. Concepts of drug receptors, lipophilicity, pharmacophore, pharmacological activity and typical range of parameters related to drug likeness.</p> <p>C. General introduction of pharmacokinetics and pharmacodynamics.</p>	16	<ol style="list-style-type: none"> 1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes
April	Unit – 4	<p>A. Antineoplastic Agents: Introduction, Alkylating agents, antimetabolites, carcinolytic antibiotics, mitotic inhibitors.</p> <p>B. Antibiotics: Constitution and synthesis of penicillins, chloramphenicol, tetracycline and streptomycin.</p> <p>C. Antimalarials: Synthesis and properties of the following Antimalarial drug: 8-amino quinoline derivatives- Pamaquine, Primaquine, Pentaquine, Isopentaquine.</p> <p>D. aminoquinoline derivatives- Santoquine, Camaquine, Acridine derivatives- Mepacrine, Azacrin, Pyrimidine and Biguanidine derivatives-Paludrine, Pyremethamine.</p>	17	<ol style="list-style-type: none"> 1. Lecture 2. Chalk and talk method 3. Problem solving 4. Group discussion 5. Test 6. Notes

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2023-24

DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY**

CLASS: IVth SEM

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 macromolecules, Molecular receptors and design principle, cryptands, Cyclophanes, calixarenes and cyclodextrins. Supramolecular 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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2023-24

DEPARTMENT OF CHEMISTRY

Name of Department – **CHEMISTRY**

CLASS: IVth SEM

Name of Teacher – **MR. 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 , NO _x , 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, CO ₂ , 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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