Dharmabad Shikshan Sanstha's

Lal Bahadur Shastri Mahavidyalaya, Dharmabad-431809

Pro-forma for program and course outcomes (2.6.1) 2022-23

Name of Teacher: Mr. S. L. Nakkalwar **Department: Chemistry**

Program: M.Sc. FY Semester I CBCS **Subject**: Chemistry

Course Code: CH- 411 **Paper Title: Inorganic Chemistry – I** **Paper** – I

Unit No.	Unit Name	Topics	Unit-wiseOutcome
I	Reactions of metal complexes (Part first)	**Introduction.** Lible and Inert complexes.VBT explanation of libility and inertness. Taube's explanation of libility and inertness. Ligand substitution reactions. SN^1: substitution, nucleophilic, unimolecular mechanism (Dissocitive mechanism): Introduction, Characteristics, Example. SN^2: substitution, Nucleophilic, Bimolecular Mechanism (Associative mechanism): Introduction, Characteristics, Example.SN1 CB: Substitution Nucleophilic Unimolecular Conjugate Base Mechanism: Characteristics, Example. Anation Reaction. Electron-transfer reactions (Redox reaction): Introduction with example. Outer sphere mechanism, tunneling mechanism, essential requisite for electron transfer, factors which favour outer sphere electron transfer reactions. Inner-sphere mechanism, characteristics, example, proof for inner sphere mechanism, inner sphere mechanism and bridging ligand, inner sphere mechanism and electronic configuration.	Understand the proposed pathways for reactions taking place in coordination complexes such as substitution reactions, redox reactions etc. and the various factors affecting to rates of these reactions.
II	Chemistry of nanomaterials and nano science	**Introduction:** Terminology, optical properties of nonmaterials, characterization methods, top down and bottom-up fabrication, templeted synthesis using frameworks, supports and substrates, self assembled nanostructures, control of nanoarchitecture, one dimensional control, two-dimensional control, three-dimensional control, bioinorganic nanomaterials, DNA and nanomaterials, natural and artificial nanomaterials and bio nanocomposites.	Learn various approaches in analyzing structures of simple molecules

III	Electronic Absorption spectra of transition metal complexes	Introduction, Basis of electron absorption **Spin orbit coupling:** i) Russell-sounder coupling ii) j-j- coupling **Microstates and its calculations from** i) the number of orbital and number of electron ii) Orbital degeneracy, spin degeneracy and number of unpaired electrons **Term Symbols:** Rules for determining term symbols, Hund's rule for deciding the relative energies of term symbols (Hund's First, Second And third rule) Determination of ground States, Hole formation, Symmetry species of terms **Selection rules:** I) Laporte selection rule ii) Spin section rules **Spectra of transition metal complexes:** splitting of terms, Orgel diagrams for tetrahedral and octahedral complexes, Orgel correlation diagrams, Tanabe –Sugano correlation diagrams (T-S diagrams) for d2,d3 configurations, Comparison between Orgel and T-S diagrams .Nephelauxetic effect, Nephelauxetic ratio(β) and Nephelauxetic series. **Charge transfer spectra:** LMCT, MLCT and charge transfer in complexes having metal in mixed valence state (Metal to metal charge transfer) Comparison between d-d transition and charge transfer spectra. Magnetic properties of complexes: i) cooperative magnetism ii) spin crossover complexes.	To understand how to construct molecular orbital diagrams for simple molecules as well as coordination complexes

Specify Course Outcome: Draw molecular orbital diagrams for sigma and pi bond formation in coordination complexes and will be able to understand and explain the difference between respective molecular orbital diagrams

Specify Program Outcome: Learn various approaches in analyzing structures of simple molecules.

Signature of Teachers: Mr. S. L. Nakkalwar

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Pro-forma for program and course outcomes (2.6.1) 2022-23

Name of Teacher: Dr H. M. Kasralikar **Department:** Chemistry

Program: M. Sc. FY Semester I **Subject**: Chemistry

Course Code: CH-412 **Paper Title: Organic Chemistry - II** P-II

Unit No.	Unit Name	Topics	Unit-wise Outcome
I	**Nature of Bonding in Organic Molecules**	Delocalised chemical bonding –conjugation, cross-conjugation, resonance, hyperconjugation, tautomerism. Aromaticity in benzenoid and non-benzenoid compounds, alternant and non-alternant hydrocarbons, Huckel's rule, energy level ofπ-molecular orbitals, annulenes, anti-aromaticity, homo-aromaticity. Study of Structure of compounds crown ether complexes, cryptands, inclusion compounds, cyclodextrins, catenanes and rotaxanes.	Adopt the concept of Bonding in Organic Molecules
II	**Stereochemistry**	Stereo chemical principles: Enantiomeric relationships, Diastereomeric relationships, R and S, E and Z nomenclature, Dynamic stereochemistry, Prochiral relationships. Homotopic, enantiotropic, groups and faces, Stereo-specific and stereo-selective reactions. Conformational analysis of halo, hydroxy and methyl mono and disubstituted Cyclohexane, decalins, effect of conformation on reactivity, conformation of glucose and fructose. Elements of symmetry, chirality, molecules with more than one chiral center, threo and erythron isomers, optical purity, enantiotropic, and diasteretopicatoms, groups and faces, stereospecific and stereoselective synthesis. Asymmetric synthesis. Optical activity in absence of chiral carbon (biphenyls, allenes and spiranes), chirality due to helical shape, Methods of resolution and racemic modification.	Learn the concept of Stereochemistry and to identify the Stereo chemical reactions

III	**Reaction Mechanism: Structure and activity**	Types of mechanism, types of reaction, thermodynamic and kinetic requirements, kinetic and thermodynamic control, Hammond's postulate. Potential energy diagrams, transition state and intermediates, methods of determining mechanism, isotope effects. Generation, structure and stability of carbocations, carbanions, free radicals, carbenes and nitrenes. Effect of structure on reactivity – Resonance and field effect, steric effect, quantitative treatment. The Hammett equation and linear free energy relationship, substituents and reaction constants. Taft equation	Familiarize the various theoretical principles about the reaction and mechanism
IV	**Aliphatic Nucleophilic Substitution**	The SN 2, SN 1, mixed SN 1 and SN 2 and SET mechanism. The neighboring group mechanism, neighboring group participation by π and σ bonds, anchimeric assistance. The SN i mechanism. Nucleophilic substitution at an allylic, aliphatic and a vinylic carbon. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium. Phase transfer catalysis, ambident nucleophile, regioselectivity, Classical and nonclassical carbocations, phenonium ions, norbornyl system.	To understand the nucleophilic substitution reactions and their mechanisms of aliphatic compounds.
V	**Aromatic nucleophilic Substitution**	SN^{Ar}, SN1, benzyne and SRN 1 mechanism. Reactivity – effect of substrate structure leaving group and attacking nucleophile. Sommelet-Hauser and Smiles rearrangements.	To know the nucleophilic substitution reactions of Aromatic compound

Specify Course Outcome: Learn the concept of Stereochemistry and to identify the Stereo chemical reactions,
explain the various problems of aromaticity, homoaromaticty and antiaromaticity, familiarize the various types of Substitution reactions and their mechanism gain knowledge of free radical reactions and justifies the various effect of substrate.

Specify Program Outcome: Understand the various types of Reaction Mechanism.

Signature of Teachers: Dr. H. M. Kasralikar

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Pro-forma for program and course outcomes (2.6.1) 2022-23

Name of Teacher: Dr. S. B. Patwari **Department: Chemistry**

Program: MSc FY Semester –I CBCS **Subject**: Chemistry **Course Code**: CH–413 **Paper Title:** Physical Chemistry - I **Paper** –III

Unit No.	Unit Name	Topics	Unit-wise Outcome
Unit-1	**Quantum Chemistry**	A) **Introduction to Exact Quantum Mechanical Results:** a) The postulates of quantum mechanics. b) Schrödinger equation in Laplacian and Hamiltonian form. Significance of Eigen –values and Eigen functions. Significance of Ψ and Ψ2. c) Discussion of solutions of the Schrödinger equation to i. Particle in one dimensional box, ii. Particle in three-dimensional box, iii. Harmonic oscillator, iv. The rigid rotator and v. Hydrogen and Hydrogen like systems. d) Orthogonality and normalization of wave functions. e) Numericals on (c) and (d). **B) Approximate Methods:** a) The variation theorem, linear variation principle. b) Perturbation theory (first order and nondegenerate). **C. Angular Momentum:** a) Ordinary angular momentum, generalized angular momentum, eigen functions for angular, Momentum, eigen values of angular momentum. b) Spin, anti-symmetry and Pauli's exclusion principle, commutation elation, Zeeman splitting, Spin orbital coupling and R-S couplings. c) Operator using ladder operators, addition of angular momentum.	Explain basic concepts, laws and postulates of quantum mechanics

II	**Phase Rule**	a) Recapitulation of phase rule and terms involved in it. b) Three component system: representation of ternary systems. c) Partially miscible three liquid systems: - 1) system composed of three liquid components, one partially miscible pair, two partially miscible, three partially miscible pairs. 2) System composed of two solid and a liquid component: - formation of eutectic systems, crystallization of pure components only, formation of binary compounds, one double salt formation.	Explain the concept of phase rule. l
III	**Thermodynamics**	**A. Classical Thermodynamics:** a) Brief resume of concepts of laws of thermodynamics. Free energy and entropies. b) Partial molar, partial molar free energy chemical potential, partial molar volume and partial molar heat content and their significances. Determinations of these quantities.c) Concept of fugacity and determination of fugacity by graphical method and from equation of stated) non-ideal systems: Excess functions for non-ideal solutions. e) Activity, activity coefficient. Debye-Huckel theory for activity coefficient of electrolytic solutions, determination of activity and activity coefficients by 1) Solubility 2) E.M.F. method. 3) vapour pressure method, Ionic strength. **B. Statistical Thermodynamics: a**) Concept of distribution, thermodynamics probability, ensemble averaging, postulates of ensemble averaging. Canonical, grand canonical and microcanonical ensembles. b) Partition functions: Translational, rotational, vibrational and electronic partition functions. calculation of thermodynamic properties in terms of partition functions.c) Applications of partition functions. d) Numericals on A(e), B(b)	Good overview of laws of thermodynamics, partial molar properties for different systems and concept and examples of non-ideal systems
IV	**Crystallography**	a) Solid state defects. b) Semiconductors, N and P type, effect of temperature on N and P type Semi conduction. c) Packing of uniform spears, octahedral and tetrahedral voids(holes), close packing of spear. d) Isomorphism, lattice energy and born haber cycle.	Explain the concept of Crystallography with example
V	**Electrochemistry I**	a) Anomaly of strong electrolytes, Deby-Huckel theory, Onsager equation, & its verification wine effect, Deby falkenhagen effect, ion solvent, interactions. b) Thermodynamics of electrified interface equation, Derivation of electro capillary, Lippmann equation (surface excess)	Can relate and explain the entropy production in different system and understand Onsager's

		c) Structure of electrified interfaces equation, Electrical double layer, Theories of structure of Electrical double layer. Helmoholtz-perrin. Gouy-Chapman theory, Stern's theory	relations

Specify Course Outcome: Explain basic concepts, laws and postulates of quantum mechanics, describe different wave functions and operators, the Schrodinger wave equation for the calculation of Energies of rigid rotor and harmonic oscillator and solve it for hydrogen atom, explain the concept of angular momentum describe the electronic structure of atoms good overview of laws of thermodynamics, partial molar properties for different systems and concept and examples of non-ideal systems discuss concept distribution with examples, they will be able to explain most probable distribution and thermodynamic probability, concept of partition functions and its significance and can relate and explain the entropy production in different system and understand Onsager's relations.

Specify Program Outcome: Solve problems related to quantum chemistry, will have large horizon of critical thinking and analytical reasoning.

Signature of Teachers: Dr. S. B. Patwari

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Pro-forma for program and course outcomes (2.6.1) 2022-23

Name of Teacher: Dr. N.S. Kaminwar **Department:** Chemistry

Program: M. Sc. FY Semester-I **Subject**: **Physical Method in Chemistry**

Course Code: CH-414 **Paper Title:** P-IV

Unit No.	Unit Name	Topics	Unit-wise Outcome
I	**Symmetry and Group Theory in Chemistry**	Symmetry elements and symmetry operation, definitions of group, subgroup, relation between orders of a finite group and its subgroup. Conjugacy relation and classes. Point symmetry group. Schonfiles symbols, representations of groups by matrices (representation of the Cn, Cnv, Cnh, Dnh etc. groups to be worked out clearly.) Character of a representation. The great orthogonality theorem (without proof) and its importance. Character tables C1h, C2V, C3V and their use.	To know the symmetry elements in a molecule.
II	**Computer for Chemist**	Basic structure and functioning of computers with a PC as an illustrative example. Memory, I/O devices. Secondary storage. Computer languages. Operating system with DOS as an example. Introduction to UNIX and WINDOWS. Data processing, principles of programming. Algorithms and flow-charts for chemical concepts. **B. Programming in Chemistry:** Development of small computer codes involving simple formulae in chemistry, such as Vander Waal's equation, pH titration, kinetics, radioactive decay.	To understand the computer for Chemist

III	X-**ray Diffraction**	Bragg condition. Miller indices, Laue method, Bragg method, Debye-Scherrer method of X-ray structural analysis of crystals, index reflections, identification of unit cells from systematic absences in diffraction pattern. Structure of simple lattices and X-ray intensities, structure factor and its relation to intensity and electron density, phase problem. Description of the procedure for an X-ray structure analysis, absolute configuration of molecules, Ramachandran diagram. Numerical on Braggs equation. $n\lambda=2dSin\theta$	Understand the X-ray Diffraction
IV	**Electron Diffraction**	Scattering intensity vs. Scattering angle, Wierl equation, measurement technique,elucidation of structure of simple gas phase molecules with suitable examples.	Deal with degenerate and non-degenerate representations.
V	**Neutron Diffraction**	Scattering of neutrons by solids and liquids, magnetic scattering, measurement techniques	Understand the Neutron Diffraction

Specify Course Outcome: Understand how to recognize symmetry elements in a molecule. Assign the point group to a molecule. Deal with degenerate and non-degenerate representations.

Specify Program Outcome: To introduce the concepts of symmetry. Study the concept of group theory for understanding molecular representations. To provide an introductory treatment of bonding theories, electronic and vibrational spectroscopy. Molecular Symmetry, Symmetry operations and symmetry elements: Plane of symmetry, Proper/Improper Axis of symmetry, Inversion center, Identity element.

Signature of Teachers: Dr. N.S. Kaminwar

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Pro-forma for program and course outcomes (2.6.1) 2022-23

Name of Teacher: Mr. S. L. Nakkalwar **Department: Chemistry**

Program: M.Sc. FY Semester-IICBCS **Subject**: Chemistry

Course Code: CH-421 Paper Title: **Inorganic Chemistry** Paper – VI

Unit No.	Unit Name	Topics	Unit-wise Outcome
I	Reaction of Metal Complexes (Part second)	Substitution reactions of square-planar complexes. Evidence for associative type SN2 mechanism. Trans effect, applications of trans effect. Theories of trans effect, the polarization theory, evidences in favour of the polarization theory, defect of this theory, the Pibonding theory. CIS effect.	To learn the basic concept about substitution reactions of metal complexes
II	Catalyst.	Introduction, General principle and mechanism of catalytic reaction. Types of catalysts. Homogeneous Catalysis: Hydrogenation of alkenes, Hydroformulation, Methanol Carbonylation, Wacker oxidation of alkenes, Palladium-catalyzed C-C bond forming reaction, Heterogeneous catalysis: The nature of Heterogeneous catalysts, ammonia synthesis, Sulfur dioxide oxidation, Fischer-Tropsch Synthesis, Alkene Polymerization, New directions in heterogeneous catalysis such as Tethered catalysts.	Understand the homogeneous and heterogeneous catalyst and its applications
III	Bioinorganic Chemistry:	Biological importance of essential and non-essential elements. Na/K Pump. Metalloporphyrin's: Structure of porphyrin molecule. Hemoglobin: Structure, function of hemoglobin. Myoglobin: Structure & function. Difference between hemoglobin & Myoglobin. Chlorophyll: Structure & function, Photosynthesis PS-I & PS-II. Electron carrier proteins in biological system: i. Iron sulfur proteins - Rubredoxin, ferrodoxin. ii. Cytochrome: Structure & functionoid. Iron storage protein: Ferritin. Iron transporting biomolecule: Transferrin, siderophores (non-Protein), hemerythrin and hemocyanins. Biological enzymes: Nitrogenase and Superoxide dismuthases. Vitamin B12(Cynocobalanine), structure and function.	Learn the biological applications of essential and non-essential elements

IV	Structural methods in inorganic chemistry	**Vibrational spectroscopy**: Introduction Physical basis requirement for vibrational spectroscopy. Number of modes of vibration. Force constant concept in vibrational spectroscopy. Application of vibrational spectroscopy with respect to change in spectra of donor molecule upon complexation. b. **Electron spin resonance spectroscopy**: Introduction, Basic principle Hyperfine structure of ESR in isotropic system (Examples). EPR spectra of transition metal complexes as single crystals. Nuclear spin of metal ion. Reference compound in ESR. Frequency in ESR and g-splitting factor. (Numerical) c. **Mossbauer spectroscopy**: Introduction, Basic principle, Condition for the Mossbauer spectroscopy Parameter from Mossbauer spectra, isomer shift and electrical quadruple interactions. Structural deduction.(Illustration) Mossbauer spectra of inorganic compound/complexes	To know the basic principles of Vibrational, electron spin resonance & Mossbauer Spectroscopy.

Specify Course Outcome: Students should get the knowledge about the substitution reactions and mechanisms of metal complexes. Information about the type of catalyst and their applications. Use of vibrational spectroscopy, electron spin spectroscopy and Mossbauer spectroscopy to determine the structure of inorganic compounds and complexes.

Specify Program Outcome: Knowledge about the reactions of metal complexes and technologies used to determine the structure of complexes.

Signature of Teachers: Mr. S. L. Nakkalwar

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Pro-forma for program and course outcomes (2.6.1) ***2022-23***

Name of Teacher: Dr. H. M. Kasralikar & Dr. N. S. Kaminwar **Department:** Chemistry

Program: M.Sc. FY Semester-II **Subject**: Chemistry

Course Code: CH-422 **Paper Title: Organic Chemistry** P-VI

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	Aliphatic Electrophilic Substitution	Bimolecular mechanism – SE^2 & SE^i. The SE^1 mechanism, electrophilic substitution accompanied by double bond shift. Effect of substrates, leaving group and the solvent polarity on the reactivity.	To understand the aliphatic substitution reactions.
II	Aromatic Electrophilic Substitution	The arenium ion mechanism, orientation and reactivity, energy profile diagrams. The ortho/para ratio, ipso attack. Quantitative treatment of reactivity in substrates and electrophiles. Diazonium coupling, Vilsmeir reaction, Gatter-Koch reaction.	Obtain an outline about mechanism of Aromatic Substitution reactions
III	Addition to Carbon Carbon Multiple Bonds:	Mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regioselectivity and chemo selectivity, orientation and reactivity. Addition to cyclopropane ring. Hydroboration, Michael reaction. Sharpless asymmetric Epoxidation	Gain the knowledge of addition reaction between a carbon atom and double bonded carbon compounds
IV	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 organo-lithium reagents to carbonyl and unsaturated carbonyl compounds. Wittig reaction. Mechanism of condensation reaction involving enolates- Aldol, Knoevenagel, Claisen, Mannich, Benzoin, Perkins and Stobbe reaction	Gain the knowledge of addition reaction between a hetero atom and double bonded Carbon compounds

V	Pericyclic Reactions:	Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3- butadiene, 1,3,5-haxatriene and allyl system. 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 –antarafacially and suprafacial additions, 4n and 4n +2 systems, 2+2 addition of ketenes, 1,3 dipolar cycloadditions and cheleotropic reactions. Sigmatropic rearrangements -Suprafacial and antarafacial shifts of H, sigmatropic shifts involving carbon moieties, 3,3 and 5,5-Sigmatropic rearrangements. Claisen, Cope and aza-Cope rearrangements	Understand the skill of solving problems of pericyclic reactions.
VI	Photochemistry	Principles–photochemical theory, electronic excitation, singlet and triplet states, Jablonski diagram. Energy transfer, quantum efficiency. a) Photochemistry of carbonyl compound: Photoreduction, Norrish type–I & II, Paterno-Buchireaction. b) Photochemistry of α, β-unsaturated ketones.c) Photochemistry of olefins: cis-trans isomerism.d) Miscellaneous photochemical reaction: Photo-fries reaction of anilides, Photo rearrangements, Barton reaction singlet molecular oxygen reaction Photochemical formulation of smog photo-degradation of polymers,photochemistry of vision, nπ- pπ rearrangement.	Understand the Photochemical reactions and mechanism

Specify Course Outcome: Gain the knowledge of addition reaction between a hetero atom and double bonded carbon compounds. Learn familiar name Reaction. Obtain an outline about mechanism of Aromatic Substitution reactions. Know synthetically the process relevant Organic –Chemical reactions and be able to discuss the mechanism of these reactions. Get the clear picture of about photochemical reactions

Specify Program Outcome: Gain the knowledge of addition reaction between a hetero atom and double bonded carbon compounds and learn familiar name Reaction

Signature of Teacher: Dr. N. S. Kaminwar Dr. H. M. Kasralikar

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Pro-forma for program and course outcomes (2.6.1) 2022-23

Name of Teacher: Dr.S.B.Patwari **Department:** Chemistry

Program: M.Sc.FY Semester-II **Subject**: Chemistry **Course Code**: CH 423

Paper title: Physical Chemistry P-VIII

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	**Surface Chemistry**	**A. Adsorption:** a) Surface tension, capillary action, pressure difference across curved surface(Laplace equation). b) Gibbs adsorption isotherm. c) BET equation and estimation of surface area. d) Surface films on liquids (Electro-kinetic phenomenon) and catalytic activity at surfaces. **B. Micelles:** a) Surface active agents, classification of surface-active agents. b) Micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization - phase separation and mass action models **C. Macromolecules:** a) Polymers - definition, types of polymers, electrically conducting, fire resistant, liquid crystal polymers. b) kinetics of polymerization, mechanism of polymerization. c) Difference between polymers and macromolecules. d) Molecular mass, number and mass average molecular mass, molecular mass determinations by i) osmometry, ii) viscometry, iii) diffusion and iv) light scattering methods	Understand the basic concepts and properties of surfactants and macromolecule.
II	**Electrochemistry-II:**	a) Over potential, types of over potentials. b) Exchange current density, Derivation of Butler-Volmer equation, Tafel plot. c) Semi conductor interface. Theory of double layer at Semiconductor, electrolyte solution Interface, effect of light at semiconductor, Solution interface. d) Polarography, Theory, instrumentation, working and applications of the technique. e) Introduction to corrosion, homogenous theory, forms of corrosion, Corrosion monitoring and prevention methods.	State and apply different laws, principles, theories related to the electrochemistry of the solutions

III	**Chemical Dynamics**	a) Methods of determining rate laws – i) Differential method and ii) Fractional change method. b) Theories of reaction rates – i) collision theory of reaction rates, steric factor, ii) Transition state theory, thermodynamic formulation of TST.c) Ionic reactions, kinetic salt effects. d) Dynamic chain (Kinetics of the reactions, thermal/photochemical) –i) pyrolysis of acetaldehyde , ii) decomposition of ethane, iii) hydrogenchlorine reaction, iv) hydrogen-bromine reaction.e) Oscillatory reactions (Belousov-Zhabotinsky reaction).f) Enzyme catalysis, kinetics of enzyme reactions, Michalis - Menten equation.g) General features of fast reactions, study of fast reaction by flow method. Flashphotolysis and the nuclear magnetic resonance method.h) Dynamics of unimolecular reactions - i) Lindemann hypothesis ii) Hinshelwood theory iii) K-R-R treatment and iv) slater's theory . i) Numricals on (a) and (b).	Understand the kinetics of complex reactions, catalysis etc. And Perform the calculations and solve the numerical of electrochemistry and chemical kinetics

Specify Course Outcome: Understand the basic concepts and properties of surfactants and macromolecules. State and apply different laws, principles, theories related to the electrochemistry of the solutions and discuss and apply the information about corrosion, its monitoring and presentation, distinguish different theories of reaction rates and understand the kinetics of complex reactions, catalysis.

Specify Program Outcome: Develop skill in problems solving, critical thinking and analytical reasoning.

Signature of Teacher: Dr. S. B. Patwari

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Pro-forma for program and course outcomes (2.6.1) 2022-23

Name of Teacher: Dr.N.S.Kaminwar **Department:** Chemistry

Program: M. Sc. FY Semester-II **Subject**: Chemistry

Course Code: CH -428 4 **Paper Title:** Principles of Spectroscopy Paper -IX

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	**1.Unifying Principles**	Electromagnetic radiation, interaction of electromagnetic radiation with matterabsorption,emission, transmission, reflection, refraction dispersion, polarisation andscattering. Uncertainty relation and natural line width and natural line broadening, transitionprobability, results of the time dependent perturbation theory, transition moment, selection rules, intensity of spectral lines.	Explain the basic principles of rotational, vibrational, electronic and Raman spectroscopy
II	**2. Mircowave Spectroscopy**	Classification of molecules, rigid rotor model, effect of isotopic substitution on the transition frequencies, intensities, non-rigid rotor. Stark effect, nuclear and electron spin interaction and effect of external field	Identify and explain factors that influence the strength and frequency of peaks in the Microwave, IR spectra.
III	**3. Vibrational Spectroscopy**	A. **Infrared Spectroscopy:** Review of linear harmonic oscillator, vibrational energies of diatomic molecules, zero-point energy, force constant and bond strengths; an harmonicity, Morse potential energy diagram, vibration-rotation spectroscopy, P, Q, R, branches. Breakdown of Oppenheimer approximation; vibrations of polyatomic molecules. Selection rules, normal modes of vibration group frequencies, overtones, hot bands, factors affecting the band positions and intensities, far IR region, metal-ligand vibrations, normalco-ordinate analysis. B. **Raman Spectroscopy:** Classical and quantum theories of Raman Effect. Pure rotational, vibrational and vibrational-rotational Raman spectra, selection rules, mutual	Describe the selection rule for rotational, Vibrational and electronic spectroscopy. and determine the vibrations for a molecule and identify whether they are active in infrared and/or Raman spectroscopy.

		exclusion principle. Resonance Raman Spectroscopy.	
IV	**Electronic Spectroscopy**	**A. Atomic Spectroscopy:** Energies of atomic orbitals, vector representation of momenta and vector coupling, spectra of hydrogen atom and alkali metal atoms. **B. Molecular Spectroscopy:** Energy levels, molecular orbitals, vibronic transitions, vibrational progressions and geometry of the excited states, Franck-Condon principle, electronic spectra of polyatomic molecules. Emission spectra; radioactive and non-radioactive decay, internal conversion, spectra of transition metal complexes,charge-transfer spectra. **C. Photoelectron Spectroscopy:** Basic principles; photo-electric effect, ionization process, Koopman's theorem	Able to interpret the molecular electronic spectra and deduce the electronic structure information in ground and excited states of diatomic molecules.
V	**Magnetic Resonance Spectroscopy**	A. Nuclear Magnet ic Resonance Spectros copy: Nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shift and its measurements. Factors influencing chemical shift. Deshielding, spin-spin interactions, factors influencing coupling constant J. Classification (ABX, AMX, ABC, A2B2 etc.) spin decoupling; basic ideas about instrument. NMR studies of nuclei other than proton - 13C and 19F. FT NMR, advantages of FT NMR, use of NMR in medical diagnostics. B. Electron Spin Resonanace Spectroscopy: Basic principles zero field splitting and Karmer's degeneracy, factors affecting the 'g' value. Isotropic and anisotropic hyperfine coupling constants, spin Hamiltonian, spin densities and McConnell relationship, measurement techniques, applications. C. Nuclear Quadrupole Resonance Spectroscopy: Quadrupole nuclei, quadrupole moments, electric field gradient, coupling constant splitting. Applictions	Justify the difference in intensity between Stokes and anti-Stokes lines and draw the Stokes and anti-Stokes lines in a Raman spectrum of a compound when given the energies of the different transitions.

Specify Course Outcome: Explain the basic principles of rotational, vibrational, electronic and Raman Spectroscopy, identify and explain factors that influence the strength and frequency of peaks in the Microwave, IR spectra, selection rule for rotational, Vibrational and electronic spectroscopy, the difference between Stokes and anti-Stokes lines in a Raman spectrum and justify the difference in

intensity between Stokes and anti-Stokes lines and able to interpret the molecular electronic spectra and deduce the electronic structure
information in ground and excited states of diatomic molecules.

Specify Program Outcome: Explain the basic principle of spectroscopy

Signature of Teacher: Dr. N.S. Kaminwar

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Pro-forma for program and course outcomes (2.6.1) 2022-23

Name of Teacher: Mr. S. L. Nakkalwar **Department:** Chemistry

Program: M.Sc. FY Semester- II CBCS **Subject**: **Chemistry**

Course Code: LCH- 411

Paper Title: Laboratory Course – I (Inorganic Chemistry) **Paper** – XI

Unit No.	Unit Name	Topics	Unit-wise Outcome
Unit-1	Laboratory Course I (Inorganic Chemistry)	1. Record and viva voce 05 2. Detection of three acidic and three basic radicals from a given salt mixture. Report the spot test of radicals. (At least five mixtures) 3. Preparation of metal complexes and haracterized by spectral analysis.a. Tris-(thiourea) copper(I) sulphate.b. Bis (acetylacetanato) copper (II) c. Potassium trioxalato ferrate(III). d. Cis - potassium dioxalato diaquo chromate(III) e. Bis(dimetyl glyoxime) Nickel (0) Complex f. Hexammine nickel(II) Chloride. g. Tris(Acetyl acetanato) Magnease(III). i. Schiff's base copper (II) Complexes. 4. Separation and estimation of one of the metal ion volumetrically. a. Fe+3 and Zn+2 b. Ni+2 and Cu+2 c. Cu+2 and Ba+2 d. Ni+2 and Zn+2 e. Cu+2 and Fe+2 f. Ba+2 and Mg+2	Students will be able to learn synthesis methods for the preparation of various coordination complexes and will understand the basic principles involved in operational procedures while synthesizing the complexes to a deeper level.

Specify Course Outcome: Learn synthesis methods for the preparation of various coordination complexes and will understand the basic principles involved in operational procedures while synthesizing the complexes to a deeper level and to characterize a synthesized complex using various characterization techniques such as melting point determination, solubility behavior in various solvents, molar conductance, magnetic susceptibility measurements, IR and electronic spectra etc, While following all these methods he/she will be able to understand operation procedures, care that should be taken while using these techniques and the practical utility of these techniques.

Specify Program Outcome: Understand the basic principles lying behind inorganic analysis such as precipitation, solubility product, buffer solution, applications of buffer solution in maintaining pH,

common ion effect etc. and this much information will be helpful while analyzing any inorganic compound in future

Signature of Teachers: Mr. S. L. Nakkalwar

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Pro-forma for program and course outcomes (2.6.1) 2022-23

Name of Teacher: Dr H.M. Kasralikar **Department:** Chemistry

Program: M. Sc. FY Semester II **Subject**: Chemistry

Course Code: CH-412 **Paper Title:** Laboratory Course II (Organic Chemistry) Paper-XII

Unit No.	Unit Name	Topics	Unit-wise Outcome
I	Laboratory Course II	**1. Techniques:** a) Simple distillation. b) Steam distillation. c) Thin layer chromatography. d) Column chromatography.**2. Qualitative analysis:** a) Separation, Purification, sample submission and identification of compounds of binarymixture (one solid and one liquid) by chemical method (Any six). b) Separation, Purification, sample submission and identification of compounds of binary mixture (solids) physical method (Any three). **3. Preparations (Double stage), (Any Four):** a) Phthalic anhydride-phthalimide-Anthranilic acid. b) Acetophenone-oxime-Acetanilide. c) Phthalic anhydride-o-benzoyl benzoic acid-Anthraquinone. d) Chlorobenzene-2,4-dinitrochlorobenzene-2,4-dinitrophenol. e) Benzoin-benzil-benzilic acid. f) Acetanilide-p-Bromo-acetanilide-p-bromo aniline. 4. Use of Computer (Chem Draw, Chem Sketch, ISI Draw**):** Draw the structure of aliphatic, aromatic and heterocyclic compounds and corrected IUPAC name.	Learn the pilot separation of the binary mixture and familiarize the systematic procedure of organic mixture analysis and the preparation involving nitration, bromination, Sandmeyer reaction, and Aldol condensation

Specify Course Outcome: Learn the pilot separation of the binary mixture, familiarize the systematic procedure of organic mixture analysis, the preparation involving nitration, bromination, Sandmeyer reaction, and Aldol Condensation, learn the test involving identification of special elements and learn the confirmatory test for various functional groups and understand the technique involving drying and crystallization by various methods.

Specify Program Outcome: Expertise the various techniques of preparation and analysis of organic substances and learn the estimation of various organic compounds and understand micro scale technique.

Signature of Teachers: Dr. H. M. Kasralikar

Dharmabad Shikshan Sanstha's

Lal Bahadur Shastri Mahavidyalaya, Dharmabad. 431809

Pro-forma for program and course outcomes (2.6.1) 2022-23

Name of Teacher: Dr. S. B. Patwari **Department: Chemistry**

Program: M.Sc. FY Semester –II CBCS **Subject**: Chemistry

Course Code: CH–413 Paper Title: Laboratory Course III (Physical Chemistry) Paper –XIII

Unit No.	Unit Name	Topics	Unit-wise Outcome
Unit-1	**Laboratory Course III (Physical Chemistry)**	**SECTION - A** **INSTRUMENTATION**: **1. CONDUCTOMETER:** 1. To estimate the concentrations of sulphuric acid, acetic acid and copper sulphate in given solution. 2. To determine solubility product and thermodynamic properties (ΔG , ΔH, ΔS) of sparingly soluble salts.3. To determine the relative strength of chloroacetic acid and acetic acid. 4. To determine the hydrolysis constant of Aniline hydrochloride.5. To investigate basic hydrolysis of ethyl acetate at four different temperatures and tofind out the energy of activation. **2. POTENTIOMETER:** 1. To determine PK**1** PK**2** values of Phosphoric acid.2. To determine strength of strong acid and weak acid in given mixture. 3. To determine the oxidation state of metal ion by method of concentration cell without transparence. **3. pH-METER:** 1. To determine Hammet constant of given substituted benzoic acid. 2. To determine pH values of various mixtures of sodium acetate and acetic acid in aqueous solution and hence to find out dissociation constant of acid. **4. COLORIMETER** 1. To determine equilibrium quotient for formation of mono thiocyanate iron(III) complex. 2. To determine Indicator constant of an indicator. 3. To determine concentration of Cu(II) iron in given solution titrating with E.D.T.A.solution. **5. REFRACTOMETER:** 1. To determine the molar refractivity of methyl acetate, ethyl acetate, n-hexane and carbon tetra chloride and to calculate refractive equivalence of C, H and Cl atom. 2. To study the variation of refractive index with composition of mixture of	. Apply their knowledge for setting various experiments based on the instrumentations studied

		CCl4 and ethyl acetate. **6. POLARIMETER.** 1. To determine the relative strength of two acids. 2. To determine the percentage of two optically active substance (d-glucose and dtartaric acid) in the mixture. **SECTION B** **NON-INSTRUMENTATION** 1. To determine partial molar volume of ethanol and water mixture at given Composition . 2. To determine molecular weight of high polymer by viscosity measurement. 3. To study the effect of surfactant on surface tension of water by using stalagmometer. 4. To determine solubility of benzoic acid at different temperature and hence to determine it's heat of solution. 5. To investigate the autocatalytic reaction between KMnO4 and oxalic acid and to find energy of activation. 6. To determine the rate constant of hydrolysis of methyl acetate catalyzed by HCl. 7. To determine effect of ionic strength on rate constant of reaction between potassium per sulphate and potassium iodide. 8. To investigate the solubility of three component system and hence tie line on bimodal curve. 9. To study the variation of viscosity with composition of mixture of i) ethanol-water ii) methanol-ethylidene chloride iii) nitric acid-Chloroform and determine whether or not there is compound formation between two liquids. 10. To determine surface tension of methyl acetate, ethyl acetate and chloroform and hence to calculate atomic parachors of C, H, Cl. 11. To determine order of reaction of given reaction kinetics by fractional change method. 12. To study distribution of benzoic acid between benzene and water at room temperature and hence show that benzoic acid dimerises in benzene.	

Specify Course Outcome: Perform different qualitative and quantitative analysis

Specify Program Outcome: Apply their knowledge for setting various experiments based on the instrumentations studied

Signature of Teachers: Dr. S. B. Patwari

Dharmabad Shikshan Sanstha's

Lal Bahadur Shastri Mahavidyalaya, Dharmabad. 431809

Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Dr N.S. Kaminwar **Department:** Chemistry

Program: M. Sc. FY Semester-II Subject: **Laboratory Course – IV (Analytical Chemistry)**

Course Code: LCH-414 **Paper Title:** P-XIV

Unit Number	Unit Name	Topics	Unit-wise Outcome
I		**(Instrumental)** **A. Conductometry** 1. Determination of the strength of strong acid and weak acid from mixture solution conductometrically 2. Analysis of aspirin by conductometric method. **B. Potentiometry** 1. Determination of the strength of halides in the given mixture using Potentiometry. 2. Determine the acid and basic dissociation constant of an amino acid (Glycine) and hence isoelectric point of an acid **C. pH-metry** 1. Acid-base titration in non-aqueous media by pH-metry (benzoic acid in ethanol /NaOH). 2. Determination of pKa of weak acid by pH-metry. 3. Determination of degree of dissociation of weak electrolyte and to study the deviation from ideal behavior that occurs with a strong electrolyte. D. **Colorimetry** 1. Verification of Beer's law for a) KMn04 and Cu+2 ammonia complex solution. 2. Determination of empirical formula for the formation of ferric salicylate complex by Job's method. 3. Determination of stability constant for the formation of complex between Fe3+ ions and 5-sulphosalicylic acid. **E. Polarimetry** 1. Determination of rate constant for inversion of cane sugar by polarimetry. 2. Study of inversion of cane sugar by enzyme kinetics.	Understand the basic principles and theory of different instruments used during the conduction of the experiments

		3. Determine the percentage of two optically active substances in a mixture polarimetrically. **F. Flame photometry** 1. Estimation of Na+ / K+ by Flame photometry. **Section**-B **(Non-Instrumental)** **A. Statistical analysis** 1. Application of '**t'** test for experimental data. 2. Application of rejection criteria (Q test) for experimental data. 3. Treatment of analytical data with least square method applied to Beer's law for KMn04 solutions. **B. Chromatography** 1. Separation of cations and anions by paper chromatography and determination of Rf values. 2. Determination of Ion-exchange capacity of an cation exchanger. 3. Determination of Ion-exchange capacity of an anion exchanger. **C. Chemical Kinetics** 1. Investigate the reaction between bromic acid and hydroiodic acid. 2. To study the kinetics of iodination of acetone. **D. Heterogeneous equilibria:** 1. Determine the formula of complex form between Cupric ion and ammonia by distribution method. 2. Investigate the solubility of three component system and hence draw a tie lone on bimodal curve. 3. Determination of hardness of water by complexometric titration.	

Specify Course Outcome: Understand the basic principles and theory of different instruments used during the conduction of the experiments and apply their knowledge for setting various experiments based on the instrumentations studied and perform different qualitative and quantitative analysis.

Specify Program Outcome: Perform the different experiments on conductometer, pH meter, potentiometer, colorimeter, polarimeter, flame photometry

Signature of Teachers **Dr N. S. Kaminwar**

Dharmabad Shikshan Sanstha's

Lal Bahadur Shastri Mahavidyalaya, Dharmabad- 431809

Pro-forma for program and course outcomes (2.6.1) 2022-23

Name of Teacher: Mr. S. L. Nakkalwar **Department:** Chemistry

Program: M.Sc. SY Semester –III CBCS **Subject**: Chemistry

Course Code: OCH 511 **Paper Title:** Advanced Spectroscopic Methods **Paper** – XV

Unit No.	Unit Name	Topics	Unit-wise Outcome
I	UV-Visible Spectroscopy	Fieser-Woodward rules for conjugated dienes and carbonyl compounds, Fieser-Kuhn rules for polyenes. UV spectra of aromatic compounds and heteroaromatic compounds. Calculation of max for the benzene derivatives (R-C6H4-Co-G) by A. I. Scott empirical rules.	Students are familiar with UV and Visible spectroscopy by determining absorption maxima of various dienes, enones and organic compound.
II	IR spectroscopy	Recapitulation, Characteristic vibration frequencies of Alkanes, Alkenes, Alkynes, Aromatic compounds, Alcohols, Ethers, Phenols and Amines. detailed study of vibrational frequencies of carbonyl compounds Ketones, Aldehydes, Esters, Amides, Acids, Anhydride, Lactose, Lactams and Conjugated Carbonyl compounds. Factors affecting group frequencies: overtones, combination bands and Fermi-resonance. FITR and sampling techniques.	Student develops the detail knowledge to get the different peaks of functional groups in organic molecules by infra-red spectroscopy

III	^{1}H - NMR Spectroscopy	General introduction and definitions, Chemical shift, Spin-spin interaction, shielding mechanism of measurement of chemical shift values and correlation for protons bonded to carbon (aliphatic, olefinic, aldehyde and aromatic) and other nuclei (alcohols, phenols, enols, carboxylic acids, amines, amides and mercapto). Factors affecting chemical shift. Deuterium exchange. Spin-spin coupling, factors affecting coupling constant. Complex spin-spin interaction between two and three nuclei. Simplification of complex spectra, nuclear magnetic double resonance, contact shift reagents, solvent effects. Fourier transform technique. Nuclear Over-Hauser effect (NOE). Resonance of other nuclei; ^{19}F and ^{31}P.	Students understand the importance and applications of NMR Spectroscopy for determination of structure of unknown organic compounds
IV	^{13}C NMR	Resolution and multiplicity of ^{13}C NMR, ^{1}H-decoupling, noisedecoupling, broad band decoupling; Deuterium, fluorine and phosphoruscoupling; NOE signal enhancement, off-resonance, proton decoupling, Structural applications of CMR	Students are recognizable with CMR to authenticate the position of carbon atom in organic compound.
V	Mass Spectroscopy	Theory, instrumentation and modifications; Unit mass and molecular ions; Important terms- singly and doubly charged ions, metastable peak, base peak, isotropic mass peaks, relative intensity, FTMS, etc.; Recognition of M^{+} ion peak; General fragmentation rules: Fragmentation of various classes of organic molecules, including compounds containing oxygen, sulfur, nitrogen and halogens; α, β-, allylic and benzylic cleavage; McLafferty rearrangement	Students are recognizable with CMR to authenticate the position of carbon atom in organic molecules
VI	Structural Problems**:**	a) Combined problems on UV, IR, NMR and Mass spectral data for structure determination. b) Elucidation of structure of organic molecules using spectra (IR, PMR&CMR).	Know the complete structure of compounds using UV, IR, PMR, CMR and Mass spectroscopic methods

Specify Program Outcome: Know the complete structure of compounds using UV, IR, PMR, CMR and Mass spectroscopic methods.

Specify Program Outcome: Students are acquainted with various spectroscopic techniques to elucidate the known andunknown organic molecules

Signature of Teachers: Mr. S. L. Nakkalwar

Dharmabad Shikshan Sanstha's

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Pro-forma for program and course outcomes (2.6.1) ***2022-23***

Name of Teacher: Dr. H. M. Kasralikar & Dr. N.S. Kaminwar **Department:** Chemistry

Program: M. Sc. SY Semester III **Subject**: Organic Chemistry

Course Code: OCH-512 **Paper Title:** Natural Products P-XVI

Unit No.	Unit Name	Topics	Unit-wise Outcome
I	Vitamins	Classification, Occurrence Chemistry of Vitamins A, Vitamin C and Vitamin-E Structure elucidation and synthesis. Deficiency syndromes etc.	To study the different natural products, and their Nomenclature, occurrence, deficiency syndromes.
II	Terpenoids and Carotenoids	Classification, nomenclature, Occurrence, isolation, isoprene rule, structure determination, stereochemistry and biogenesis of the following molecules Citral, Camphor, Menthol, Farnesol, Zingiberene, Abietic acid. Biosynthesis of terpenoids	To study the different natural products, and their Nomenclature, occurrence, deficiency syndromes
III	Alkaloids	Structure, stereochemistry and synthesis of quinine and morphine.	To study the Biogenesis of Natural Products.

IV	Steroids	Occurrence, Nomenclature, Basic Skeleton, Diel's hydrocarbon and Stereochemistry. Structure determination and synthesis of Cholesterol, Bile acid, Androsterone, Testosterone, Oestrone, Aldosterone and Progesterone	To study the Structure elucidation and synthesis of Vitamins, Terpenoids and Steroids.
V	Plant pigments	Occurrence, nomenclature and general method of structure, determination of Anthocyanidins. Synthesis of Cyanidin Chloride, Chalcones, Flavones, Quercetin. Peral methods of structure determination of Anthocyanidins. Synthesis of Cyanidin Chloride, Chalcones, Flavones, Quercetin.	To study the Biogenesis of Natural Products.
VI	Prostaglandins, pyrethoids, Rotenones and pheromones	Occurrence, classification. Biogenesis, physiological effects and synthesis of PGE and PGF2z. Natural and synthetic of pyrethroids, Rotenone's and pheromones. Synthesis of Bombykol	To study the physiological effects of prostaglandins, pyretheroids.

Specify Course Outcome: Familiarize the students with Classification, Occurrence Chemistry of Vitamins A, Vitamin C and Vitamin E Structure elucidation and synthesis. Deficiency syndromes etc., Classification, nomenclature, Occurrence, isolation, isoprene rule, structure determination, stereochemistry and biogenesis of the following molecules Citral, Camphor, Menthol, Farnesol, Zingiberene, Abietic acid. Biosynthesis of terpenoids, Structure, stereochemistry and synthesis of quinine and morphine**,** Occurrence, Nomenclature, Basic Skeleton, Diel's hydrocarbon and Stereochemistry. Structure determination and synthesis of Cholesterol, Bile acid, Androsterone, Testosterone, Oestrone, Aldosterone and Progesterone, Occurrence, nomenclature and general method of structure, determination of Anthocyanidins. Synthesis of Cyanidin Chloride, Chalcones, Flavones, Quercetin., Occurrence, classification. Biogenesis, physiological effects and synthesis of PGE and PGF2z. Natural and synthetic of pyrethroids, Rotenones and pheromones. Synthesis of Bombykol.

Specify Program Outcome: To study the different natural products, and their Nomenclature, occurrence, deficiency syndromes, to study the Biogenesis of Natural Products, to study the physiological effects of prostaglandins, pyretheroids

Signature of Teachers: Dr. H.M. Kasralikar & Dr. N.S. Kaminwar

Dharmabad Shikshan Sanstha's

Lal Bahadur Shastri Mahavidyalaya, Dharmabad. 431809

Pro-forma for program and course outcomes (2.6.1) 2022-23

Name of Teacher: Dr. H.M. Kasralikar **Department: Chemistry**

Program: MSc SY Semester –III CBCS **Subject**: Organic Chemistry

Course Code: OCC–513 Paper Title: Organic Synthesis Paper – XVII

Unit No.	Unit Name	Topics	Unit-wise Outcome
Unit-1	Oxidation	a) Oxidation of alcohol to aldehyde, ketone or acid: Jones reagent, Swern oxidation, Collins reagent, Fetizones reagent, PCC, PDC, PFC, IBX,Activated MnO_2, Chromyl chloride (Etard reaction), TEMPO, CAN, NMO, Moffattoxidation, Baeyer-Villiager , Woodward and Prevostdihydroxylation, b) Oxidative cleavage of Carbon-Carbon double bonds: $KMnO_4$, Ozonolysis. c) Oxidations using SeO_2, PhSeBr. Selective cleavages at functional groups: Cleavage of glycols, IO^- Pb(OAc).	To learn the mechanism of condensation, oxidation.
II	Reductions	a) Catalytic Hydrogenation; (b) Reduction of nitriles, oximes and nitro compounds; (c) Reduction of acids and Esters; (d) Reduction with metal hydride- Sodium cyanoborohydride, Diborane, L- & K- Selectrides, $LiBH_4$, DIBAL-H; (e) Birch reduction and related reactions, (h) Luche reagent, Wolf- Kishner reduction, Clemmenson reduction, Wilkinson catalyst, TBTH.	To learn the mechanism of condensation, reduction.
III	Organic Reagents	DCC, EDC, DDQ, 1,3 Dithiane, LDA, DMDO, OsO_4, RuO_4, SmI_2, Dess-Martin Periodinane, Diazomethane, Lawesson's reagent	Synthetic application of reagent
IV	(i) Ylides (ii) Enamines	Ylides: Preparation and their synthetic applications along with their stereochemical aspects of Phosphorous, Sulphur and Nitrogenylides. Enamines: Generation & application in organic synthesis with mechanistic pathways, stork enamine reaction.	To learn the Synthesis and applications of ylides.
V	Rearrangement	Pummerer, Payne, Eschenmoser fragmentation, Brook, Wagner-Meerwein, Wolf, Semipinacol, Epoxide rearrangement with lewis acid, Dienone-Phenol rearrangement, Tiffeneau-Demjanov, Favorskii, von Richter, Wittig, Neber, Smiles, Fries, Curtius, Lossen, Schmidt, Steven, Hofmann, Iodolactonisation.	To know the conversion of different substrate molecules through the rearrangement and develop the basic knowledge

			to write the mechanisms.
V	Name Reactions	Hunds-Diecker reaction, Dakin, Gabriel synthesis, Michael, Darzen, Prins, Henry, Reimer-Tiemann, Hoffmann–Loffler–Freytag, Dieckmann cyclization, Chichibabin, Vilsmeier, Ene, Ullmann reaction, Mannich, Strecker amino acid synthesis. Bamford-Steven, Baylis-Hillmann, Corey-Fuchs Reaction, Julia olefination, Mukaiyamaaldol, Mitsunobu, Peterson olefination, Corey-Winter olefination, Shapiro, Ritter, Stille, Heck, Sonogashira, Suzuki, Duff, Chugaev, Petasis, McMurry reaction and Coupling.Ring closing metathesis (Grubb's metathesis), Aldol- Tishchenko (Evans-Tishchenko reaction), Ugi, Passerini, Biginelli, Hantzsch condensation.	To understand the principles of different name reaction and transformations

Specify Course Outcome: To learn the mechanism of condensation, oxidation, Reduction, and synthetic application of reagent and name reactions.

Specify Program Outcome: Familiarize the students with the molecular rearrangement mechanism of condensation, oxidation, reduction and application of reagent.

Signature of Teachers: Dr. H. M. Kasralikar

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Pro-forma for program and course outcomes (2.6.1) 2022-23

Name of Teacher: Dr. N.S. Kaminwar **Department:** Chemistry

Program: M. Sc. SY Semester-III **Subject**: Organic Chemistry

Course Code: OCC-514 **Paper Title:** Medicinal Chemistry P-XVIII

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	Concepts of Medicinal Chemistry, Classification of Drugs:	**A) Concepts of Medicinal Chemistry**: Important terminologies in Medicinal Chemistry: Drugs, Pharmacy, Pharmaceutics, Toxicology; Pharmacodynamic agents, Pharmacophore, Pharmacodynamics, metabolites and antimetabolites, Chemotherapy. Mechanism of chemotherapeutic actions: 1) Biological defences 2) Chemical defences. a) Surface active agent, b) Metabolic antagonism. Assay of Drugs: Chemical assay, Biological assay, Immunological assay **B) Classification of Drugs:** **i**) Classification of drugs on the basis of therapeutic action. a) Chemotherapeutic agents, b) Pharamacodynamic agents. iii) Differentiate medicine and drugs	• Learn basic principles involved in drug discovery and designing process
II	Drug Design	**A] Drug Discovery.** i) Introduction ii) Procedure followed in drug design. **a) Drug discovery without a lead, b) Lead discovery, rational approaches to lead discovery** iii) Lead modification: Drug design and development, a) Identification of the active part: The pharmacophore, b) Functional group modification, c) Structure-activity relationship, Qualitative versus quantitative approaches-advantages and disadvantages d) Structure modification to increase potency and the therapeutic index; 1) Homologation, 2) Chain branching, 3) Ring-chain transformation., 4) Bioisosterism,	• To know the role of medicinal chemist in development of medicinal agents

		5) Combinatorial chemistry. iv) Structural modification to increase oral bioactivity. 1) Electronic effect, 2) The Hammet equation, 3) Lipophilicity effect. **B] Concept of prodrugs and soft drugs** a) Prodrugs: i) Prodrugs designing, types of prodrugs, ii) Prodrug formation of compounds containing various chemical groups, Prodrugs and drug delivery system b) Soft drugs: i) Soft drug concept ii) Properties of soft drugs. **A] Theories of drug activity** Drug-receptor interactions, receptor theories and drug action, i) Occupancy theory, ii) Rate theory, iii) Induced theory; LD-50 and ED-50, Therapeutic index **A] QSAR method:** Introduction, Methods used in QSAR studies, Hansch method, Free-Wilson method (Mathematical derivations of equations excluded), Advantages and disadvantages of free approach, Computer based methods of QSAR related to receptor binding, Physico-Chemical properties, Lipophilicity, Electronic parameters, Steric substituent constants, Experimental determination of partition coefficients**.** **A] Molecular docking:** Rigid docking, flexible docking, manual docking; Advantages anddisadvantages of flex-X, flex-S, Autodock and Dock softwares, with successful examples. **B] Structure based drug design.** i) Process of structure based drug design, ii) Deactivation of certain drug**,** iii) Determination of the structure of the protein, iv) Design ofinhibitors **C] Molecular modelling using computers** i) Introduction ii) Uses of molecular modelling: a) Manual use, b) Further-computer programming iii) Artificial Intelligence Methods in molecular modelling c) X-ray crystallography. **D] Design of Enzyme inhibitors** i) Introduction, ii) Competitive inhibitors, iii) Active-site directed irreversible inhibition of enzymes, iv) Suicide enzyme inactivation. Drug action through enzyme inhibition.Theories of enzyme inhibition and inactivation, Enzyme activation of drugs and prodrugs**.** I] Nucleic acids: Nucleic acids (NA) as targets for drug action, NA-interactive agents, Classes of drugs that interact with nucleic acids, Intercalation, NA-alkylation, NA-strand breaking and their	

		importance in drug action. **J] New developments Gene therapy and drug resistance** **K] Informatics methods in drug design:** Brief introduction to bioinformatics, cheminformatics, their relation to drug design as per the topics discussed above**.**	
III	: Pharmacokinetics and Pharmacodynamics	A] Pharmacokinetics: a) Drug absorption, b) Distribution, c) Elimination d) Disposition; Chemistry of ADME and toxicity properties of drugs.Uses of pharmacokinetics in drug development process**. B] Pharmacodynamics** a) Introduction, Elementary treatment of enzyme inhibition, b) Membrane active drug, c) Sulphonamides	• Learn insight knowledge to analyze and perform SAR and QSAR
IV	Drug metabolism	I] Introduction, II] Oxidation, III] Reduction, IV] Hydrolysis, V] Conjugation, Significance of drug metabolism in Medicinal Chemistry	• Learn insight knowledge to analyze and perform SAR and QSAR
V	Antimicobacterial drugs	**A] drugs:** Introduction. Mechanism of action of anti-tuberculosis drugs, Targets for anti-tuberculosis drug development, Mechanism of drug-resistance in tuberculosis a)First-line agents (Primary tubercular drugs): Structure and activity of streptomycin and dihydro-streptomycin, Synthesis and SAR of 4-amino salicylic acid and isoniazid b)Second line agents (Secondary antitubercular agents): Structure and activity of Rifampicin, Cycloserine, Viomycin, Enthionamide, Ethambutol, Thioacetazone. (Synthesis of Cycloserine and Ethambutol expected) **B)Antileprotic drugs** Chaulmoogra and hydnocarpus oil, Multidrug therapy, SAR of sulphones, Dapsone (DDS), Acedapsone, Solapsone, Diaminodipheylthiourea, Rifampicin. (Synthesis of Acedapsone expected)	Learn insight knowledge to analyze and perform SAR and QSAR
VI	Antibiotics	1.Introduction, classification of antibiotics, 2. Cell wall synthesis, 3. Mechanism of action of antibiotics, a) Inhibition of cell-wall synthesis, b) Inhibition of bacterial protein synthesis, c) Disorganization of the cytoplasmic membrane, d) Interference in the bacterial nucleic acid synthesis,e) Inhibition of the tetrahydro-folate biosynthesis I)Cell wall synthesis inhibitors (β-Lactam antibiotics): Synthesis of Penicillin-V, Penicillin-G, amoxicillin, ampicilin from 6-APA, cephalexin, Structure and activity of benzyl penicillin, semi- synthetic penicillin, cephalosporin, Mode of action of penicillin and	Learn how to analyze and perform SAR of Antimicobacterial,drug,Antibiotics,Coagulants

		cephalosporin**.**Protein synthesis inhibitors: Structure activity of tetracycline and synthesis of chlortetracycline, Synthesis and SAR of chloramphenicol, Mode of action of chloroamphenicol.	
VII	Coagulants and Anticoagulants	Mechanism of blood clotting, Coagulant, Vitamin-K, Vitamin-K analogues, anticoagulant, Action of anticoagulant, Heparin, Coumarin derivatives, Synthesis of 4-hydroxy coumarin, Dicoumarol, Structure and activity coumarin derivatives	Learn how to analyze and perform SAR of Antimicobacte-rial,drug,Ant-ibiotics,Coag-ulants

Specify Course Outcome: To impart knowledge of Important terminologies in Medicinal Chemistry, Classification of Drugs**,** Drug Discovery, Concept of prodrugs and soft drugs, Theories of drug activity, QSAR method, Molecular docking, Molecular modelling using computers, Design of Enzyme inhibitors, Pharmacokinetics and Pharmacodynamics, Drug metabolism, Antimicrobacterial drugs, Antibiotics, Coagulants and Anticoagulants

Specify Program Outcome: Learn basic principles involved in drug discovery and designing process, learn insight knowledge to analyze and perform SAR and QSAR, how to analyze and perform SAR of Antimicobacterial drug, Antibiotics, Coagulants.

Signature of Teachers: Dr. N. S. Kaminwar

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Pro-forma for program and course outcomes (2.6.1) 2022-23

Name of Teacher: Mr. S. L. Nakkalwar **Department: Chemistry**

Program: M.Sc. SY Semester –IV CBCS **Subject**: Chemistry- IV Sem.

Course Code: OCH- 521 **Paper Title:** Advanced Heterocyclic Chemistry P-XX

Unit No.	Unit Name	Topics	Unit-wise Outcome
Unit-1	Nomenclature of heterocycles:	Systematic nomenclature system (Hantzsch-Widman system) Trivial nomenclature system. Fusion nomenclature system and Replacement nomenclature system	different systems for nomenclature will be presented
II	Nonaromatic heterocycles	Synthesis, reactivity, and importance of the following ring systems.Azirines, Oxaranes, Thiiranes, Diazirenes, Diaziridines andAzetidines.	Emphasis is given on the most important heterocyclic systems, such asAziridines, Oxaranes,Thiiranes,Diaziridines,Diazirenes and Azetidines
III	Five and six-membered heterocycles with two hetero atoms:	Synthesis, reactivity, aromatic character and importance of the followingheterocycles: Pyrazole, Imidazole, Oxazole, Thiazole, Pyrimidine and Pyrazine	Emphasis is given on the most important heterocyclic systems, such as Pyrazole, Imidazole, Oxazole, Thiazole, Pyrimidine andPyrazine

IV	Heterocycles with more than two hetero atoms	Synthesis, reactivity, aromatic character and importance of the following heterocycles: Triazoles, Oxadiazoles, Thiadiazoles and Triazines	For each group, ring synthesis, chemical properties and characteristic reactions will be discussed
V	Larger ring and other heterocycles:	Synthesis and reactivity of Azepines, Oxepines and Thiepines. Synthesis of Benzoazepines, Benzooxepines, Benzothiepines, Azocines and Azonines	For each group, ring synthesis, chemical properties and characteristic reactions will be discussed
VI	Banzanellated azoles and heterocycles with ring-junction nitrogen:	Banzanellated azoles: Synthesis and chemical properties of Benzimidazoles, Benzoxazoles and Benzothiazoles.Heterocycles with Ring-Junction nitrogen: Synthesis and reactivity ofQuinolizines andIndolizines	. Aromaticity applied to heterocyclic compounds, general methods for ring synthesis (by a number of cyclisation and cycloadditon reactions)

Specify Course Outcome: The student will get familiar with particular properties and reactions for the most important heterocycles as well as different systems of nomenclature.

Specify Program Outcome: This course aims at giving a fundamental theoretical understanding of heterocyclic chemistry, including alternative general methods for ring synthesis and application of such methods for the preparation of specific groups of heterocyclic systems. The student will get familiar with particular properties and reactions for the most important heterocycles as well as different systems of nomenclature.

Signature of Teachers: Mr. S. L. Nakkalwar

Dharmabad Shikshan Sanstha's

Lal Bahadur Shastri Mahavidyalaya, Dharmabad. 431809

Pro-forma for program and course outcomes (2.6.1) 2022-23

Name of Teacher: Mr. S. L. Nakkalwar **Department: Chemistry**

Program: M.Sc. SY Semester –IV CBCS **Subject**: Chemistry

Course Code: OCH- 522 **Paper Title:** Advanced Organic Chemistry P-XXI

Unit No.	Unit Name	Topics	Unit-wise Outcome
Unit-1	Enzyme Chemistry	Introduction, Nomenclature, Classification and Extraction of enzymes, Introduction to catalysis and enzymes; Multifunctional catalysis, Intramolecular Catalysis, Mechanism of enzyme action, Factors responsible for enzyme specificity, Enzyme activity and kinetics (Michaelis Menten and Lineweaver–Burk plots), Enzyme Inhibitions (Reversible and irreversible), Structure, Mechanism of action and applications of α-Chymotrypsin, Ribonuclease, lysozyme and Carbopeptidase-A. Enzymes in synthetic organic chemistry [Additions, eliminations, substitutions, condensations, cyclocondensations, oxidations, reductions and rearrangement one example each to be covered]	To study the applications and Mechanism of Enzymes
II	Mechanism of enzyme action and co-enzyme chemistry	Transition-state theory, orientation and steric effect, acid-base catalysis, covalent catalysis, strain or distortion.Example of some typical enzyme mechanisms for chymotrypsin, ribonuclease, lysozyme and carboxypeptidase A. Chemical structures of co-enzymes and cofactors, Oxidoreduction (NAD+, NADP+), Pyridoxal phosphate (PLP), Thiamine pyrophosphate (TPP), Biotin (CO2 carrier).	To study the applications and Mechanism of Enzymes
III	Asymmetric Synthesis	Chiral pool, Chiral auxiliary, Enantio-&Diastereoselective synthesis, Chiral reagent and chiral catalyst including CBS reagent, NADH, Asymmetric hydrogenation including BINAP, Hydroboration- Ipc2BH, IpcBH2, Asymmetric epoxidation- (+) DET & (-) DET, Sharpless, Jacobson, Asymmetric dihydroxylation-(DHQD)2PHAL & (DHQ)2PHAL, Felkin-Anh model, Zimmermann-Traxler transition state model, Proline catalyzed asymmetric reactions.	To study Asymmetric synthesis

IV	Formation of Carbon-Carbon bonds via organometallic reagents	Synthesis and applications of organo, Magnesium, Titanium, Cerium, Boron, Silicon, Cadmium .Introduction, generation, stability, reactivity, characteristics, structural and stereo chemical properties of free radicals	
V	Reaction of free radicals	Addition, substitutions, fragmentations, Oxidations and reductions, Detection of free radicals, Homolysis and free radical displacement. Radical chain reactions, Addition and rearrangements, radical cyclization, reactivity of aliphatic and aromatic substrates at bridgehead, Coupling of alkynes and arylation of aromatic compound by diazonium salt, Sandmeyer reaction, Hunsdieker reaction, McMurry reaction, Acyloin condensation, Bouveault-Blank reduction	To study Free radical reaction

Specify Course Outcome: Applications and uses of Green catalysts and Reagents. and use of Ionic Liquids and PTC in Green Synthesis.

Specify Program Outcome: The basic Principles of Green Chemistry,

Signature of Teachers: Mr. S. L. Nakkalwar

Dharmabad Shikshan Sanstha's

Lal Bahadur Shastri Mahavidyalaya, Dharmabad. 431809

Pro-forma for program and course outcomes (2.6.1) 2022-23

Name of Teacher: Dr. H. M. Kasralikar **Department: Chemistry**

Program: M.Sc. SY Semester –IV CBCS **Subject**: Chemistry

Course Code: OCH–523

Paper Title: Organic synthesis: Retro synthetic Approach Paper – **XXII**

Unit No.	Unit Name	Topics	Unit-wise Outcome
I	Disconnection Approach	Introduction to:(i) Grounding of organic chemistry for understanding retrosynthesis; Retrosynthetic analysis and designing of the synthesis; Disconnection approach: An introduction to synthons, synthetic equivalents, disconnection approach, functional group interconversions, importance of order of events in organic synthesis, one and two group C-X disconnections, selective organic transformations: chemoselectivity, regioselectivity, stereoselectivity, enentioselectivity, Reversal of polarity, cyclization reactions, amine synthesis	To persuade the subject specific knowledge as well as relevant understanding of the Retrosynthesis
II	Protecting group	Protection and deprotection of hydroxyl, carbonyls in aldehydes and ketones, amines, carboxylic acids, alkenes and alkynes	To study the protection and deprotection group approach
III	Protection and deprotection of hydroxyl, carbonyls in aldehydes and ketones, amines, carboxylic acids, alkenes and alkynes	(i) One group C-C Disconnections: Alcohols (including stereoselectivity), carbonyls (including regioselectivity), Alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis. (ii) Two group C-C Disconnections: Diels-Alder reactions, 1,3difunctionalized compounds and α, β-unsaturated compounds, control in carbonyl condensations, 1,5 difunctionalized compounds, Michael addition and Robinson annelation.	The academic and professional skills required for Chemistry-based professions

IV	**Ring Synthesis:**	Introduction to ring synthesis, saturated heterocycles, synthesis of 3, 4, 5 and 6 membered rings, rearrangements and photochemistry in synthesis, aromatic heterocycles	To know the ring synthesis for cyclic molecules
V	Complex molecules	Synthetic routes based on retrosynthetic analysis for following molecules: Longifoline, Reserpine, Juvabione, Aphidicoline, Taxol.	To devlop synthetic routes based on retrosynthetic analysis for molecules.

Specify Course Outcome: To persuade the subject specific knowledge as well as relevant understanding of the Retrosynthesis, the academic and professional skills required for Chemistry-based professions. Learning experiences gained from this Disconnection approach is important for industrial purpose.

Specify Program Outcome: To persuade the subject specific knowledge as well as relevant understanding of the Retrosynthesis

Signature of Teachers: Dr. H.M. Kasralikar

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Pro-forma for program and course outcomes (2.6.1) 2022-23

Name of Teacher: Dr. N. S. Kaminwar **Department:** Chemistry

Program: M. Sc. SY Semester-IV **Subject**: Organic Chemistry

Course Code: OCC-524 **Paper Title:** Medicinal Chemistry P-XXIII

Unit No.	Unit Name	Topics	Unit-wise Outcome
I	Anti-cancer and Anti-AIDS agents	**A] Anti-cancer Agents (Anti-neoplastic agents)**:Introduction, Cancer or tumor, Types of tumor, Terminology: Neoplasma, Sarcoma, Carcinoma, Blastoma, Cancers of blood, Metastases. Mechanism of tumor formation, Treatment of cancer: a) Surgery, b) Photo radiation, c) Radation therapy, d) Immunology, e) Cancer Chemotherapy. Role of alkylating agents and antimetabolites in the treatment of cancer, i) Alkylating agents, Mustard gas, nitrogen mustards (General methods of preparations), Mechloethamine, melphalan (synthesis) and chlorambucil (synthesis), ii) Antimetabolites, Synthesis and structure activity of 6-mercaptopurine, 5-flurouracil. Brief discussion regarding use of hormones, natural products, carcinolytic antibiotics and mitotic inhibitors. **B] Anti-AIDS agents:** Introduction, structure and life cycle of the AIDS virus, Mechanism of action of anti-HIV drugs, Targets for anti-HIV drug development, Taxol and Azedothymidine (AZT) derivatives.	Learn basic principles involved in Anti-cancer and Anti-AIDS agents,Hypoglycemic agents, Cardiac drugs, antiviral antimalarials.

II	**(A)**Insuli n and Hypogly cemic agents (B)Cardi ac drugs:	Introduction, Types of diabetics, Insulin and its preparation, Storage, secretion, and function of insulin, SAR and mechanism action of Sulphonyl urea and Biguanides, Sweeting agents: Saccharin and p-Phenyl urea **A: Insulin and Hypoglycemic agents**. **(Dulcin), (Synthesis** Introduction, Types of diabetics, Insulin and its preparation, Storage, secretion, and function of insulin, SAR and mechanism action of Sulphonyl urea and Biguanides, Sweeting agents: Saccharin and p-Phenyl urea (Dulcin), (Synthesis of sodium saccharin expected). **B] Cardiac drugs:** Introduction, Myocardial cell, Molecular basis of mycocardial contraction, cardiovascular diseases, pathophsiology heart failure.i) Cardiotonic (Cardiac glycosides): Structure and activity of glycosides, ii) Antianginal drugs. Types of angina pectoris, Mechanism of action of antianginal drugs. Classification of antianginal drugs, a) Nitrates and nitrites, b) Non-nitrate. SAR of Diperidamol, Khellin, Xanthines and Papavarine, iii) Antiarrhythmic drugs: Synthesis and SAR of guanidine, procainamide, iv) β-Adrenergic blocking agents: Synthesis and SAR of propranolol and isoproterenol, v) Calcium channel blockers: Structure activity of 1,4-dihydropyridines, synthesis of Verapamil and Diltiazem, vi) Antihypertensive drug: Primary and secondary hypertension agents like Rauwolfia alkaloids, Synthesis and structure activity of methyldopa, Clonidine, Hydralazin.	To know the role of medicinal chemist in development of medicinal agents for analgesic agents, Anti-inflammatory drugs, Anaesthetics, depressants, Anticonvulsant agents,Drug acting on Gastrointestinal tact infections
III	: Antiviral agents, Antimalarial s	**Antiviral agents, Antimalarials** Antiviral Agents: Introduction, Classification of antiviral agents, viral diseases, viral replication and transformation of cells, SAR of amantadine hydrochloride and interferons. Coronavirus: Introduction, genome structure and life cycle, COVID-19 drug development. **Antimalarials:** Introduction, life cycle of plasmodia, chemotherapy of malaria, Mechanism of action of anti-malarial drugs, Targets for anti-malarial drug development, Mechanism of drug-resistance in malaria types of antimalarial drugs. SAR of 8-aminoquinoline derivatives, 4-aminoquinoline derivatives, pyrimidine and biguanide derivatives. Synthesis of pamaquine, primaquine, santoquine, camaquine, and pyrimethamine and choroquine	Understand key components of Antiviral agents, Antimalarials

		phosphate (expected).	
IV	[A] Analgesic and Anti-inflammatory drugs [B]]Antifungal agents	A] Analgesic and Anti-inflammatory drugs: i) Analgesics: SAR of piperidine, meperidin, methadone, and 6, 7-benzomorphans Synthesis of mepiridine, methadone and 6, 7-benzomorphans (expected) **II)** Anti-inflammatory drugs: -Introduction, classification on non-steroidal anti-inflammatory drugs, SAR of methyl salicylate, aspirin, iodomethazone, mefenamic acid, phenyl butazone, oxyphenbutazone, naproxen, rofecoxib, celecoxib, Synthesis of ibuprofen and phenylbutazone. **III)** Treatment of Gout: -Introduction, synthesis and uses of Allopurinol.B] Antifungal agents. -Introduction, SAR and synthesis of Fluconazole.	Understand key components of Analgesic and Anti-inflammatory drugsAntifungal agents
V	Drugs acting on CNS	**A) Anaesthetics:** i) General anaesthetics: Synthesis of methohexital, structure activity of divinyl ether, nitrous oxide, Pentothal. ii) Local anaesthetics: Introduction, development of local anaesthetics, classification (according to chemical structure), a) Procaine and related amino benzoic acid, b) Stovain and its analogues, c) Lidocaine and its analogues, d) Synthesis and SAR of procaine, lidocaine and stovaine **B) Depressants:** **Introduction** i) Sedative and hypnotics, SAR of aldehydes, ketones and sulphones ii) Anticonvulsant: Introduction, Structure and activity of substituent barbiturates. Synthesis of Phenobarbital sodium (expected), Hydantoins: General synthesis and SAR ofhydantoins. **C) Antipsychotic agents (Neuroleptic agents): Selective modifier ofCNS (Tranquillizers)** **Introduction, Classification,** i) Phenothiazine derivatives: SAR and synthesis of chloropromazine and related compounds. ii) Butyrophenones derivatives: Synthesis of haloperidol, spiroperidol. SAR of	Understand key components of Drugs acting on CNS

		butyrophenones derivatives iii) Central nervous system stimulants (Antidepressants): Introduction Tricyclic system with central seven membered ring: Dibenzepine and related compounds, SAR of dibenzepine derivatives Synthesis of imipramine, amitriptyline, Chloropromazine and Diazepam.	
VI	A)Intellectual property right (IPR): B)Agents for organ imagine OR Diagnostic agents	**A) Intellectual property right (IPR):** Manual of patent practices and procedure, Introduction, Patentable subject matter, Application for patents, Patent application under PCT, Publication and examination of application. B) **Agents for organ imagine OR Diagnostic agents**. Introduction, Classification, Radiopagues agents (contrast media), Water soluble and Water insoluble contrast media.Synthesis of Metrizamide, Iopanoic acid and Pyropylidone.Diognostic chemicals: i) Drugs used to test kidney functions, ii) Drugs used to test liver functions, iii) Agents used to test gastric function, iv) Agents used to test cardiac function	Understand to file the patents
VII	Drug acting on Gastrointestinal tract (Drug acting on GIT**).**	Introduction, a) Gastric antacid: i) Treatment of gastric hyperacidity, ii) H2-receptor antagonists-Synthesis of Ranitidine (Zantac) and Famotidine. b) Ulcerative colitis. c) Antispansmodics agents (Spasmolytic agents), d) Anthelmintic agents: Introduction, anthelmintic agents, synthesis of mebendazole.	Understand the Drug acting on Gastrointestinal tract (Drug acting on GIT)

Specify Course Outcome: Understand key components of drug discovery of Anti-cancer and Anti-AIDS agents, Hypoglycemic agents, Cardiac drugs, antiviral antimalarial agents

Specify Program Outcome: Understand key components of drug discovery of Anti-cancer and Anti-AIDS agents, Hypoglycemic agents, Cardiac drugs, antiviral antimalarial agents.

Signature of Teachers: Dr. N. S. Kaminwar

Dharmabad Shikshan Sanstha's

Lal Bahadur Shastri Mahavidyalaya, Dharmabad. 431809

Pro-forma for program and course outcomes (2.6.1) 2022-23

Name of Teacher: Dr H. M. Kasralikar **Department:** Chemistry

Program: M. Sc. SY CBCS **Subject**: Chemistry

Course Code: OCH-525 **Paper Title**: Mixture Analysis **Paper** – XXV

Unit No.	Unit Name	Topics	Unit-wise Outcome
I	Qualitative Analysis(At least 10 Organic Mixtures):	Semi-micro–Qualitative Analysis of Ternary Mixtures (Solids; Two Solids and One Liquid, One Solid and Two Liquids) containing single/poly functional compounds by Chemical and Physical Method with Chromatographic Separation (TLC) for purity of all three components and its Expected Theoretical Spectral Data (IR, ^{1}H NMR & ^{13}C NMR).	Learn basics practical knowledge of qualitative analysis

Specify Course Outcome: Creating awareness of chemistry practical's regarding analysis, synthesis and instrumental skills.

Specify Program Outcome: Building confidence of chemistry practical knowledge among the students and become skilled at organic compounds determination.

Signature of Teachers: Dr. H. M. Kasralikar.

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Pro-forma for program and course outcomes (2.6.1) 2022-23

Name of Teacher: Mr. S. L. Nakkalwar **Department:** Chemistry

Program: M.Sc. SY Semester-IV **Subject**: Chemistry

Course Code: OCH-526 **Paper Title: Synthesis of Organic Molecules** P-XXVI

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	Multistage Synthesis (At least three)	a) Benzophenone→ benzopinacol→ benzopinacolone b) Benzoin → benzil→ benzilic acid c) Benzaldehyde→ chalcone → chalcone epoxide,d)Acetanalide→ 4-bromoacetanalide → 4-bromoaniline.e)Cyclohexanone→ cyclohexanoneoxime→ caprolactonef)Anthranilic acid → o-chlorobenzoic acid → N-phenyl anthranilic acid.	Learn basics practical knowledge of multistage synthesis of organic molecules
II	Synthesis of Drug Molecules (At least three)	a) Synthesis of anaesthetic drug Benzocaine.b) Synthesis of anticancer drug 6-methyluracil.c) Synthesis of antibacterial drug sulfanilamide.c) Synthesis of anti-epileptic drug antypyrine.d)Synthesis of anti-convulsant drug Phenytoin.	Learn fundamentals of organic synthesis in drug discovery

III	Use of microwaves in organic synthesis (At least one)	a)The Hantzchdihydropyridine synthesis from aldehydes, ethyl acetoacetate and ureain microwave irradiation (*Synthetic Letters*, 8, 1296-1298, 2001; *Synthetic Communications*, 31, 425-430, 2001) b)Synthesis of coumarin by Knoevenagel synthesis using salicyladehyde, ethylacetatein presence of base in microwave irradiation (*J. Chem. Res. (S)*, 468-469,1998).c) Synthesis of dihydropyrimidones from Biginelli Reaction by acid-catalyzed, threecomponentreaction between an aldehyde, ß-ketoester and urea *(Tetrahedron,* **2005**, 61, 4275-4280)	. Learn about the one-pot organic synthesis by microwave techniques

Specify Course Outcome: Learn fundamentals of organic synthesis in drug discovery and Learn about the one-pot organic synthesis by microwave techniques

Specify Program Outcome: Learn basics practical knowledge of multistage synthesis of organic molecules.

Signature of Teachers: Mr. S. L. Nakkalwar

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Lal Bahadur Shastri Mahavidyalaya, Dharmabad. 431809

Pro-forma for program and course outcomes (2.6.1) 2022-23

Name of Teacher: Dr N. S. Kaminwar **Department:** Chemistry

Program: M.Sc. SY Semester-IV **Subject**: Chemistry

Course Code: **LOCH-527 Paper Title: Physico-Organic Estimations Paper–XXVIII**

Unit No.	Unit Name	Topics	Unit-wise Outcome
I	A] Estimation of Drugs by Titrimetric: (At least three)	a) Assay of Aspirin. b) Assay of Ibuprofen. c) Assay of Analgin. d) Determination of Chloride in Ringer Lactate solution for Injection. e) Determination of Calcium ions in Calcium Gluconate Injection	To trained the estimation of different organic molecules in day to day's life chemistry.
II	B] Isolation of natural products. (At least three)	a) Isolation of caffeine from tea leaves. b) Isolation of piperine from black pepper c) Isolation of β-carotene from carrots d) Isolation of lycopene from tomatoes e) Isolation of limonene from lemon peel f) Isolation of euginol from cloves	Learn about the Isolation of natural products.
III	**Estimation of Drugs by Instrumental Methods: (At least Four)**	a) Assay of sulfanilamide by Potentiometry. b) Assay of Riboflavin by Colorimetry. c)Assay of ascorbic acid by Colorimetry. d) Assay of Diazepam by UV-Vis Spectrophotometer. e) Assay of Riboflavin by UV-Vis Spectrophotometer. f) Estimation of carbohydrates, amino acids, proteins by UV-Vis spectrophotometer. g) Determinationof Hammett constants and determine its substitution effect. i) Benzoic acid, ii) P-Nitro Benzoic acid, iii) P-Methoxy Benzoic acid, iv) PMethyl benzoic acid, v) P-Chlorobenzoic acid. (Out of two compounds one compound must be benzoic acid and another should be substituted benzoic acid is given to the students)	Develops the techniques for the estimation of drugs by Instrumental Methods.

Specify Course Outcome: To trained the estimation of different organic molecules in day to day's life chemistry.

Specify Program Outcome: Gain the practical knowledge to estimate the drug molecules by instrumentation methods

Signature of Teachers: Dr. N. S. Kaminwar

Dharmabad Shikshan Sanstha's

Lal Bahadur Shastri Mahavidyalaya, Dharmabad. 431809

Pro-forma for program and course outcomes (2.6.1) 2022-23

Name of Teacher: Dr. S. B. Patwari, Dr. N. S. Kaminwar, Mr. S. L. Nakkalwar, Dr. H. M. Kasralikar

Department: Chemistry **Program:** M. Sc. SY Semester-IV **Subject**: Chemistry

Course Code: L OCH -528 **Paper Title:** Project P-XXIII

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	Project	Literature Survey, Studies of Reactions, Synthesis, Mechanism, Isolation of Natural Products, Standardization of Reaction Conditions, New Synthetic Methods etc.	To develop research aptitude in students.

Specify Course Outcome: Development of practical skill and research aptitude in the students.

Specify Program Outcome: Development of practical skill and research aptitude in the students.

Signature of Teacher: Dr. S. B. Patwari Dr. N. S. Kaminwar Mr. S. L. Nakkalwar,

Dr. H. M. Kasralikar