# LESSION PLAN

CLASS –B.Sc 5TH Sem

Session -2022-23

**August 2022 NMR Spectroscopy-I** Principle of nuclear magnetic resonance, the PMR spectrum,number of signals, peak areas, equivalent and nonequivalent protons positions of signals and chemical shift,shielding and deshielding of protons, proton counting,splitting of signals and coupling constants, magnetic equivalence of protons.

**September 2022 NMR Spectroscopy-II** Discuss ion of PMR spectra of the molecules: ethyl bromide, npropyl bromide, isopropyl bromide, 1,1-dibromoethane, 1,1,2-tribromoethane, ethanol, acetaldehyde, ethyl acetate, toluene, benzaldehyde and acetophenone..Simple problems on PMR spectroscopy for structure determination of organic compounds **Carbohydrates-I** Classification and nomenclature. Monosaccharides, mechanism of osazone formation, inte rconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose in to mannose. Formation of glycos ides, ethers and esters. Determination of ring size of glucose and fructose. Open chain and cyclic structure of D(+)-glucose & D(-) fructose. Mechanism ofmutarotation. Structures of ribose and deoxyribose. Test,Seminar& Group Discussion in Class

**October 2022 Carbohydrates-II** An introduc tion to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination. **Organometallic Compounds** Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reactions. Organozinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions. Test,Seminar& Group Discussion in Class

**November 2022 Spectroscopy-I** Introduction: Electromagnetic radiation, regions of spectrum, basic features of spectroscopy, statement of Bornoppenheimer approximation, Degrees of freedom. **Rotational Spectrum** Diatomic molecules. Energy levels of rigid rotator (semi-classical principles), selection rules, spectral intensity distribution using population distribution (Maxwell-Boltzmann distribution), determination of bond length, qualitative description of non-rigid rotor, isotope effect **Spectroscopy-II** Vibrational spectrum Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effects of anharmonic motion and isotopic effect on the spectra., idea of vibrational frequencies of different functional groups. Test,Seminar& Group Discussion in Class

**December 2022 Raman Spectrum**: Concept of polarizibility, pure rotational and pure vibrational Raman spectra of diatomic molecules, selectin rules, Quantum theory of Raman spectra. Revision of Syllabus.

**Chiranjiv Tayal, Asstt. Prof.**
**Department of Chemistry**

# LESSON PLAN

**CLASS- BSc 1st Sem**

**Session- 2022-23(even sem)**

**August 2022 Structure and Bonding:-** Localized and delocalized chemical bond, van der Waals in teractions, resonance: conditions, resonance effect and its applications, hyperconjugation, inductive effect, Electromeric effect & their comparison.

**September 2022 Stereochemistry of Organic Compounds-I** Concept of isomerism. Types of isomerism. Optical isomerism, elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. **Stereochemistry of Organic Compounds-II** Relative and absolute configuration, sequence rules, R & S systems of nomenclature. Geometric isomerism determination of configuration of geometric isomers. E & Z system of nomenclature, Conformational isomerism conformational analysis of ethane and n-butane, conformations of cyclohexane, axial and equatorial bonds,. Newman projection and Sawhorse formulae, Difference between configuration and conformation.Test,Seminar& Group Discussion in Class.

**October 2022 Mechanism of Organic Reactions** :-Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents – electrophiles and nucleophiles. Types of organic reactions. Energy considerations. Reactive intermediates carbocations, carbanions, free radicals, carbenes , arynes and nitrenes (formation, structure & stability). Assigning formal charges on intermediates and other ionic species Test,Seminar& Group Discussion in Class.

**November 2022 Alkanes and Cycloalkanes:-** IUPAC nomenclature of branched and unbranched alkanes , the alkyl group, classi fication of carbon atoms in alkanes. Isomerism in alkanes, sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties, Cycloalkanes nomenclature, synthesis of cycloalkanes and their derivatives – photochemical (2+2) cycloaddition reactions, dehalogenation of -dihalides, pyrolysis of calcium or barium salts of dicarboxylic acids, Baeyer's strain theory and its limitations., theory of strainless ring. Test,Seminar& Group Discussion in Class.

**December 2022 Revision of syllabus**

**ChiranjivTayal,Asstt. Prof.**
**Department of Chemistry**

Lession Plan

B.Sc 2nd Sem (Even)

2022-23

Jan-2023

**Alkenes-** Nomenclatu re of alkenes, , mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides,. The Saytzeff rule, Hofmann elimination, physical p roperties and relative stabilities of alkenes. Chemical reactions of alkenes mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration–oxidation, oxymercurationreduction, ozonolysis, hydration, hydroxylation and oxidation with KMnO4

Feb-2023

.**Arenes and Aromaticity**- Nomenclatu re of benzene deriva tives:. Aromatic nucleus and side chain. Aromaticity: the Huckel rule, aromatic ions, annulenes up to 10 carbon atoms, aromatic, anti - aromatic and non – aromatic compounds. Aromatic electrophilic substitution general pattern of the mechanism, mechansim of nitration, halogenation, sulphonation, and Friedel-Crafts reaction. Energy profile diagrams. Activating , deactivating subs tituents and orientation

March-2023

**Dienes and Alkynes**- Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of butadiene,. Chemical reactions 1,2 and 1,4 additions (Electrophilic & free radical mechanism), Diels-Alder reaction, Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration- oxidation of alkynes

April-2023

**Alkyl and Aryl Halides**- Nomenclatu re and classes of alkyl halides, methods of formation, chemical reactions. Mechanisms and stereochemistry of nucleophilic substitution reactions of alkyl halides , SN2 and SN1reactions with energy profile diagrams.Methods of formation and reactions of aryl halides, The additionelimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides.

Chiranjiv Tayal

Department of Chemistry

Lession Plan
B.Sc 6th Sem (Even)
2022-23

Jan-2023

**Heterocyclic Compounds-II** -Introduction to condensed five and six- membered heterocycles. Prepration and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of, quinoline and isoquinoline

Feb-2023

**Heterocyclic Compounds-I-** Introduction: Molecular orbital p icture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole

**Organosulphur Compounds** Nomenclature, structural features, Methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine. Synthetic detergents alkyl and aryl sulphonates

March-2023

**Synthetic Polymers** Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers. Condensat ion or step growth polymerization. Polyeste rs ,polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy re sins and polyurethanes. Natural and synthetic rubbers.

**Organic Synthesis via Enolates** -Acidity of -hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate

**Amino Acids, Peptides& Proteins Classification, of amino acids**. Acid-base behavior, isoelectric point and electrophoresis. Preparation of -amino acids.Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid– phase peptide synthesis. Structures of peptides and proteins: Primary & Secondary structure

April 2023

**Spectroscopy-** Electronic Spectrum Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck- Condon principle. Qualitative description of sigma and pie and n molecular orbital (MO) their energy level and respective transitions.

**Photochemistry** -Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grotthus-Drapper law, Stark- Einstein law (law of photochemical equivalence) Jablonski diagram depiciting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions-energy transfer processes (simple examples).

Chiranjiv Tayal
Department of Chemistry

# LESSON PLAN

**CLASS- BSc 5th Sem**

**Session -2022-23**

**August 2022** **Metal-ligand Bonding in Transition Metal Complexes** Limitations of valence bond theory, an elementary idea of cr ystal-f ield theory, crystal field split ting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal field parameters

**September 2022** **Thermodynamic and Kinetic Aspects of Metal Complexe** A brief outline of thermodynamic stability of metal complexes and factors affec ting the s tab ility, substitution reac tions of square planar complexes of Pt(II). **Magnetic Properties of Transition Metal Complexe** Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of s and eff values, orbital contribution to magnetic moments, application of magnetic moment data for 3dmetal complexes. Test,Seminar& Group Discussion in Class

**October 2022** **Electron Spectra of Transition Metal Complexes** Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series. Orgel-energy level diagram for d1 and d9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion **Physical Properties and Molecular Structure** Optical activity, polarization – (clausius – Mossotti equation). Orientation of dipoles in an electric field, dipole moment, included dipole moment, measurement of dipole moment-temperature method and refractivity method, dipole moment and structure of molecules, Magnetic permeability, magnetic susceptibility and its determination. Applica tion of magnetic susceptibility, magnetic properties – paramagnetism, diamagnetism and ferromagnetics. Test,Seminar& Group Discussion in Class

**November 2022** **Quantum Mechanics -I** Black-body radiation, Plank's radiation law, photoelectric effect, heat capacity of solids, Compton effect,wave function and its significance of Postulates of quantum mechanics , quantum mechanical operator, commutation relations, Hamiltonial operator, Hermitian operator, average value of square of Hermitian as a positive quantity, Role of operators in quantum mechanics, To show quantum mechanically that position and momentum cannot be predicated simultaneously, Determination of wave function & energy of a partic le in one dimensional box, Pictorial representation and its significance. Test,Seminar& Group Discussion in Class

**December 2022**

**Revision of Syllabus**

**Dr. Deepika Rana, Ext. Lect.**
**Department of Chemistry**

Lession Plan
B.Sc 2nd Sem (Even)
2022-23

JAN-2023

**Hydrogen Bonding & Vander Waals Forces** -Hydrogen Bonding – Definition, Types, effects of hydrogen bonding on properties of substances, applicat ion Brief discussion of various types of Vander Waals Forces . Metallic Bond and Semiconductors Metallic Bond- Brie f introduction to meta llic bond, band theory of meta llic bond Semiconductors- Introduction, types and applications.

FEB-2023

**S-Block Eleme nts** Comparative study of the elements including , diagonal relationships, salient features of hydrides (methods of preparation excluded), solvation and complexation tendencies including their function in biosystems. **Chemis try of Noble Gases** Chemical properties of the noble gases with emphasis on their low chemical reactivity, chemistry of xenon, structure and bonding of fluorides, ox ides & oxyfluorides of xenon.

MARCH-2023

**p-Block Elements** Emphasis on comparative study of properties of p-block elements (including diagonal relationship and excluding methods of preparation). Boron family (13th gp):- Diborane – properties and structure (as an example of electron – deficient compound and multicentre bonding), Borazene – chemical properties and structure Trihalides of Boron – Trends in fewis acid character structure of aluminium (III) chloride. Carbon Family (14th group) Catenation, p $\pi$– d $\pi$ bonding (an idea), carbides, fluorocarbons, silicates structural aspects), silicons – general methods of preparations, properties and uses

APRIL2023

Nitrogen Family (15th group) Oxides – structures of oxides of N,P. oxyacids – structure and relative acid strengths of oxyacids of Nitrogen and phosphorus. Structure of white, yellow and red phosphorus. Oxygen Family (16th group) Oxyacids of sulphur – structures and acidic strength $H_2O_2$ –structure, properties and uses.

Halogen Fami l y (17th group) Basic prope r ties of ha logen, interha logens types propert ies ,hydro and oxyacids of chlorine – structure and compari son of acid strength

Dr. Deepika Rana
Department of Chemistry

Lession Plan
B.Sc 6th Sem (Even)
2022-23

Jan 2023

**Solutions:** Dilute Solutions and Colligative Properties Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient. Dilute solution,Colligative properties, Raolut's law, relative lowering of vapour pressure, molelcular weight determination, Osmosis law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point, Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes

Feb 2023

**Phase Equillibrium** -Statement and meaning of the terms – phase component and degree of freedom, thermodynamic derivation of Gibbs phase rule, phase equilibria of one component system –Example – water and Sulpher systems. Phase equilibria of two component systems solid-liquid equilibria, simple eutectic Example Pb-Ag system, desilerisation of lead

March 2023

**Organometallic Chemistry** Definition, nomenclature and classification of organometallic compounds. Preparation, properties, and bonding of alkyls of Li, Al, Hg, and Sn a brief account of metal-ethylenic complexes, mononuclear carbonyls and the nature of bonding in metal carbonyls.

**Acids and Bases**- HSAB Concept Arrhenius, Bronsted – Lowry, the Lux – Flood, Solvent system and Lewis concepts of acids & bases, relative strength of acids & bases, Concept of Hard and Soft Acids & Bases. Symbiosis, electronegativity and hardness and softnes

April 2023

**Bioinorganic Chemistry-** Essential and trace elements in biological processes, metalloporphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca2+. Nitrogen fixation.

**Sil icones and Phosphazenes** -Silicones and phosphazenes, their preparation, properties,structure and use

Dr. Deepika Rana
Depart ment of Chemistry

# Lesson Plan

B. Sc. Ist Year (Ist Semester)

Paper- Physical Chemistry

Session 2022-23

Teacher name: Dr. Nitu kumari

August 2022

Kinetic Molecular Theory of Gases, Maxwell's distribution of velocities and energies (derivation excluded) Calculation of root mean square velocity, average velocity and most probable velocity.,

September 2022

Collision diameter, collision number, collision frequency and mean free path (Derivations excluded), Deviation of Real gases from ideal behavior, Derivation of Van der Waal's Equation of State, its application in the calculation of Boyle's temperature (compression factor) Critical Phenomenon Critical temperature

October 2022

critical pressure, critical volume and their determination. PV isotherms of real gases, continuity of states, the isotherms of Van der Waal's equation, relationship between critical constants and Van der Waal's constants. Critical compressibility factor.

November 2022

The Law of corresponding states. Section-B (22 Periods) Liquid States Structure of liquids, Properties of liquids – surface tension, refractive index, viscosity, vapour pressure and optical rotation. Solid State Classification of solids, Law of constancy of interfacial angles, law of rational indices,

Miller indices, elementary ideas of symmetry and symmetry elements, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of Laue method, rotating crystal method and powder pattern method.

# Lesson Plan

B. Sc. III Year (Vth Semester)

Paper-Physical Chemistry

Session 2022-23

Teacher name: Dr. Nitu Kumari

August 2022

Quantum Mechanics-I Black-body radiation, Plank's radiation law, photoelectric effect, postulates of quantum mechanics, quantum mechanical operators, commutation relations, Hamiltonian operator, Hermitian operator, average value of square of Hermitian as a positive quantity, Role of operators in quantum mechanics, To sw quantum mechanically that position and momentum cannot be predicated simultaneously

## September 2022

Determination of wave function & energy of a particle in one dimensional box. Physical Properties and Molecular Structure Optical activity, polarization – (Clausius – Mossotti equation derivation excluded ). Orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment-temperature method and refractivity method, dipole moment and structure of molecules

## October 2022

, Magnetic permeability, magnetic susceptibility and its determination. Application of magnetic susceptibility, magnetic properties – paramagnetism, diamagnetism and ferromagnetism. Spectroscopy Introduction: Electromagnetic radiation, regions of spectrum, basic features of spectroscopy, statement of Born-oppenheimer approximation, Degrees of freedom. 25 Rotational Spectrum Selection rules, Energy levels of rigid rotator (semi-classical principles), rotational spectra of diatomic molecules ,

## November 2022

spectral intensity distribution using population distribution (Maxwell-Boltzmann distribution), determination of bond length and isotopic effect Vibrational spectrum Selection rules, Energy levels of simple harmonic oscillator, pure vibrational spectrum of diatomic molecules, determination of force constant and qualitative relation of force constant and bond energy idea of vibrational frequencies of different functional groups Raman Spectrum Concept of polarizibility, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules, Quantum theory of Raman spectr

Lesson Plan

B. Sc. III Year (Vth Semester)
Paper- Inorganic Chemistry
Session 2022-23

Teacher name: Dr. Nitu kumari

August 2022

Metal- Ligand Bonding in Transition Metal complexes Limitations of valence bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral and square planer complexes,

September 2022

factors affecting the crystal field parameters. Thermodynamics and Kinetic Aspects of metal complexes A brief outline of thermodynamic stability of metal complexes and factors affecting the stability

October 2022

Irving William Series, substitution reactions of square planer complexes of Pt[II], Trans effect. Section – B (23 periods) Magnetic properties of Transition metal complexes Types of magnetic materials, magnetic susceptibility, method of determining magnetic susceptibility, spin only formula

November 2022

L-S coupling, correlation of μs and μeff values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes. Electronic spectra of Transition metal complexes Selection rules for d-d transition, spectroscopic ground states, spectrochemical series, orgel energy level diagram for d1 and d9 states, discussion of electronic spectrum of $[Ti(H2O)6]^{+3}$ complex ion.

Lesson Plan

B. Sc. IIInd Year (VIth Semester)

Paper- Physical Chemistry

Session-2022-23

Teacher name: Dr. Nitu kumari

January 2023

Introduction to statistical mechanics Need for statistical thermodynamics, thermodynamic probability, Maxwell Boltzmann distribution statistics, Born oppenheimer approximation, partition function and its physical significance. Factorization of partition function. Photochemistry Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grotthus-Drapper law, StarkEinstein law (law of photochemical equivalence), Jablonski diagram depiciting various processes occurring in the excited state,.

February 2023

qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions-energy transfer processes (simple examples). Solutions, Dilute Solutions and Colligative Properties Ideal and non-ideal solutions, methods of expressing concentrations of solutions, Dilute solutions, Raoult's law. Colligative properties: (i) relative lowering of vapour pressure (ii) Elevation in boiling point (iii) depression in freezing point (iv) osmotic pressure

March 2023

Thermodynamic derivation of relation between amount of solute and elevation in boiling point and depression in freezing point.. Applications in calculating molar masses of normal, dissociated and associated solutes in solution. Phase Equillibrium Statement and meaning of the terms – phase, component and degree of freedom, thermodynamic derivation of Gibbs phase rule,

April 2023

phase equilibria of one component system –Example – wsater system. Phase equilibria of two component systems solid-liquid equilibria, simple eutectic Example Pb-Ag system, desilverisation of lead.

Lesson Plan

B. Sc. Ist Year (IInd Semester)

Paper-Physical Chemistry

Session-2022-23

Teacher name: Dr. Nitu Kumari

January 2023

Rate of reaction, rate equation and its types, factors influencing the rate of a reaction – concentration, temperature, pressure, solvent, light, catalyst. Order of a reaction, integrated rate expression for zero order, first order, second and third order reactions. Half life period of a reaction. Effect of temperature on the rate of reaction – Arrhenius equation. Theories of reaction rate – Simple collision theory for unimolecular collision.

February 2023

Transition state theory of bimolecular reactions. Electrochemistry Electrolytic conduction, factors affecting electrolytic conduction, specific conductance, molar conductance, equivalent conductance and relation among them, their variation with concentration. Arrhenius theory of ionization, Ostwald's Dilution Law.

March 2023

DebyeHuckel – Onsager's equation for strong electrolytes (elementary treatment only), Application of Kohlrausch's Law in calculation of conductance of weak electrolytes at infinite dilution. Applications of conductivity measurements: determination of degree of dissociation, determination of Ka of acids determination of solubility product of sparingly soluble salts, conductometric titrations.

April 2023

Concepts of pH and pKa , Buffer solution, Buffer action, Henderson – Hazel equation, Buffer mechanism of buffer action.

Lesson Plan

B. Sc. III Year (VIth Semester)

Paper-Inorganic Chemistry

Session 2022-23

Teacher name: Dr. Nitu Kumari

January 2023

Acids and Bases Arrhenius, Bronsted-lowry, Lux-flood, solvent system and Lewis concept of acids and bases, relative strength of acids and bases, levelling solvents, hard and soft acids and bases(HSAB), Applications of HSAB principle. Organometallic chemistry Definition, classification and nomenclature of

February 2023

organometallic compounds, preparation, properties and bonding of alkyls of Li, Al, Hg and Sn, concept of hapticity of organic ligand, Structure and bonding in metal-ethylenic complexes, Structure of Ferrocene, classification in metal carbonyls, preparation, properties and bonding in mononuclear carbonyls.

March 2023

Bio inorganic chemistry Metal ions present in biological system, classification on the basis of action (essential, non essential, trace, toxic), Metalloporphyrins with special reference to haemoglobin and myoglobin. Biological role of $Na^+$ , $K^+$ , $Ca^{+2}$, $Mg^{+2}$ , $Fe^{+2}$ ions, Cooperative effect, Bohr effect. Silicones and Phosphazenes Nomenclature, classification,

April 2023

prepration and uses of silicones, elastomers, polysiloxane copolymers, poly phosphazenes and bonding in triphosphazene.

# Lesson Plan

B.Sc. IInd Year (IIIrd Semester)

Paper-X (CH-203) Organic Chemistry

Teacher name: Sandeep Kumar

## Aug.2022

Alcohols nomenclature, methods of formation by reduction of—Monohydric alcohols aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohols. Dihydric alcohols — nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [Pb(OAc) 4 and HIO4 ] and pinacol-pinacolone rearrangement. Phenols Nomenclature, structure and bonding.

## Sept.2022

Preparation of phenols, physical properties and acidic character. Comparative ac idic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols — electrophilic aromatic substitution, Mechanisms of Fries rearrangement, Claisen rearrangement, Reimer-Tiemann reaction, Kolbe's reaction and Schotten and Baumann reactions. Epoxides Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.

## Oct.2022

Ultraviolet (UV) absorption spectroscopy Absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and m a x of simple$\lambda$enones,Woodward- Fieser rules, calculation of - unsaturated ketones

## Nov.2022

.$\beta$,$\alpha$conjugated dienes and Applications of UV Spectroscopy in structure elucidation of simpl e organic compounds. Carboxylic Acids & Acid Derivatives Nomenclature of Carboxylic acids, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Reduction of carboxylic acids.

## Dec. 2022

Mechanism of decarboxylation. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Mechanisms of esterification and hydrolysis (acidic and basic).

# Lesson Plan

B. Sc. IIIrd Year (Vth Semester)

Paper-XVII (CH-303) Organic Chemistry

Teacher name: Sandeep Kumar

## Aug.2022

NMR Spectroscopy Principle of nuclear magnetic resonance, the PMR spectrum,number of signals, peak areas, equivalent and nonequivalent protons positions of signals and chemical shift,shielding and deshielding of protons, proton counting,splitting of signals and coupling constants, magnetic equivalence of protons.

## Sept.2022

Discussion of PMR spectra of the molecules: ethyl bromide, n-propyl bromide, isopropyl bromide, 1,1-dibromoethane, ethanol, acetaldehyde, ethyl acetate, toluene, benzaldehyde and acetophenone. Simple problems on PMR spectroscopy for structure determination of organic compounds. Carbohydrates Classification and nomenclature of Monosaccharides

## Oct.2022

mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose into mannose. Formation of glycosides, Determination of ring size of glucose and fructose. Open chain and cyclic structure of D(+)-glucose & D(-) fructose. Mechanism of mutarotation.

## Nov.2022

Structures of ribose and deoxyribose. An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination. Organometallic Compounds Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reactions.

## Dec.2022

Organozinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions

Lesson Plan

B. Sc. IIIrd Year (VIth Semester)

Paper-XX (CH-306) Organic Chemistry

Teacher name: Sandeep Kumar

Jan. 2023

Organic Synthesis via Enolates -hydrogens, alkylation of diethyl malonate and ethylαAcidity of acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate. Heterocyclic Compounds Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives.

Feb.2023

Comparison of basicity of pyridine, piperidine and pyrrole. Introduction to condensed five and six-membered heterocycles. Prepration and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of, quinoline and isoquinoline. Section–B (22 Periods) Amino Acids, Peptides& Proteins Classification, of amino acids. Acid-base behavior, isoelectric -amino acids.α point and electrophoresis. Preparation of Structure and nomenclature of peptides and proteins.

March 2023

Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid– phase peptide synthesis. Structures of peptides and proteins: Primary & Secondary structure. Synthetic Poly mers Addition or chain-growth polymerization.

April 2023

Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins. Natural and synthetic rubbers.

# Lesson Plan

B. Sc. IInd Year (4th Semester)

Paper- Organic Chemistry

Teacher name: Sandeep Kumar

January, 2023

Infrared (IR) absorption spectroscopy.

Molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds Applications of IR spectroscopy in structure elucidation of simple organic compounds

Feb.2023

**Lecture method**:- Amines
Structure and nomenclature of amines, physical properties. Separation of a mixture of primary, secondary and tertiary amines. Structural features affecting basicity of amines. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles, reductive amination of aldehydic and ketonic compounds. Gabriel-phthalimide reaction, Hofmann bromamide reaction.
Electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid.

March, 2024

**Lecture Method:- Diazonium Salts**
Mechanism of diazotisation, structure of benzene diazonium chloride, Replacement of diazo group by H, OH, F, Cl, Br, I, $NO_2$ and CN groups, reduction of diazonium salts to hydrazines, coupling reaction and its synthetic application.
**Aldehydes and Ketones**
Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides

April, 2024

**Lecture Method**:- advantage of oxidation of alcohols with chromium trioxide (Sarett reagent) pyridinium chlorochromate (PCC) and pyridinum dichromate. Physical properties, Comparison of reactivities of aldehydes and ketones. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction. Mannich reaction. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction. MPV, Clemmensen, Wolff-Kishner, $LiAlH_4$ and NaBH4 reductions.