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, Mr. S. L. Nakkalwar & Dr. H, M. Kasralikar

Department: Chemistry **Program:** B. Sc. FY Semester –I CBCS

Subject: Chemistry **Course Code**: CCCI

Paper Title: Organic + Inorganic Chemistry **Paper : I**

Unit	Unit Name	Topic	Unit wise Outcome
Unit I	**Nomenclatu-re of Organic Compounds**	01) Functional groups and types of organic compounds, Basic rules of IUPAC nomenclature, Nomenclature of mono- and bi-functional compounds on the basis of priority order of the following classes of compounds: alkanes,alkenes, alkynes, haloalkanes, alcohols, ethers, aldehydes, ketones,carboxyclic acids, carboxylic acid derivatives (acid halides, esters, anhydrides, amides), amines; Nomenclature of aromatic compounds: mono-, di-, and polysubstitutedbenzene (with not more than two functional groups),	Consolidate & Recall formulae & Names of organic compounds.
Unit II	Basic Concepts In Organic Chemistry	Basic terms: Substrate and Reagents, types of reagents (Electrophilic and Nucleophilic).Notation of arrows: curved arrow, Half headed arrow, double headed arrow, straight arrow. Bond fission: Homolytic and heterolytic fission. Reaction intermediates: Carbocation, Carbanion, Free radical, (Introduction, structure & Stability), carbene, nitrene & benzyne (only introduction). Electron mobility: Inductive effect (effect on acidic strength of alpha substituted acetic acid and α-chloroacetic acid), Mesomeric effect (Aniline and Nitrobenzene), Hyperconjugation (toluene).	Student Should learn the basic concepts of organic chemistry
Unit -III	**Alkanes, Alkenes and Alkynes**	3.1 Alkanes: Introduction, Preparation of alkanes from a) Hydrolysis of Grignard reagent b) Kolbes synthesis. Chemical reaction: a) Pyrrolysis (mechanism), b) aromatization. 3.2 Alkenes: Introduction, Preparation methods a) But-1-ene from but-1-yne b) But-2-ene from butan-2-ol. Chemical reactions with mechanism: a) Electrophilic addition of Br_2 to ethene b) Electrophilic addition of HBr to	To understand the basic concepts and different aliphatic hydracarbons.

		propene C) Free radical addition of HBr to propene (Peroxide effect). 3.3 Alkynes: Introduction, Preparation of ethyne from a) Iodoform, b)Hydrolysis of calcium carbide. Chemical reactions: Electrophilic addition of HBr and Br_2 to ethyne (with mechanism).	
IV	**Cycloalkanes, Cycoloalkenes and Dienes**	4.1 Cycloalkanes: Introduction, Preparation of cycloalkanes from a)Adipic acid b)Aromatic hydrocarbon. Baeyer strain theory and Saches Mohr theory. Ring opening reaction with H_2 and HI. 4.2 Cycloalkenes: Introduction, preparation methods: a)Dehydration of cyclohexanol, b) Dehydrohalogenation of halocyclohexane. Chemical reactions: a) Epoxidation of cyclohexene, b) Allylic halogenations. 4.2 Dienes: Introduction, classification & Resonance structures. Preparation methods of 1,3-butadiene from- a) 1,4-dibromobutane, b)1,4-butanediol.Chemical reactions: a) addition of Br2 and HBr to 1,3-butadiene, b) addition of ethene to 1,3-butadiene (Diel's- Alder reaction).	To know about the cycloalkanes, cycloalkenes and deine, and their chemical properties.
IV	**Periodic Table and Periodic properties**	**Part – II** **Inorganic Chemistry** **A] Periodic Table:** Modern periodic law, Long form of the periodic table, Sketch, Cause of periodicity, Division of elements in to s, p, d, and f blocks. General characteristics of s, p, d and f block elements.**B] Periodic properties:** ***a) Atomic and Ionic size****:* Definition and explanation of atomic radius, ionic radius, Covalent radius, Vander waals radius. Variation of atomic size along a period and in a group.***b) Ionization Energy****:* Definition and Explanation, Successive ionization energy, Factors affecting ionization energy. Variation of ionization energy along a period and in a group. Applications of ionization energy to chemical behavior of an element. ***c) Electron Affinity****:* Definition and Explanation, Successive electron affinity, Factors affecting electron affinity. Variation of electron affinity along a period and in a group.Applications of electron affinity to chemical behavior of an element. Difference between ionizationenergy and electron affinity. ***d) Electronegativity****:* Definition and Explanation, Factors affecting electronegativity. Variation of electronegativity along a period and in a group.Pauling's approach of electronegativity. Calculations of electronegativity by Pauling's method (Numerical), Mulliken,s approach. Applications of	Know the importance of periodic table & properties of elements.

		electronegativity to bond properties such as percent ioniccharacter, bond length, bond angle.	
V	**Noble Gas Chemistry**	a) Position in the Periodic table b) Electronic configuration c) Compounds of inert gases, under excited condition, through coordination, by physical trapping (Clathrates). d) Fluorides of xenon : XeF2 , XeF4 and XeF6 preparation, properties and structures.	Learn the electronic configuration, properties of Noble gases.

Specify Course Outcome: Acquire basic concepts such as formulae, nomenclature, reactions of organic compounds. Student learns some exceptional electronic configuration, trends and periodicity in related to properties of elements.

Specify Program Outcome: Creating awareness among students about importance, applications, classification, preparations of organic and inorganic compounds.

Signature of Teacher Dr. N. S. Kaminwar Mr. S. L. Nakkalwar Dr. H. M. Kasralikar

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Pro-forma for program and course outcomes (2.6.1)

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

Department: Chemistry

Program: B. Sc. FY Semester –I CBCS **Subject**: Chemistry

Course Code: CH-102,

Paper Title: Physical + Inorganic Chemistry Paper: II

Unit	Unit Name	Topic	Unit wise Outcome
I	**Mathematical Concept and SI Units**	**(A) Mathematical concept:** 1.1 Logarithm: Rules of logarithm, Characteristic and Mantissa, Change of sign and base, Numerical problems. 1.2 Definition of pH and pOH, Relation between pH and POH, Numerical Problems based on PH and POH. 1.3 Graphical representation: Rules for drawing graph, coordinates etc., Equation of straight lines, slope and intercept and Numerical Problems. 1.4 Derivative: Rules of differentiation, partial differentiation, Algebraic, logarithmic and exponential functions. 1.5 Integration: - Rules of integration, Algebraic and exponential functions. 1.6 Permutation, combinations and Probability, Numerical Problems. **(B) SI Units:** 1.7 International systems of units, derived units, subsidiary units, prefixes used in SI units, internal conversions of these units.	Rules of logarithm, drawing graph, Derivatives, Integration, different mathematical concept and SI units, and their use in solving numerical.
II	**Surface Chemistry**	2.1Introduction, Adsorption, mechanism of adsorption, factors affecting adsorption. 2.2 Difference between adsorption and absorption. 2.3 Types of adsorption: Physical adsorption and chemical adsorption. 2.4 Adsorption of gaseous by solids. Adsorption isotherm,Types of adsorption isotherm: i) Freundlich adsorption isotherm ii) Langmuir adsorption isotherm (Derivation).	Learning surface phenomena at heterogeneous surfaces.
III	**Gaseous Chemistry**	3.1 Kinetic molecular theory of gases -Postulates of kinetic molecular theory of gases. Derivation of kinetic gas equation. Ideal and non-ideal gases. 3.2 Deviation of gases from Ideal behavior and Compressibility factor (Z). Derivation of Van der waals equation, Units for Van der Waal's	learn the basic knowledge of gas phase, Kinetic molecular theory,

		constants. 3.3 Critical phenomenon-The P-V isotherms of Carbon dioxide, application of Vander Waals' equation to the isotherms of Carbon dioxide, relation between critical constants and Van der Waals constants.. 3.4 Liquefaction of gases, Linde's method, Claude's method. 3.5 Molecular velocities-Root mean square, average and ii) Most probable velocities, Relation between molecular velocities Qualitative discussion of the Maxwell's distribution of molecular velocities. 3.6 Numerical on Vander Waals constants and Critical constants, Root mean square velocities.	critical phenomenon, liquefaction and molecular velocities
IV	**Solid State**	4.1 Introduction, Characteristics of solids, space lattice and Unit Cell. 4.2 Laws of crystallography :- (i) Law of constancy of interfacial angles, (ii) Law of symmetry, Symmetry elements in crystals and (iii) Law of rational indices. 4.3 Weiss indices and Miller indices, Determination of Miller indices. Numerical on Miller indices 4.4 Cubic Unit cells and types of cubic unit cells, spacing of lattice planes. 4.5 X-rays crystallography, Derivation of Bragg's equation. Experimental methods- The Rotating Crystal method and The Powder method. 4.6 Determination of crystal structure of NaCl and KCl on the basis of Bragg's equation.	Impart knowledge about solid phase, crystallography and some crystal structure
V	**S-Block elements**	General characteristics of S-block elements Variation in properties of S-block elements, atomic radii , ionization potential, colour of flame, reducing property and metallic property, diagonal relationship between Li and Mg, Points of difference between Li and other alkali metals. General study of hydrides of IA and IIA group. General studies of Oxides IA and IIA group, Basic strength of hydroxides of alkali and alkaline earth metals , Carbonates and bicarbonates of alkali and alkaline earth metals. Complexes of alkali metals with salicylaldehyde, acetylacetone. wrap around complexes with polydentate ligand such as crown ether and cryptate. Complexes of alkaline earth metals such as beryllium oxalate ion, chlorophyll and complex of calcium with EDTA.	characteristics of s-block elements, oxides, hydroxide, carbonate & its complexes
VI	**Oxidation and Reduction**	Definition of oxidation, Reduction, Oxidizing agent and reducing agents according to classical concept , electronic concept, oxidation number	oxidation and reduction by different

		concept. Rules for assigning oxidation number, Balancing of redox reaction by 1) Ion-electron method and 2) Oxidation number method	methods

Specify Course Outcome: Familiarize the students with the concept and principle of Rules of logarithm, drawing graph, Derivatives, Integration, different mathematical concept and SI units. surface phenomena at heterogeneous surfaces and basic knowledge of gas phase, Kinetic molecular theory, critical phenomenon, liquefaction and molecular velocities. Impart knowledge about solid phase, crystallography and some crystal structure characteristics of s-block elements, oxides, hydroxide, carbonate & its complexes oxidation and reduction by different methods.

Specify Program Outcome: Understand the students with the Rules of logarithm, Derivatives, Integration, concept and SI units surface phenomena and gas phase, Kinetic molecular theory, critical phenomenon, liquefaction and molecular velocities. To know about solid phase, crystallography and some crystal structure characteristics of s-block elements, oxides, hydroxide, carbonate & its complexes, oxidation and reduction by different methods

Signature of Teacher Prof. S. B. Patwari Mr. S. L. Nakkalwar Dr. H. M. Kasralikar

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Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Dr. N. S. Kaminwar, Mr. S. L. Kaminwar & Dr. H. M. Kasralikar
Department: Chemistry
Program: BSc FY Semester –II CBCS **Subject**: Chemistry **Course Code**: CH-103
Paper Title: Organic + Inorganic Chemistry **Paper – III**

Unit	Unit Name	Topic	Unit wise Outcome
I	**Aromatic Hydrocarb-ons and Aromaticity**	Introduction, Nomenclature, kekule and resonance structure of benzene, stability, Orbital picture of benzene. Aromaticity and antiaromaticity by Huckel's Rule (Benzene, Napthalene, Anthracene, Pyrrrole, Furan, Thiophene, Pyridine, Cyclopentadienyl cation and anion, Cyclopropenyl cation). Electrophilic Substitution reaction of benzene (with mechanism): Nitration, Halogenation, Friedel Craft alkylation and acylation. Orientation effect: Effect of activating and deactivating groups (-OH, NO_2, CH_3, Cl) on aromatic electrophilic (Nitration) substitution reaction(with mechanism)	Understand Aromaticity, Anti-aromaticity of organic molecules accessing Huckel's Rule.
II	**Phenols, Haloalkene and Haloarene**	Introduction, classification, Acidic character (Comparison of acidity : phenol and ethanol) Chemical Reactions: Reimer-Tiemann reaction(Mechanism),Acetylation (mechanism), Fries rearrangement(Mechanism), Kolbe's Carboxylation reaction. a] Vinyl Chloride: synthesis of vinyl chloride from 1) 1, 2-dichloroethane 2) ethane Chemical reactions: Addtion reaction with HBr , polymerization reaction. b] Allyl Iodide: synthesis of allyl iodide from 1) allyl chloride 2) glycerol and HI. Chemical reactions: Reaction with NaOH, KCN, & Br_2. 2.2 Haloarenes: Introduction, Synthesis of halobenzene from 1) Hunsdiecker reaction 2) Gattermann reaction. Chemical reactions (with mechanism): Ullamann biaryl synthesis. Resonance & Relative reactivity of alkyl halides v/s vinyl and aryl halides towards nucleophilic substitution reactions.	Predict the stepwise mechanism of reactions of phenols, Haloalkenes & Haloarenes.
III	**Carboxylic acid derivatives**	A) Acid Chlorides: Introduction, preparation methods: 1) From acetic acid and thionyl chloride, 2) From acetic acid and phosphorous pentachloride . Chemical reactions:(Hydrolysis, Action with alcohol, Action with amines). B) Acid anhydrides: Introduction, preparation	Finding less expensive chemical methods to synthesise desired

		methods: 1) From acetyl chloride and carboxylic acid, 2) From acetyl chloride and sodium acetate. Chemical reactions: (Hydrolysis, Action with alcohol, Action with amines). C) Esters: Introduction, preparation methods: 1) From ethyl alcohol and acetic acid , 2) From ethyl alcohol and acetyl chloride. Chemical reactions: (Hydrolysis, Action of amines, Reduction).D) Amides: Introduction, preparation methods: 1) From ammonia and acetyl chloride 2) From ammonia and acetic anhydride. Chemical reaction: (Hydrolysis, Action of nitrous acid).	products of carboxylic acids.
IV	**Alcohols and epoxides**	**A) Alcohols:** Introduction and Classification. a) **Dihydric alcohol (ethylene glycol**): Preparation methods: (Hydroxylation of alkene and From 1,2-dihaloalkane). Chemical reactions: [Reaction of ethylene glycol with, 1) $Pb(OAC)_4$, 2) $P_2O_5/ZnCl_2$].b**) Trihydric alcohol Glycerol):** Preparation methods from: 1) Oils and fats 2)Propene. Chemical reactions: [Reactions of glycerol with, 1) Nitric acid, 2) Acetyl chloride]. **B) Epoxides :** Introduction and nomenclature. Preparation methods: a) Oxidation of ethene in presence of Ag catalyst , b) Oxidation of ethene with per acetic acid. Chemical reactions: (Ring opening reactions of propylene oxide in Acidic b) and basic medium/reagent.	
IV	**Study of P-block elements**	**Part -II Inorganic chemistry** Variation in properties : atomic radius, ionization energy, electron affinity, electronegativity , metallic character , melting and boiling point , oxidizing and reducing properties , Variation in acidic and basic character of hydroxides of P-block elements, diagonalrelationship between B and Si.	Know the periodic table ofP- Block elements.
V	**Acids and Bases.**	Introduction, Arrhenius concept, Bronsted-Lowry concept, Lewis acids and bases concept Discuss briefly with suitable example. Solvent systemconcept, Cady-Elsey concept, Lux-Flood concept and Usanovich concept for acids and bases. Definition of Hard, Soft and borderline acids and bases with various example. Pearson's principle (SHAB Principle), theories of hardness and softness such as Electronic theory, pibonding theory and Pitzer's theory.Application of SHAB Principle such as relative stability of compound, feasibility of chemicalreaction. Limitation of SHAB concept.	Distinguish between acids &Bases with respective chemical properties.

Specify Course Outcome: Understand the aromatic, aliphatic compounds pertaining to chemical and physical properties.
Specify Program Outcome: Familiarize the students with the concept of reactions, mechanism, and synthesis of organic molecules.

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Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Prof. S. B. Patwari, Mr. S. L. Nakkalwar & Dr. H. M. Kasralikar
Department: Chemistry **Program:** B. Sc. FY Semester-II **Subject**: Chemistry
Course Code: CH-104 **Paper Title:** Physical + Inorganic Chemistry P-IV

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	**Atomic Structure**	Introduction, Rutherford's alpha particle scattering experiment, Rutherford's atomic model and its drawbacks. Bohr's theory of hydrogen atom: Bohr's atomic model- Postulates, Merits and demerits. Derivation for radius of an orbit, velocity of an electron and energy of an electron. Energy difference in terms of wave number and Rydberg constant. Bohr's explanation of hydrogen spectrum. The Sommerfeld extension of the Bohr theory. Electronic configuration of elements: Aufbau principle, Pauli's Exclusion principle, Hund's rule of maximum multiplicity and (n + l) rule. 1.4 Numerical problems on radius and energy. 1.5 Quantum numbers.	To impart knowledge of atomic structure, different theories of atomic structure, rulesof electronic configuration and quantum numbers
II	**Liquid State**	Introduction,Various intermolecular forces in liquids dipole-dipole attraction, London forces, Hydrogen bonding. Surface tension of liquid, units of surface tension, effect of temperature on surface tension, determination of surface tension of liquids by stalagmometer method, numerical Problems based on method. Viscosity of liquid, units of viscosity, effect of temperature on viscosity, measurement of viscosity by Ostwald's method, numerical Problems based on method. Parachor and chemical constitution: Relation between parachor and surface tension, application of parachors in deciding structures.	Learning of propertiesof liquid phase as surface tension, Viscosity and parachor
III	**Colloidal State**	Introduction , classification of colloidal systems.Sols (Solids in liquids):-Types of sols, Preparation of sols, Dispersion and aggregation methods. Properties of sols- Colour, Optical (Tyadall effect), Kinetic (Brownian movement) and electrical properties (electrophoresis and electro osmosis). Coagulation of colloidal solution –Hardy Schulze rule. Protective action of sol and Gold Number. Emulsions (Liquids in liquids):- Types of emulsions, preparation of emulsion, Emulsifier, Role of emulsifier. Gels (Liquids in solids):- Classification gels, preparation of gel and properties gel –Hydration, Swelling, Syneresis and Thixotropy. Applications of colloids (Food, Medicine, smoke precipitation,	Student will learn the basic knowledge of colloidal state, types, preparation, properties and applications of colloidal state

		sewage precipitation and in purification of water.)	
IV	**Catalysis**	Introduction to Catalyst and Catalysis. Catalyst- Type of catalyst, positive and negative catalyst with examples.4.3 Catalysis:-Type of catalysis, homogenous and heterogeneous catalysis with examples Autocatalysis- explanation with examples. Characteristics of catalytic reactions. Promoters: - Definition, example, explanation of promotion action.4.7 Catalytic poisoning:- Definition, example, explanation of catalytic poisoning. 4.8 Acid-Base catalysis, General Acid-Base catalysis, examples. 4.9 Enzyme catalysis, examples, mechanism of enzyme catalysis, characteristics of enzyme catalysis. 4.10 Applications of catalysis in industries.	Learning and understanding of catalysis, types of Catalyst
V	**Chemical Bonding I**	Definition, Cause for chemical bonding, Types of chemicalbonding. ***Ionic Bonding****:* Definition and explanation, Factors affecting the formation of ionic bond, Energy charges in the formation of ionic bond, Lattice energy and Born-Haber cycle. Polarizing power andpolarisability andFajan's rule. ***Covalent bonding*** *:* Definition and explanation, Sigma and pi-bond, Valence bond theory of covalent bonding and its limitations, Percentage ionic character in covalent bond from dipole moment and electronegativity difference (Numericals). ***Metallic bonding****:* Definition and explanation, Free electron theory of metallic bonding, Effects of metallic bonding on metallic properties. ***Vander Waal's bonding****:* Definition and explanation, Types of Vander Waal's forces responsible for Vander waals bonding. ***Hydrogen bonding****:* Definition and explanation, Types of hydrogen bonding and consequences of hydrogen bonding. Unique properties of water based on hydrogen bonding. Importance of hydrogen bonding in sustaining life.	To understanding the chemical bondand its different types of bonds
VI	**Chemical Bonding II**	***Concept of hybridization****:* Definition and explanation of dsp^2 hybridization by taking example of [Ni(CN)4]-2, sp^3d hybridization by taking example PCl5, Sp^3d^2 hybridization by taking example SF6. Sp^3d^3 hybridization by taking example IF7. ***VSEPR Theory****:* Postulates and explanation, Applications in explaining geometry and bond angle in molecules such as CH_4, NH_3, and H_2O. Limitations of VSEPR theory. ***Molecular Orbital Theory****:* Basic principle of MOT, LCAO, Bonding and antibonding molecular orbital, Energy level diagram for molecular orbital. Rules for adding electronsin MO's, Bond order, Molecular orbital diagram of homo nuclear	Learning the Concept of hybridization and study of VSEPR & Molecular Orbital theory

		diatomic molecules such as H_2, N_2, O_2, and Ne_2 And CO.	

Specify Course Outcome: To impart knowledge of different theories of atomic tructure, rules of electronic configuration and quantum numbers also Liquid phase as surface tension, Viscosity and parachor. colloidal state, types, preparation, properties and applications of colloidal state. Catalysis, types of catalysis and characteristics of catalyzed reactions chemical bond and its different types of bonds Learning the Concept of hybridization and study of VSEPR & Molecular Orbital theory

Specify Program Outcome: Understand concept of Atomic structure, Liquid state, Colloidal state,Catalysis and Chemical Bonding

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Pro-forma for program and course outcomes (2.6.1)

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

Department: Chemistry **Program:** BSc FY CBCS

Subject: Chemistry **Course Code**: CH-105

Paper Title: Inorganic + Organic + Physical Chemistry **Paper** – V

Unit No.	Unit Name	Topics	Unit-wise Outcome
I	**Inorganic Chemistry**	A) Inorganic Chemistry Identification of Two acidic and Two basic radicals by Semi-micro qualitative analysis technique.(Including interfering radicals). (Any Six) 1) At least eight mixtures of salt must be practiced. 2) Spot- tests (of each radical) are compulsory.	Analyse & identify of acidic & basic radicals
II	**Organic Chemistry**	B) Organic Chemistry I) Preparations (Any Four) : a) Phthalimide from phthalic anhydride and urea. b)Acetanilide from aniline. c) Iodoform from acetone. d) Phenyl – azo – β –naphthol from aniline. e) m - Dinitobenzene from nitrobenzene. f) Phthalic anhydride from phthalic acid. (Recrystallization and Melting point of product is compulsory) II)Determination of Physical constant of Organic liquids (Any four) Aniline, Ethanol, Toluene, Benzene, ortho and meta toluidines, Chlorobenzene and Nitrobenzene. III)Demonstration on purification by - a)Recrystalisation of Phthalic acid/Benzoic acid from hot water. b) Distillation of Ethyl alcohol. c) Sublimation of Napthalene.	Nurture the research attitude to synthesize various organic products.
III	**Physical Chemistry**	C) Physical Chemistry (Any Six) 1. Determination of the Viscosity of liquid by Ostwald's viscometer. 2. Determination of the Viscosity of two pure liquids A & B. Hence find the composition of the mixture of two liquids. (Density data of liquids, viscosity of water to be given). [Any two liquids from : Acetone, Carbon terachloride, Chloroform, Ethyl alcohol, Benzyl alcohol, Ethylene glycol and n-propyl alcohol]. 3. To determine the surface tension of a given liquid by stalagmometer method.	Creating the skills of accessing instruments

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.

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Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Dr. N. S. Kaminwar,
Department: Chemistry **Program:** B. Sc. SY Semester –III CBCS
Subject: Chemistry **Course Code**: CH-201,
Paper Title: Organic + Inorganic Chemistry **Paper : VI**

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	**Name Reaction with Mechanism**	A) Condensation reactions of Aldehydes and Ketones. 1. Benzoin Condensation Reaction. 2. KnoevengeI Reaction. 3. Mannich Reaction 4. Perkins Reaction, 5. Reformatsky reaction. 6. Gatterman Koch reaction. 7. Gatterman synthesis. B) Reduction reactions 1. Clemmensen Reduction Reaction. 2. eervin-Pondorof- Verly reduction reaction. 3. Reduction with $LiAlH_4$. 4. Reduction with $NaBH_4$. [C] oxidation reactions. 1. Baeyer- Villiger Oxidation Reaction. 2. Oppenauer oxidation.	Learn the mechanism of name reactions Learn the mechanism of name reactions
II	**Aromatic Carboxylic and Sulphonic Acids.**	1. Introduction and Classification of Aromatic Carboxylic Acids. 2. Synthesis and Chemical Reactions of Following Acids. [A] Benzoic Acid. 1. Preparations From: (a) Phenyl Cyanide, (b) Toluene. 2. Reactions of Benzoic Acids: a) Acyl halide formation b) Reduction. C) Nitration [B] Anthranilic Acid: 1. Preparations From : (a) Phthalimide. b) O-nitroToluene. 2. Reactions of Anthranilic Acids: a) Action of heat, b) Nitrous Acid, c) Action of acetic anhydride/acetyl chloride. [C] Salicylic Acid: 1. Preparations From: (a) Kolbe's reaction. (b) Reimer-Tiemann reaction. 2. Reactions of Salicylic Acids: a) Bromination, b) Nitration, c) Decarboxylation, d) Reaction with Zn-dust. [D] Phthalic Acid 1. Preparations From: (a) o-xylene. (b) Naphthalene. 2. Reactions of Phthalic Acids: a)Action of heat. b) Action of $PC1_5$. C) Action of ethanol. [E] Benzene Sulphonic Acid. 1. Introduction. 2. Preparation of benzene sulphonic acid from benzene with mechanism. 3. Chemical Reactions of benzene sulphonic acid, a) Salt formation b) formation of sulphonyl chloride, c) formation of sulphonic ester and amide. 4. Replacement of sulphonic group by: a) Hydroxyl group. b) cyano group, c) Hydrogen atom d) NH_2 –group.	Know the Classification, Synthesis, and Reactions of Aromatic Carboxylic and Sulphonic acids.
III	**[A] Introduction to**	1. Preparation of Methyl magnesium bromide. 2. Synthetic applications of Methyl magnesium	Know the Synthesis, and

	Organometallic Compounds.	bromide (CH_3MgBr) : Hydrocarbons, Ethanol, 2- propanol, 2-methyl-2-propanol, Ethanal, 2-propanone, ethanoic acid, Methanamine, Acetonitrile, Ethyl ethanoate. 2. Organo Lithium Compounds. 1. Preparation of methyl lithium from methyl iodide. 2. Synthetic application of Methyl lithium(CH_3Li): Methane, Ethanol, 1-propanol, 2-propanol. 3. Organo Zinc Compounds: 1. Preparation of diethyl zinc from ethyl iodide. 2. Synthetic application of diethyl zinc [$(C_2H_5)_2Zn$]: Methane, 2-propanone, Ethanol, 2-propanol.	Reactions of Organometallic compounds Know the Synthesis, and Reactions of Organometallic compounds
	[B] Organic Synthesis via Enolates.	1. Introduction, Acidity of alpha hydrogen. 2. Synthesis of Ethyl Acetoacetate. [Claisen Condensation Reaction with Mechanism] 3. Ketol-EnolTautomerism of ethyl acetoacetate. 4. Synthetic Applications of Ethyl Acetoacetate. Synthesis of Enamines, Acetylation and Alkylation of Enamines.	Learn the synthesis, mechanism, applications of active methylene compounds
IV	**Oils, Fats, Soaps and Detergents**	A. Introduction, chemical nature, General physical properties and 1. General chemical properties. a) Hydrolysis b) hydrogenation c) hydrogenolysis d) trans-esterification e) Rancidity and autoxidation. f) Analysis of Fats and Oils. i) Saponification number (Saponification value) ii) Iodine number (Iodine value) iii) Acid value iv) Reichert Meissl value (R. M. value) B] SOAPS 1. Introduction, 2. Manufacture of soaps by i) Kettles process ii) Hydrolyser process.iii) Cleansing action of soap. C] Synthetic Detergents. 1. Introduction, 2. Synthetic detergent classification, i) Anionic detergent ii) Cationic detergents iii) Non ionic detergents. 3. Synthetic detergent versus soaps, Soft versus Hard detergents	Gathering basic knowledge of Oils, Fats, Soaps and Detergents Gathering basic knowledge of Oils, Fats, Soaps and Detergents
V	**[A] Theory of Qualitative Analysis**	a) Introduction: Definition of qualitative analysis, macro, micro and semimicro qualitative analysis, radicals, acidic and basic radicals. b) Role of sodium carbonate extract in qualitative analysis. c) Interfering radicals. Removal of interfering radicals such as oxalate, borate, fluoride and phosphate. d) Use of solubility product, common ion effect and complex ion formation in the analysis of basic radicals: i) Separation of IIA and IIB, ii) Separation of II and IIIB. iii) Separation of IIIA and IIIB, iv) Separation of Zn^{++} and Mn^{++}. v) Separation of Co^{++} and Ni^{++} vi) Separation of Fe^{+++} and Al^{+++}. vii) Separation of Cu^{++} and Cd^{++}. e) Use of organic reagents in qualitative analysis. i) 8-Hydroxy quinoline for aluminium ii) α-Benzoinoxime for copper. iii) Dimethylglyoxime for Nickel iv) 1,10-Phenonthroline for Iron. v) α-	Understand the basic principle and application of Qualitative Analysis

		Nitroso-β-naphthol for cobalt.	
VI	**[B] Non-aqueous Solvents**	a) Introduction b) Classification of Solvents. c) Water as a universal solvent b) Physical properties of solvent: Dipole moment, Dielectric Constant, Trouton's Constant, Viscosity. Melting Point & Boiling Point. c) Reactions in liquid ammonia as solvent : Auto ionization, Acid-Base, Ammonolysis, Precipitation and ammonation. d) Reactions in liquid SO_2 : Autoionization, Acid- Base, Solvolysis, Precipitation and Solvation.	Know the Classification, Properties of Non- aqueous solvents

Specify Course Outcome: Acquire basic knowledge about name reactions with mechanism and synthesis of aromatic carboxylic, sulphonic acids, organometallic, active methylene compounds and understand qualitativeanalysis with properties of non aqueous solvents.

Specify Program Outcome: Understand organic reactions with mechanism and analyze different solvents.

Name of Teacher: Dr. N. S. Kaminwar,

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Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Prof. S. B. Patwari,
Department: Chemistry **Program:** B. Sc. SY Semester –III CBCS
Subject: Chemistry **Course Code**: CH-202
Paper Title: Physical + Inorganic Chemistry **Paper : VII**

Unit Number	Unit Name	Topics	Unit-wise Outcome
I	**Atomic Structure and Wave Mechanics**	1.1 Planck's quantum theory. 1.2 Photoelectric effect, explanation on the basis of quantum theory. Compton Effect: Statement, explanation. de-Broglie hypothesis; derivation of de-Broglie equation, explanation. 1.5 Davisson-Germer experiment.1.6 Heisenberg's uncertainty principle: Statement, explanation. 1.7 Schrodinger wave equation; Derivation in time independent form and Laplacian operator form, Physical significance of wave function (Ψ) and (Ψ2). 1.8 Numerical on photoelectric effect, de-Broglie equation, Heisenberg's uncertainty principle.	Understand the development of structure of atom.
II	**Thermodynamics:**	Introduction to First law of thermodynamics. Joule's law. Joule-Thomson effect. Joule-Thomsoncoefficient and inversion temperature. Need for second law thermodynamics, different statements of second law of thermodynamics. Carnot's cycle and its efficiency. Carnot's theorem. Numerical on efficiency of Carnot cycle.	Apply the laws of thermodyn - ami cs in day to day life.
III	**Concept of entropy**	Introduction, Definition, Mathematical Expression, Unit. Entropy as a state function. 3.3 Entropy change in Physical transformations: (i) Fusion of a solid. (ii) Vaporization of a liquid. (iii) Transition from one crystalline form to another. 3.4 Entropy changes for an ideal gas as a function of V and T and as a function of P and T. Entropy changes of an ideal gas in different processes. Physical significance of entropy. 3.7 Numerical on entropy change in physical transformations and entropy changes of an ideal gas in different processes.	Evaluate the concept of entropy.
IV	**Phase equilibrium**	Phase rule, Statement and explanation of the terms-phase, component and degree of freedom. Phase equilibria of one component system: Water system, Sulphur system and CO2 system. Phase equilibria of two component system: Pb-Ag system, desilverisation of lead, KI-H2O system. Partially miscible liquids: Critical	Analyse the phase equilibrium.

		solution temperature, upper critical solution temperature, lowers critical solution temperature. Phenol-water, triethylamine-water, nicotine-water systems. Effect of impurities on critical solution temperature.	
V	**[A] Nuclear Chemistry**	a)Introduction, composition of nucleus and nuclear size. b)Classification of nuclides: Isotopes, isobars, isotones, isotones and isomers. c) Nuclear Stability: Odd and even number of protons and neutrons, N/Z ratio, magic number, packing fractions (Numerical), mass defect (Numerical), nuclear binding energy (Numerical) and mean nuclear binding energy (Numerical). d) Release of nuclear energy: i) Nuclear fission reaction, nuclear fuels and plutonium bomb. ii) Nuclear fusion reaction, the energy of sun, hydrogen bomb. e) Definition of radioactivity, characteristics of α, β, and γ particles, group displacement law. f) Application of radioisotopes in medicine, agriculture, industry, and carbon dating.	Understand the role of nuclear chemistry in various fields.
VI	**[B] Theory of Gravimetric Analysis.**	a) Introduction, definition of gravimetric analysis. b) Steps involved in gravimetrc analysis c) Precipitation, Conditions for Prcipitation d) types of precipitates. e) Factors affecting precipitation such as temperature and pH, Solubility and Solubility Product. f) Different Steps involved in gravimetric analysis: i) Precipitation, ii) Digestion , iii) Filtration & Washing, iv)Drying,v) Ignition & Inceneration, vi) Weighing.	Apply theoretical knowledge in practical.

Specify Course Outcome: Understand the concept of atomic structure, thermodynamics, phase rule,entropy, nuclear chemistry and theory of gravimetric analysis

Specify Program Outcome: Apply the understanding of structure of atom, thermodynamics, phaserule, entropy, nuclear chemistry and theory of gravimetric analysis in practical exercise.

Signature of Teacher: Prof. S. B. Patwari,

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Lal Bahadur Shastri Mahavidyalaya, Dharmabad. 431809

Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Dr. N. S. Kaminwar, Mr. S. L. Nakkalwar & Dr.H,M. Kasralikar
Department: Chemistry **Program:** B. Sc. SY Semester –III
Subject: Chemistry **Course Code**: SECC-I (A)
Paper Title: Water Pollution **Paper : SEC I**

Unit	Unit Name	Topic	Unit wise Outcome
I	**Pollution**	Pollution: - Introduction, Definition, Sources & effect of water pollution. Control measures of water pollutions.	
II	**Analysis of water pollution:- Theory & Practically**	Physical Parameters a) Temperature b) Electrical Conductance c) Total Suspended Solids d) Total dissolved Solids e) Total Solids f) Oil & Greases.	
III	**Chemical Parameters**	a) PH b) Dissolve Oxygen c) Chemical Oxygen demand d) Bio-Chemical Oxygen demand e) Hardness f) Chloride g) Sulphate	
IV	**Biological aspects.**		

Specify Course Outcome:

Specify Program Outcome:

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

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Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Dr. N. S. Kaminwar
Department: Chemistry **Program:** B. Sc. SY Semester –IV CBCS
Subject: Chemistry **Course Code**: CH-203
Paper Title: Organic + Inorganic Chemistry **Paper: VIII**

Unit	Unit Name	Topic	Unit wise Outcome
I	**Stereochemistry**	1. Introduction 2. Concept and Types of isomerism. (a) Structural isomerism (b) Stereo isomerism. 3. Types of structural isomerisin [Chain, Position, Functional, Metamerism, Tautomerism] 4. Types of Stereoisomerism [Conformational(n-butane) and Configurational] 5. Geometrical isomerism: Cis -Trans and E and Z system of nomenclature. 6. Optical isomerism: a) Concept of asymmetric carbon atom, Chiral centre. b) Dextro and Laevo forms, Racemic mixture. c) Element of symmetry [plane, Centre, and Axis] d) Concept of Diastereoisomers. e) Racemic modification. (with one example) f) Resolution (Concept) (with one example) g) Walden inversion. (with one example) h) Relative Configuration and Absolute configuration.[D,L and R,S notations]	Learn the stereoisomerism of chiral compounds
II	**Carbohydrates**	1. Introduction. 2. Classification and Nomenclature 3. Reactions of Monosaccharide's (Glucose and Fructose) a) Addition reactions b) Ether formation c) Reduction of glucose d) Oxidation of glucose e) Osazone formation with mechanism 4. Open and cyclic structure of glucose 5. Determination of ring size 6. Mutarotation with Mechanism. 7. Epimerization. 8. Cyclic Structure of D-glucose.(supporting evidence for six member ring) 9. Interconvertions: a) Glucose to Fructose. b) Fructose to Glucose. c) Glucose to Mannose. d) Glucose to Arabinose (Ruff Degradation) e) Arabinose to Glucose (Kiliani synthesis) 10. Pyranose Structure of Glucose. 11. Manufacturing of sucrose (sugar) from sugar cane.	Know the Classification, and Reactions of carbohydrates.
III	**Nitrogen Containing Organic Compounds.**	A] Aromatic Nitro Compounds. 1. Introduction, Nomenclature, 2. Preparation of Nitrobenzene from benzene 3. Physical and Chemical properties of Nitrobenzene. 4. Electrophilic substitution reactions. 5. Reductions: a) in acidic medium. b) In neutral medium. c) In alkaline medium. d)	Know the Synthesis, and Reactions of Nitrogen Compounds

		Electrolytic reduction. B] Aromatic amines: 1) Introduction, Classification, Nomenclature, 2) Methods of preparations of aniline from i) chlorobenzene ii) phenol iii) nitrobenzene iv) from phthalimide 3) Chemical properties. i) Diazotization reaction. ii) Action of carbon disulphide. iii) Action of benzoyl chloride. iv) Formation of Schiff's base. v) Carbylamine reaction. vi)Formation of p-nitroacetanilide 4. Effect of substituent (-NO2, -OCH3, -CH3)on the basicity of aniline. C] Diazomethane 1. Introduction. 2. Methods of preparations i) From N-nitroso-N-methylurethane ii) From nitrous oxide and methyl lithium 3. Reactions of Diazomethane i) Action of heat ii) Reaction with mineral acid iii) Reaction with phenol iv) Reaction with ethanol and ethanamine v) Ring expansion (cyclopentanone to cyclohexanone) D] Urea: 1. Synthesis of urea by a) Wohlers methods and b) From CO2. 2. Reactions: a) Action of heat b) Action of nitrous acid c) Hydrolysis d) Action of thionyl chloride e) Action of formaldehyde f) Action of hydrazine g) Action of acetyl chloride h) Salt formation.	
IV	**Applications of Reagents In Organic Synthesis.**	A] Osmium Tetraoxide [OsO4] 1. Introduction, Preparation 2. Reactions: a) In the formation of Cis-l,2-diol, b)Acralaldehyde to glyceraldehyde, c) Cis- hydroxylation of maleic acid, d) 9, 10-dihydroxylation of phenanthrene. B] Ozone. [O3] 1. Preparation, 2. Reactions. a) Synthesis of aldehydes and ketones, b) Synthesis of dialdehydes and hydroxyl aldehydes, c) In degradation of alcohols. C] Selenium Dioxide. [SeO2] 1. Preparations, 2. Reactions: a) Oxidation of reactive methylene group into Carbonyl group. b) In dehydrogenation reactions. c) allylic hydroxylation and oxidation D] Boron Trifluoride. [BF3] 1. Preparation, 2. Reactions: In the formation of: a) acids, b) esters c) diketones, d) Nitration, e) Sulphonation, f) Rearrangement reaction.	Gathering Applications of Reagents In Organic Synthesis
V	**[A] Chemistry of d-Block Elements**	a) General Characteristics of d-Block Elements. b) Electronic Configuration of Second & Third Transition Series Elements. c) Comparison of Second & Third Transition Series Elements with first transition series elements. d) Compounds of i) Rhodium & Irridium ii) Palladium & Platinum iii) Silver & Gold iv) Cadmium & Mercury.	Understand the Characteristics of d- Block Elements
VI	**[B] Chemistry**	a) General Characteristics of d-Block Elements.	Know the

	of f-Block Elements.	b) Electronic Configuration of Second & Third Transition Series Elements. c) Comparison of Second & Third Transition Series Elements with first transition series elements. d) Compounds of i) Rhodium & Irridium ii) Palladium & Platinum iii) Silver & Gold iv) Cadmium & Mercury.	Characteristics of d- Block Elements

Specify Course Outcome: Acquire basic knowledge about stereochemistry, carbohydrates, nitrogen containing compounds and reagents.

Specify Program Outcome: Understand stereochemistry, sugars, nitrogen compounds, reagents.

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

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Lal Bahadur Shastri Mahavidyalaya, Dharmabad. 431809

Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Prof. S. B. Patwari
Department: Chemistry **Program:** B.Sc.SY Semester-IV **Subject**: Chemistry
Course Code: CH-204 **Paper title:** Physical+ Inorganic Chemistry **P**-IX

Unit	Unit Name	Topic	Unit wise Outcome
I	**Chemical Kinetics**	1.1 Introduction: Rate of reaction, Definition and units of rate constant, Factors affecting rate of reaction, Order and Molecularity of reaction. 1.2 Zero order reaction: Rate expression and Characteristics. 1.3 First order reaction: Rate expression and Characteristics. 1.4 Pseudounimol - ecular reactions. 1.5 Second order reaction: Derivation of rate constant for equal and unequal concentrations of the reactants. Characteristics of second order reaction. 1.6 Methods of determina - tion of order of a reaction. 1.7 Collision theory of reaction rates. 1.8 Effect of temperature on reaction rates and Arrhenius equation. 1.9 Numericals on first order eactions, half-life method.	Understand the concept of chemical kinetics and order of reaction.
II	**Electrochemistry**	2.1 Introduction, Conduction of electricity, Types of conductors: electronic and electrolytic. 2.2 Conductance of electrolytes: Conductance, Specificresistance, Specific conductance, Equival - ent conductance, Molecular conductance and their units. 2.3 Variation of specific and equival -ent conductance with dilution, Equivalent conductance at infinite dilution. Effect of tempera -ture on conductance. 2.4 Conductivity cell, Cell constant and its determination. 2.5 Strong and weak electrolyte. Arrhenius theory of electrolytic dissociation and its limitations. Debye-Huckel theory of strong electrolytes. Relaxation effect and electrophoretic effect, Debye-Huckel, Onsager's equation and its verification. 2.6 Migra -tion of ions, Transport number. 2.7 Numericals on Specific conductance, Equivalentconductance and cell constant.	Apply the concept of electrochemistry to learn the phenomenon of conductance.
III	**Kohlrausch's law**	3.1 Kohlrausch's law, Applications of Kohlrau -sch's law: i) Determination of equivalent conductance at infinite dilution of weak electroly -tes. ii) Determination of degree of dissociation. iii) Determination of solubility of sparingly soluble salts. iv) Determination of absolute ionic mobility. v) Determination of ionic product of water. 3.2 Conductometric titrations: (i) Strong acid against strong base. (ii) Strong acid against weak base (iii)	Evaluate the concept of conductancein various titration.

		Weak acid against strong base. (iv) Weak acid against weak base. (v) Precipitation titration. 3.3 Advantages of conductometric titrations.	
IV	**Photochemistry**	3.1 Introduction to photochemistry, types of chemical reactions, difference between thermal and photochemical reactions. 3.2 Lambert-Beer Law: Light absorption by solution, molar extinction coefficient, transmittance, absorbance, optical density. Laws of photochemistry: Grothus-Drapper law, Stark-Einstein law of photochemical equivalence. Quantum yield, experimental determination of quantum yield. High and low quantum yield reactions. Reasons for high and low quantum yield. 3.5 Jablonski diagram with various Processes occurring in the excited state. (internal Qualitative description of Fluorescence, phosphorescence, non-radiative processes Conversion, inter- system crossing). Photosensitized reactions. Chemiluminescence. 3.6 Numericals on quantum yield.	Analyse the photochemical reaction.
V	**Chemistry of Non-transition elements**	a) Silicates: Definition, Basic Unit of silicate and classification on the basis of basic unit and their characteristics. b) Zeolite: Definition,preparation, classification and applications. Ultramarine.c) Carbide: Definition, classification, preparation, properties and structure of ionic or salt like carbides (CaC2), Metallic carbide (TiC) and covalent carbides (SiC). d) Fullerene: Preparation, properties, structure and applications.	Understand the role of non transition elements in various fields.
VI	**Chemistry Halogen compounds**	a) Inter-halogen compounds: i)Definition preparation and structure of XY, XY3, XY5, and XY7 types of inter-halogen compounds. ii)Pseudo-halogen: Definition, preparation and properties. b) luorocarbon: Definition, preparation properties and uses (Teflon). c) Polyhalides: definition, preparation, properties & structure of ICl2-, & ICl4-d) Oxides of halogens: Preparation, structure & uses of F2O, Cl2O, Cl2O7, & I2O5. e) Oxyacids of halogens: Introduction, oxidation state, structure strength and stability. Basic properties of halogens: I+ and I+3 compounds and their preparation	Understand the role of halogen in the synthesis of various compounds.

Specify Course Outcome: Understand the concept of chemical kinetics, electrochemistry, photochemistry, non transition elements and halogen and with illustration.

Specify Program Outcome: Apply the understanding of chemical kinetics, electrochemistry, Photochemistry, non transition elements and halogen in the welfare of society.

Signature of Teacher

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Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Prof. S. B. Patwari, Dr. H. M. Kasralikar &
Department: Chemistry **Program:** B. Sc. SY Semester-III & IV **Subject**: Chemistry
Course Code: CH-205, (CCC III & IV Section- A) **P** - X
Course Name Practical's based on P-VI & P-VIII **Paper Title:** Organic + Inorganic Chemistry

Unit	Unit Name	Topic	Unit wise Outcome
I	**Part I (Organic Chemistry) Only demonstration**	i) Determination of Rf values of O, M and P-nitro aniline. ii) Separation of benzene and water by distillation method.	Learn basics of thin layer chromatograph yand distillation
II	**Qualitative analysis**	Identification of following organic compounds. (Two from each of the following) a) Acids: Benzoic acid, Phthalic acid, Salicylic acid, Cinnamic acid, o-chloro benzoic acid. b) Base: Aniline, P-nitroaniline, m-nitroaniline, resorcinol, P-toludiene. c) Phenols: Phenol, α-naphthol, β-naphthol, p-cresol, m-nitro - phenol. d) Neutral: Naphthalene, Anthracene, Acetanilide, m-dinitrobenzene, Nitrobenzene.	Learn fundamentals of organic qualitative analysis
III	**Quantitative analysis: (estimation)any four)**	a) Estimation of glycine by Sorenson's method. b) Estimation of phenol by bromination method. c) Estimation of glucose by iodination method. d) Estimation of unsaturation (cinnamic acid). e) Estimation of saponification value of an oil. f) Estimation of iodine value of an oil	Learn about estimations
IV	**Part II (Inorganic Chemistry)**	1 Determine volumetrically the amounts of sodium carbonate and sodium hydroxide present together in the given solution provided 0.1 N HCl solution 2. Determine the percentage of $CaCO_3$ in the chalk sample, provided 1 N Hcl and 0.1N NaOH 3 Estimate the strength of the given sample of $KMnO_4$ Solution in g/lit. Prepare a standard solution of N/10 Mohr's salt or N/10 Sodium Oxalate solution 4 Estimate volumetrically the strength of Ferrous and ferric ion in the given solution provided N/10 $KMnO_4$ Solution 5 Determine the strength in g/lit of each of HCl and HNO_3 present together in the given solution. Provided N/10 NaOH and N/20 $AgNO_3$ 6 Determination of Nickel using murexide as an indicator (Direct method) 7 Prepare standard solution of Zn ion standardize the give EDTA solution and estimate the amount of unknown Zn ion concentration 8 To determine the total, permanent and temporary hardness of water by complexometric	Basics of Volumetric analysis

		method using EDTA.	

Specify Course Outcome: Learn basics of thin layer chromatography, distillation, fundamentals of qualitative analysis of organic compounds, estimation of glycine, phenol, glucose, Cinnamic acid oil, vitamin-C and formaldehyde and basics of Volumetric analysis.

Specify Program Outcome: Understand concept of layer chromatography, distillation, qualitative analysisorganic compounds and estimation of organic compound and Volumetric analysis of compounds.

Signature of Teacher

Dharmabad Shikshan Sanstha's
Lal Bahadur Shastri Mahavidyalaya, Dharmabad. 431809

Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Prof. S. B. Patwari, Dr. H. M. Kasralikar & Dr. N. S. Kaminwar
Department: Chemistry **Program:** B. Sc. SY Semester-III & IV **Subject**: Chemistry
Course Code: CH-206 **Paper** - XI
Course Name Practical's based on P-VI & P-VIII **Paper Title:** Physical + Inorganic Chemistry

Unit	Unit Name	Topic	Unit wise Outcome
I	**Instrumental**	1. Determine the normality and strength of strong acid (HCl /H2SO4 / HNO3) onductometrically using standard solution of strong base (NaOH / KOH). 2. Determine the normality and strength of weak acid (CH3COOH / HCOOH) conductometrically using standard solution of strong base (NaOH / KOH). 3. To determine the solubility of a sparingly soluble salts(BaSO4 / PbSO4 / AgCl) conductometrically at room temperature. 4. Determine the normality and strength of strong acid (HCl /H2SO4 / HNO3) potentiometrically using standard solution of strong base (NaOH / KOH). 5. Determine redox potential of Fe3+ / Fe2+ / or Sn4+/Sn3+or Ce4+ / Ce3+ system by titrating it with standard K2Cr2 O7 / KMnO4 potentiometrically 6. Verification of Lamberts-Beer's law using KMnO4 /NiSO4 / K2Cr2 O7 / CuSO4 colorimetrically and determine concentration of unknown solution. 7. Determine the concentration of Cu++ ion in given solution,titrating it against std. EDTA Solution by colorimetric measurement. 8. To determine the hydrolysis constant of aniline hydrochloride by pH measurement.	Understand the role of instrumentation for the accurate determination of concentration of solution.
II	**Non-Instrumental**	1. To study the effect of addition of electrolyte (KCl / NaCl)on solubility of weak organic acid at room temperature. 2. Determine energy of activation of reaction between KI and $K_2S_2O_8$. 3. Determine the parachorof p-dichloro benzene by stalgmometer method. 4. To determine the composition of the given mixture consisting of two miscible liquids, A & B by viscosity measurement. 5. Determine partition coefficient of iodine between carbon tetrachloride and water. 6. Determine the solubility of benzoic acid in water at different temperaturesand hence its heat of solution. 7. To study the effect of solute (NaCl / Succinic acid) on the CST of phenol- water system and hence	Apply the practical knowledge of chemistry for the verification oftheoretical aspect.

		determine amount ofsolute in given sample of phenol – water composition. 8. To find out the enthalpy of neutralization of weak acid/weak base against strong base/strong acid and determine the enthalpy of ionization of weak acid/ weak base. 9. To study the kinetics of dissolution of magnesium metal in dil.HCl 10. To study the kinetics of decompo -sition of sodium thiosulphate by a mineral acid	
III	**Inorganic Chemistry**	Inorganic Chemistry Separation of binary mixtures and estimation of any one byvolumetric method: 1. Cu + + + Zn + + 2. Ba + + + Ca+ + 3. Mn + + + Zn+ + 4. Fe + + + Al + + +	Evaluate the theor -etical concept of qualitative analy -sis in practical.

Specify Course Outcome: Understand the concept of instrumentation, non instrumentation and qualitative analysis for the correct estimation.

Specify Program Outcome: Apply the skill during the instrumentation, non instrumentation and qualitative analysis for the correct estimation.

Name of Teacher: Prof. S. B. Patwari, Dr. H. M. Kasralikar & Dr. N. S. Kaminwar

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Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Dr. N. S. Kaminwar, Mr. S. L. Nakkalwar & Dr.H,M. Kasralikar
Department: Chemistry **Program:** B. Sc. SY Semester –IV
Subject: Chemistry **Course Code**: SECC-II
Paper Title: Preparation of Solutions & its standerdisation **Paper : SEC II**

Unit	Unit Name	Topic	Unit wise Outcome
I	**Introduction**	Solute, solvent, solution, types ofsolutions, Homogeneous solution, Heterogeneous solution. Concentration of solution, dilute solution, standard solution.	Learn fundamental concepts of solutionsand it's concentration
II	**Ways of expressing the concentration ofsolutions and their preparation**	Percentage by mass (% w/W) Percentage by volume (% v/V)Mole fraction (x) Molarity (M) Molality (m) Normality (N) Parts per million (Ppm)Parts per thousand (Ppt)	Understand how toexpress concentration
III	**Preparation of standard solutions**	Preparation of any standard solutions from stock solution. **Numerical**. (a) Molarity, Molality, Normality, Mole fraction, ppm, ppt. (b) Determination of concentration of mixing different concentrations and volume of same solution. (c) Determination of compostions of mixture in terms of mole fraction.	Understand how to prepare solutions of different concentrations by solving numerical
IV	**Standardisat-ion ofsolutions**	1.6 Standardisation of $KMnO_4$ solution. Standardistion of HCl solution. Standardisation of NaOH solution. Standardisation of EDTA solution. Standardisation of $K_2Cr_2O_7$ solution.	Learn how to prepare the solution of exact concentration

Specify Course Outcome: Familiarize the students with the basic principle of solutions and preparation ofsolutions of exact concentration expressed in different ways

Specify Program Outcome: Understand basic concepts of solution and different ways for expressing concentration also how to prepare solutions of different concentration from standard solutions.

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

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Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Dr. N. S. Kaminwar, Mr. S. L. Nakkalwar
Department: Chemistry **Program:** B. Sc. TY Semester-V
Subject: Chemistry **Course Code**: CH-301 **P** - XII
Course Name B. Sc. TY, Sem-V Paper **Title:** Organic + Inorganic Chemistry

Unit	Unit Name	Topic	Unit wise Outcome
I	**Heterocyclic Compounds**	Introduction, definition, nomenclature and classification. Simple five membered heterocycles with one hetero atom: Furan, Thiophene and Pyrrole. Aromatic character and molecular orbital picture of Furan, Thiophene and Pyrrole.General mechanism of electrophilic substitution reaction with reactivity. Preparation and chemical properties of five membered heterocycles. 1) Furan: Synthesis from: a) Mucic acid b) Succinaldehyde. Physical Properties,chemical Properties: Nitration, Gatterman-Koch reaction, Gomberg reaction, Diels-Alder reaction and Reduction reaction. 2) Pyrrole: Synthesis from: a) Furan b) Succinamide. Physical properties, Chemical Properties: Sulphonation, Gatterman Reaction, Reimer-Tiemann reaction, Ring Expansion, Coupling reaction and Reduction reaction. 3) Thiophene: Synthesis from: a) n-Butane b) Sodium Succinate, Physical properties. Chemical Properties: Halogenation, Chloromethylation, Mercuration, Reaction with n-Butyl Lithium and Reduction reaction.	Learn the mechanism of Electrophilic Substitution reaction of Heterocyclic Compounds
II	**Six-membered heterocyclic compounds**	Introduction, Nomenclature, Aromatic character, Basic character and comparison with Pyrrole , General Mechanism for electrophilic substitution reaction and nucleophilic substitution reaction Synthesis from: a) Acetylene b) Pentamethylene diamine hydrochloride c) β-Picoline Chemical Properties: Nitration, Sulphonation, Halogenation, reaction with KOH, Amination reaction.	Learn the mechanism of Electrophilic Substitution reaction of Heterocyclic Compounds
III	**Synthetic drugsand dyes**	(1) Synthetic Drugs: Introduction, Definition of drugs, qualities of good drug, Classification of drugs based on therapeutic action. a) Pharmacodynamic agents : Antipyretics, Analgesics, Anesthetics, Antidiabetics, Anti- inflammatory, sedatives, hypnotics and tranquillizers. b) Chemotherapeutic agents: Antimalarials, Antibacterials, Antifungals, Antituberculars. Synthesis and uses of the following drugs: a) Paracetamol b) Sulphanilamide c) Aspirin d)Benzocaine e) Isoniazide f) Sulphadiazine.	Know the characteristics ,Classification and synthesis of Drugsand Dyes

		(2) Synthetic Dyes: Introduction, Definition of dyes qualities of good dye, Classification of dyes based on methods of applications, colour and chemical constitution: a) Witt's theory b) Armstrong's theory. Synthesis and applications of Azo dyes: methyl orange and congo red (mechanism of diazo coupling); Triphenylmethane dyes: malachite green and crystal violet; Phthalein dyes: Phenolphthalein and Fluorescein dye.	
IV	**Alkaloids, Vitamins and Pesticides**	(1) Alkaloids: Introduction, occurrence and extraction, classification and general properties, determination of chemical constitution of alkaloids. Constitution and Synthesis of the following alkaloids. a) Ephedrine: Synthesis from : 1-Phenyl propane-1, 2-dione b) Nicotine : Synthesis from : Nicotinonitrile (2) Vitamins : Introduction and classification, Source, structure and deficiency diseases of the following vitamins: a) Vitamin A, D, E and K (Fat Soluble) b) Vitamin B1, B2, B3, B6, B12 and C (Water Soluble) (3) Pesticides: Introduction and classification: Insecticides, Herbicides, Fungicides and Rodenticides. Synthesis and technical manufacture and uses of representative pesticides in the following classes : Organochlorines(DDT,Gammexene,); Organophosphates (Malathion), Carbamates (Carbaryl), Quinones (Chloranil), Anilides (Alachlor).	Gathering basic knowledge of Alkaloids, Vitaminsand Pesticides
V	**Coordination Chemistry (Part-I)**	5.1.1 Introduction: addition or Comparison of double salt and coordination compound. 5.1.2 Terminology: complex ion, central metal atom, ligand, types of ligands, coordination number and coordination sphere. 5.1.3 Nomenclature: Rules of nomenclature of coordination compounds, and its applications to nomenclature of simple and bridging complex compounds. 5.1.4 Werner's theory of coordination compound, postulates, applications with reference to 5.1.5 $CoCl_3.6NH_3$, $CoCl_3.5NH_3$, $CoCl_3.4NH_3$, $CoCl_3.3NH_3$. Chelating agents and its classification, difference between metal complex and metal chelate complex. 5.1.6 Isomerism: structural isomerism, ionization, hydrate, linkage, coordination isomerism, geometrical isomerism, optical isomerism in 4 and 6 coordination complex. 5.1.7 E. A. N. of metal complexes.	Understand the basic principle andapplication of coordination complexes
VI	**The Chemistry of Elements in Medicine**	5.2.1 Introduction 5.2.2 Chelation Therapy 5.2.3Cancer Treatment 5.2.4 Anti-arthritis drugs. 5.2.5 Imaging agents.	Know the application of elements in Medicine

Specify Course Outcome: Acquire basic knowledge about Heterocyclic Compounds, Synthetic Drugs andDyes, Alkaloids, Vitamins, Pesticides, Co-ordination Chemistry and elements in Medicine.

Specify Program Outcome: Understand Heterocyclic Compounds, Synthetic Drugs and Dyes, Alkaloids,Vitamins, Pesticides, Co-ordination Chemistry and elements in Medicine.

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

Dharmabad Shikshan Sanstha's
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Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Prof.S. B. Patwari, Dr. H. M. Kasralikar Mr. S. L. Nakkalwar
Department: Chemistry **Program:** B. Sc. TY Semester-V
Subject: Chemistry **Course Code**: CH-302 **P** - XIII
Course Name B. Sc. TY, Sem-V Paper **Title:** Physical + Inorganic Chemistry

Unit	Unit Name	Topic	Unit wise Outcome
I	**Spectroscopy I**	Brief introduction to molecular Spectroscopy. Width and intensity of spectral lines. Factors affecting width and intensity of spectral line. Rotational spectra: Classification of molecules, Rotational spectra of diatomic molecules. (Rigid rotator model) Moment of inertia, energy levels of rigid rotator, selection rule, spacing between spectral lines of diatomic rigid rotator, isotopic effect. Numerical. v ibrational Spectra: Infrared spectrum, simple harmonic oscillator model, energy levels of simple harmonic oscillator, election rule, pure vibrational spectrum, intensity, determination of force constant, qualitative relation between force constant and bond energies. Numerical on force constant.	Understand the instrumentation and theoretical background of spectroscopy.
II	**SpectroscopyII**	a) Raman spectra: Raman effect, Concept of polarizability, classical and quantum theory of Raman scattering, rotational Raman spectrum of a diatomic molecule. Experimental Raman Spectroscopy. b) electronic spectra: Concept of potential energy curve, Franck-Condon Principle, Types of electronic transistions.	Understandbasic principle of Raman spectroscopy.
III	**Chemical kinetics**	a) Introduction, Third order reaction with equal concentration of all reactants, characteristics of third order reaction. b) Kinetics of complex reaction: i) Opposing reaction ii) Consecutive reaction c) Kinetics of Photochemical reaction: i) Hydrogen – chlorine reaction ii) Decomposition of HI iii) Dimerization of anthracene.	Apply the previous knowledge of chemical kinetics in various reaction
IV	**Distribution Law:**	a) Introduction, Nernst Distribution law, Solubility and distribution law, Limitations of law. b) Association and dissociation of solute in solvent. c) Henry's law. d)Determination of equilibrium constant from distribution coefficient. e) Extraction of solvent. f) Liquid -liquid chromatography. g) Applications of distribution law. h) Numerical on distribution law	Apply the law of dissociation constant in various phases.
V	**Organometal - lic compounds**	1) Definition 2) Nomenclature and classification of organometallic compounds. 3) Preparation, properties, structure of organolithium.	To understand the organometallic

		4) Preparation, properties, structure of ferrocene.	compounds and Ferrocenes.
VI	**Metal carbonyls**	a. Definition, types 1) Mononuclear carbonyl, characteristics and examples; 2) Polynuclear carbonyl, characteristics and examples. b. Preparation properties and structure of nickel tetra carbonyl. c. Nature of metal carbon bond in metal carbonyl and their evidences. d. Structure of $Fe_2(CO)_9$, $Fe_3(CO)_{12}$, $Ir_4(CO)_{12}$, $Co_2(CO)_8$.	Understand the nature of metal carbon bond in metal carbonyl.

Specify Course Outcome: Understand the basic concept of spectroscopy, rate of reaction in various chemical reaction,distribution law and metal ion in organo metallic compounds**.**

Specify Program Outcome: Understand the concepts of molecular Spectroscopy and its applications. Analyze Rotational, Vibrational and Raman, Spectra. Interpret the theoretical and experimental methods of chemical kinetics. Know the theory and application of Distribution law. Explain the Nomenclature, classification and application of Organometallic Compounds. Illustrate the classification and application of Metal Carbonyls.

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

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Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Dr. N. S. Kaminwar, Mr. S. L. Nakkalwar & Dr. H. M. Kasralikar
Department: Chemistry **Program:** B. Sc. TY Semester –V
Subject: Chemistry **Course Code**: SECC-III
Paper Title: Computer Application in Chemistry **Paper: SEC III**

Unit	Unit Name	Topic	Unit wise Outcome
I	**Use of software**	ISIS draw, Chem drawand Chem sketch. For drawing the structures, elemental (CHN) analysis, determination of molecular mass, IUPAC name and prediction of spectral data NMR andMASS.	Understand the role of softwarefor the elucidation of structure of compound.
II	**Biological activity**	Biological activity and Toxicity evaluation of organic compounds using software: Evaluation of toxicity risk assessment of organic compounds using online software. Prediction of different biological activities using online software.	Understand the mode of action and mechanism of biologically active compound.
III	**Use of Excel in Chemistry**	Functions and formulas: Sum, mean, average, power etc. Understanding formulas, the cell and the formula bar, the formula in action, copying formulas, copying and pasting a formula and complex formula. b) Excel chart and data analysis: Visual representation of the data through excel graph, plotting and X-Y data set, create calibration curve, format the view graph, add trendline, equation of line and R- square value,determine the slope of a line, scale adjustment, examples, renaming the chart and worksheet, common charting errors, add a chart title.Add regrations and equation to graph, regration analysis, run the regration and interpreting regration results.	Understand the use of excel in chemistry for ploting the graph and analysis.

Specify Course Outcome: Understand the students for the use of Software, Excel, analysis of Soil and Fuel. Able to know the use of software and Excel in Chemistry. Grasp the concept of Quality Assurance and Quality Control. Illustrate the Physical and Chemical analysis of Soil and fuel. Be able to evaluate biological activity and toxicity of organic compounds using software's.

Specify Program Outcome: To train the students for the use of Software, Excel, analysis of Soil and Fuel. Able to know the use of software and Excel in Chemistry. Grasp the concept of Quality Assurance and Quality Control. Illustrate the Physical and Chemical analysis of Soil and fuel. Be able to evaluate Biological activity and toxicity of organic compounds using software's.

Signature of Teacher: Dr. N. S. Kaminwar, Mr. S. L. Nakkalwar & Dr.H.M. Kasralikar

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Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Dr. N. S. Kaminwar, Mr. S. L. Nakkalwar
Department: Chemistry **Program:** B. Sc. TY Semester-VI
Subject: Chemistry **Course Code**: CH-303 **P** - XIV
Course Name B. Sc. TY, Sem-VI **Paper Title:** Organic + Inorganic Chemistry

Unit	Unit Name	Topic	Unit wise Outcome
I	**Spectroscopic Methods**	i) Introduction, Electromagnetic radiations; Characteristics of EMR: - a) Wave length b) Wave number c) Frequency d) Energy of EMR ii) Electromagnetic spectrum; Meaning of Spectroscopy, types of Spectroscopy and advantages of spectroscopic methods.(A) U. V. Spectroscopy:1.1.1 Introduction. 1.1.2 Absorption of U.V.radiations: Beer-Lambert Law and Molar Absorption.1.1.3 Types of Electronic Transitions.1.1.4 Terms used in U.V.Spectroscopy : Chromophore, Auxochrome, Bathochromic. Shift, Hypsochromic Shift, Hypochromic and Hyperchromic effects. 1.1.5 Effect of conjugation on position of U.V. and Visible bands. 1.1.6 Calculation of λ max by Woodward – Fieser rules for conjugated dienes and enones. 1.1.7 Spectral problems based on U.V. (B) I.R. Spectroscopy:1.2.1 Introduction 1.2.2 Principle of IR Spectroscopy.1.2.3 Fundamental Modes and types of Vibrations. Hooke's Law. 1.2.4 Conditions for absorption of IR-radiations. 1.2.5 IR Spectrum : Functional group region and Fingerprint region. 1.2.6 Characteristic absorption of various functional groups. 1.2.7 Interpretation of IR spectra of following organic compounds a) ethane b) ethane c) ethyne d) benzene e) 1-propanol f) 2-propanol g)t-butyl alcohol h) phenol i) acetone j)acetophenone k) acetaldehyde l) benzaldehyde m) benzoic acid n) methyl benzoate o) phenyl cyanide.	learn the basic principle and termsused in UV, IR-Spectroscopy
II	**(A) NMR – Spectroscopy**	2.1 Introduction 2.2 Principle of NMR Spectroscopy 2.3 Magnetic and non-magnetic nuclei,2.4 PMR-Spectroscopy:Spinning nuclei, magnetic moment and magnetic field, precessional motion, energy states for proton in magnetic field (Orientations) and nuclear resonance. 2.5 Equivalent and non-equivalent protons. 2.6 Number of absorption signals in the following compounds:a) Acetone, b) Cyclobutane, c) Methanol, d) Ethylbenzene, e) Ethyamine, f) Mesitylene, g) Diethylether, 2.7 Shielding and deshielding effects: (Example of Acetylene and Benzene) 2.8 Chemical shift, measurement of chemical shift by delta scale and tau scale 2.9 TMS as reference, Advantages of TMS.	learn the basic principle and termsused in NMR Spectroscopy

		2.10 Peak area (integration) andSpin-spin splitting (n+1) rule. 2.11 Interpretation of PMR Spectra of following compounds: a) Ethyl bromide, b) Ethyl alcohol, c) Acetaldehyde, d) 1,1,2-tribromo ethane, e) Ethyl acetate, f) Toluene, g) Acetophenone, h) Ethylamine, i) Acetic acid, j) Benzoic acid.	
	(B) Applications of IR, UV and NMR for dentification of simple organic molecules: 04 Periods Organic Molecules	a) n-Propyl alcohol, b) iso-Propyl alcohol, c) tert-Butyl alcohol, d) Acetic acid, e) Ethylamine, f) Ethyl cyanide, g) Ethyl methyl ketone, h) Ethyl acetate, i) Ethyl benzene, j) Phenyl acetaldehyde, k) Phenol, l) Ethyl methyl ether, m) Ethylene glycol, n) Propionamide and o) Propionaldehyde.	To determine the structure of organic compound by using UV, IR, NMR spectroscopy.
III	Synthetic Polymer	3.1 Introduction, Homopolymers and Copolymers. 3.2 Classification of Polymers based on source. 3.3 Types of Polymerisation reactions: a) Addition (Chain-Growth) Polymerisation reaction: (with mechanism) i) Free radical, ii) Cationic and iii) anionic b) Condensation (Step-Growth) Polymerizations reaction Example: Bakelite (Phenol-formaldehyde resin) 3.4 Synthesis and uses of following polymers :a) Nylon-6, 10, b) Polyurethanes, c) Neoprene, d) Polymethylmethacrylate.	To know the basic concept & synthesis of of synthetic polymer.
IV	**Molecular Rearrangements**	4.2.1 Introduction, classification of rea rrangements: On the basis of migratory group (a)Electrophilic rearrangement (Pinacole-Pinacolone rearrangement) (b) Nucleophilic rearrangement (ex. Favroskii rearrangement) (c) Free Radical rearrangement (ex. Photo Fries rearrangement) (d) Aromatic rearrangement (ex Stevens rearrangement)	Describe the types of Rearrangement
V	**Coordination theory (Part-II)**	5.1.1) Valence bond theory of coordination compounds: Postulates, inner orbital and outerorbital complexes of coordination number 4 and 6. Limitations of VBT. 5.1.2) Crystal field theory: Shape of d-orbital's, postulates, splitting of d-orbital in octahedral complexes, tetrahedral complexes, tetragonal and square planarcomplex. Definition of CFSE, calculations of CFSE for octahedral and tetrahedralcomplexes. 5.1.3) Factors affecting 10 Dq or magnitude of crystal field splitting : Nature of ligand, oxidation state of metal ion, size of d orbital, geometry of complexes. 5.1.4) Applications of CFT. 5.1.5) John teller effect in octahedral complexes of Cu^{++}. 5.1.6) Limitations of CFT.	Postulates and limitations of VBTand CFT
VI	**Electronic Spectra of Transition Metal**	5.2.1) Types of electronic transition 5.2.2) Selection rule for d-d transistion 5.2.3) Spectroscopic ground state and spectro-chemical series 5.2.4) Orgel energy level diagram for d 1 and d 9 states 5.2.5) Discussion	Explain the types of electronic transition and

	complexes	of electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion	selection rule

Specify Course Outcome: Familiarize the students with the concept and principle of Spectroscopy, Amino Acids, Peptides, Molecular Rearrangements, Co-ordination theory and Electronic Spectra of Metal Complexes

Specify Program Outcome: Understand concept of Spectroscopy, Amino Acids, Peptides, MolecularRearrangements, Co-ordination theory and Electronic Spectra.

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

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Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Prof.S. B. Patwari, Dr. H. M. Kasralikar Mr. S. L. Nakkalwar
Department: Chemistry **Program:** B. Sc. TY Semester-V
Subject: Chemistry **Course Code**: CH-304 **P** - XVI
Course Name B. Sc. TY, Sem-VI **Paper Title:** Physical + Inorganic Chemistry

Unit	Unit Name	Topic	Unit wise Outcome
I	Electrochemistry	i) Introduction, concept of electrode potential , single electrode potential, standard electrode potential , oxidization and reduction potential ii) Electrochemical cells, electrolytic and Galvanic cells, reversible and irreversible cells, conventional representation of electrochemical cells. EMF of cell , SHE. iii) Reference electrodes , indicator electrodes , calomel electrodes, Relation between EMF and ΔG , ΔH , ΔS iv) Nernst equation, application of Nernst equation to oxidation half cell and reduction half cell. v) Electrolyte concentration cell, Concentration cell with and without transport. Application of EMF measurement in determination of pH by using i) Quinhydrone electrode b) Glass electrode. i) Numerical on Nernst Equation.	Familiarize the students with the concept and principle electrochemistry
II	Thermodynamics I	a) Introduction b) Work function and free energy function(G): Helmholtz Function (A) or work function, Change of work function (A) at constant temperature , Gibbs' free energy function, relation between G and A, change of G at constant temperature, variation of work function with temperature and volume, variation of free energy function with temperature and pressure. The Gibb's-Helmholtz equation. a)The Nernst heat theorem. Third law of thermodynamics. b) Thermodynamics of open system: partial molar properties; concept of chemical potential, partial molar free energy. Gibb's-Duhem equation. Variation of chemical potential with temperature and pressure.	Familiarize the students with theconcept and principle of thermodynamics.

		Chemical potential in case of a system of ideal gases.	
III	Thermo- dynamics II	Thermodynamic derivation of law of mass action. a) Relation between ΔG0 and KP, relation between KP, KC and KX. b) Vant-Hoff's reaction isochore. Integrated form ofVant-Hoff's equation. c) Clausius-Clapeyron equation and its applications. d) Numerical on Integrated form of Vant-Hoff'sequation.	Know the Vant-Hoff's Reaction Osochore and numerical on it.
IV	Colligative Properties	1) Osmotic pressure. 2) Relative lowering of vapor pressure. 3) Elevation in boiling point. 4) Depression in freezing points and relation of these properties with molecular weight. Numericals on elevation of boiling point and depression in freezing point.	To know the basic concepts about colligative properties.
V	Bioinorganic Chemistry	Essential and trace elements in biological processes Metalloporphyrin with special reference to hemoglobin and myoglobin Biological role of alkali and alkaline earth metal ionsNitrogen fixation	Familiarize the students with theconcept and principle of bioinorganic chemistry and role of metal ion in biologicalsystems.
VI	Metal cluster	Boranes , Carboranes, Metalloboranes, Metallocarboranes	Familiarize the students with the concept of metalclusters.

Specify Course Outcome: Understand the basic concept of electrochemistry, thermodynamics, magnetometry, bioinorganic chemistry and metal cluster.

Specify Program Outcome: Basic concepts of electrochemistry and its applications. Understanding the Nernst heat theorem and the Thermodynamics open system Know the Vant-Hoff's Reaction Osochore and numerical on it. Explain the types of magnetic substances and effect of temperature on it. Biological role of alkali and alkaline earth metal ions. Describe the structures and functions ofMetal Cluster

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Pro-forma for program and course outcomes (2.6.1)

Name of Teacher: Dr. N. S. Kaminwar, Mr. S. L. Nakkalwar & Dr. H. M. Kasralikar
Department: Chemistry **Program:** B. Sc. TY Semester –VI
Subject: Chemistry **Course Code**: SECC-IV
Paper Title: Spectroscopic Techniques and Cosmetic Preparation **Paper : SEC IV**

Unit	Unit Name	Topic	Unit wise Outcome
I	Instruments in spectroscopy	Instrumentation: Study of UV, IR, NMR and Massspectroscopy	Learn the basic principle and terms used in UV, IR & NMR Spectroscopy
II	Determination of structures of organic compounds by using UV, IR, NMR and Mass spectra	Hydrocarbons, unsaturated hydrocarbons, alcohols, amines, aldehydes, ketones, carboxylic acids and esters, acid halides, amides and anhydrides.	Be able to determine the structure by using Spectra
III	Preparation of cosmetics	Preparation of talcum powder Preparation of shampoo Preparation of face cream Preparation of nail polish and nail polish	Train the students for the preparation of various cosmetics

Specify Course Outcome: Understanding of the basic concept of Spectroscopic Techniques, and cosmeticspreparations.

Specify Program Outcome: Able to determine the structure of organic molecules using spectroscopictechnique and prepare cosmetics**.**

Signature of Teacher: Dr. N. S. Kaminwar, Mr. S. L. Nakkalwar & Dr. H. M. Kasralikar

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Pro-forma for program and course outcomes (2.6.1)

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

Department: Chemistry **Program:** B. Sc. TY Semester-V & VI

Subject: Chemistry **Course Code**: CH-305

P - XVI **Course Name** B. Sc. TY, Sem-V &VI

Paper Title: Organic + Inorganic Chemistry P-XVI (Laboratory Course – IV (CH-305)

Unit	Unit Name	Topic	Unit wise Outcome
I	**Organic qualitative analysis**	Separation of organic binary mixture containing two solid components (Using $NaHCO_3$, NaOH and HCl) and analysis of (both/one) components with preparation one derivative of each. At least one mixture from each of the following types should be given: a) Acid + Phenol b) Acid + Base c) Acid + Neutral d) Phenol + Base e) Phenol + Neutral f) Base + Neutral g) Neutral+Neutral Following compounds should be used for preparation of mixtures: A] Acids : Salicylic acid, Phenyl acetic acid, o-Chlorobenzoic acid, Succinic acid, phthalic acid, cinnamic acid, Benzoic acid and m-cholorobenzoic acid. B] Phenols :α -naphthol, β -naphthol, resorcinol, p-nitro phenol, m-nitro phenol and hydroquinone, C] Bases : o-nitroaniline, m-nitroaniline, p-nitroaniline, p-anisidine, diphenylamine, p-toluidine and pchloroaniline D] Neutrals : Acetanilide, Anthracene, Benzamide, Benzophenone, Biphenyl, Naphthalene, m-Dinitrobenzene, p-Dichloro benzene and Thiourea.	Know the Organic qualitative analysis
II	**Organic Preparation**	a) Acetylation : Preparation of Aspirin from salicylic acid OR Preparation of β -naphthyl acetate from β -naphthol b) Electrophilic substitution : Preparation of p-nitroacetanilide from acetanilide (Nitration) c) Preparation of 2, 4, 6 – Tribromoaniline from aniline(Bromination) OR d) Preparation of p-bromo acetanilide from acetanilide(Bromination) e) Diazotisation : Preparation of Methylorange from sulphanilic acid (Coupling) OR e) Osazone formation : Preparation of Glucosazone from Glucose	Learn the Organic preparations

		f) Amide Formation : Preparation of Benzamide from benzoic acid Hydrolysis : Preparation of p-nitroaniline from p-nitroacetanilide g) Reduction : Preparation of m-nitroaniline from m- Dinitrobenzene h) Oxidation : Preparation of Benzoic acid from Toluene i) Polymerisation : Preparation of phenol formaldehyde resin	
III	**Only demonstrat-ions**	a) Extraction of clove oil from crushed cloves by steam distillation. b) Separation of a mixture of methyl orange and methylene blue by column chromatography c) Separation of a mixture of amino acids by ascending paper chromatography. d) Separation of various pigments in the extract of spinach leaves by TLC.	Understand the chromatograph-ictechniques.
IV	**Gravimetric estimations**	1) Gravimetric estimation of Iron as Fe_2O_3. 2) Gravimetric estimation of Ba as $BaSO_4$ 3) Gravimetric estimation of Nickel as $Ni(DMG)_2$. 4) Gravimetric estimation of Aluminium as $Al(Oxinate)_3$. 5) Gravimetric estimation of zinc as ZnO 6) Gravimetric estimation of Chloride as AgCl	Understand the Gravimetric estimations

Specify Course Outcome: Familiarize the students with the Organic qualitative analysis, organic preparations, chromatographic techniques and gravimetric estimations.

Specify Program Outcome: Understand concept of Organic qualitative analysis, organic preparations,chromatographic techniques and gravimetric estimations.

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Pro-forma for program and course outcomes (2.6.1)

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

Department: Chemistry **Program:** B. Sc. TY Semester-V & VI

Subject: Chemistry **Course Code**: CH-306 **P** - XVII

Course Name B. Sc. TY, Sem-V &VI

Paper Title: Physical + Inorganic Chemistry P-XVII (Laboratory Course – V (CH-305)

Unit	Unit Name	Topic	Unit wise Outcome
I	**Instrumental**	1. Determine the normality and strength of oxalic acid conductometrically using standard solution of strong base (NaOH/KOH). 2. Determine the concentration of KCl solution by titrating it with standard solution of $AgNO_3$ conductometrically. 3. Determine the equivalent conductance of a strong electrolyte at several concentrations and hence verify the Onsager's equation. 4. Determine the normality and strength of acids in mixture [strong acidm(HCl/HNO_3) and weak acid ($CH_3COOH/HCOOH$)] potentiomrtrically using standard solution of strong base(NaOH/KOH). 5. Determine the dissociation constant of a weak acid (CH3COOH/HCOOH) potentiometrically using standard solution of strong base (NaOH/KOH). 6. Determination of empirical formula of a complex between Fe^{+3} and 5-sulphosalicylic acid by Job's method colorimetrically. 7. Determination of dissociation constant of an organic acid (CH_3COOH) using various buffers ($CH_3COOH + CH_3COONa$) pH metrically. 8. To study inversion of cane sugar by polarimetrically.	Understand the role of instrumentation for the accurate determination of concentration of solution.
II	**Non-Instrumental**	Non-Instrumental 1. Determine the rate constant of the reaction between potassium persulphate and potassium iodide having equal concentrations of reacting species (a=b). 2. Determine energy of activation of hydrolysis of an ester by acid/base. 3. Investigate the reaction between bromic acid and hdroiodic acid. 4. Determine molecular weight of non volatile solute by Rast method / Beckomann's freezing point method. 5. Determine enthalpy change of neutralization of a strong acid by a strong base.	Apply the practical knowledge of chemistry for the verification of theoretical aspect.

		7. Determine interfacial tension between immiscible liquids, benzene and water by stalagmometer. Determine molecular weight of a polymer by viscosity measurement. 6. Separation of mixture of o- and p-nitro anilines on an alumina column.	
III	**(Inorganic Chemistry)**	1. Inorganic preparations and estimation of metal ion. a) $[Cu(NH_3)_4]SO_4$ b) $[Ni(NH_3)_6]Cl_2$ c) $CoCl_3.4NH_3$ d) Sodium trioxalato ferrate e) $Hg[Co(SCN)_4]$. f) Mohr's salt, $[FeSO_4(NH_4)_2SO_4].6H_2O$	Evaluate the theoretical concept of synthesis of metal complexes in practical.

Specify Course Outcome: Understand the concept of instrumentation, non-instrumentation and qualitative analysis for the correct estimation.

Specify Program Outcome: Apply the skill during the instrumentation, non-instrumentation and qualitative analysis for the correct estimation.

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

Nakkalwar