Amrut Sevabhavi Sanstha's Parbhani

Late Ku. Durga K. Banmeru Science College, Lonar Dist- Buldana

Department of Chemistry

Teaching Plan Session-2017-18

B.Sc.-Ist Semester-Ist

Name of Faculty:- Mr. Suryakant B. Borul

Sr. No.	Month	Name of Unit	Topics Names	Required Lecture	Total Lects.
1	July	A) Electronic displacements: B) Reactive Intermediates: C) Aliphatic Hydrocarbon:	Inductive effect, electromeric effect, Resonance & Hyperconjugation (Definition and Applications)	02	14
			Carbocations, Carbanions and Free radicals, their generation stability & reactions.	02	
			Alkanes- Methods of formation: i) Wurtz reaction and ii) Corey-House reaction, reactions i) Halogenation mechanism ii) Aromatisation.	03	
			Alkenes Method of formation mechanism- i) dehyhrogenation of alkyl halides (E_1 & E_2) ii) Dehydration of alcohols.	02	
			Reactions-Electrophilic and free radical addition of HX and X_2 (with mechanism)	01	
			Alkynes- Preparations from vicinal and germinal dihalides, Reaction-Hydrogenation.	02	
			Alkadienes:-Classification 1, 3-Butadiene- Preparation from cyclohexene, reactions-Addition of H_2, Br_2 & HBr	02	
2	July-Aug	**Aromatic Hydrocarbons** A) B) C) D)	Introduction, Nomenclature and Isomerism of Aromatic Compounds.	02	14
			Structure of Benzene of Benzene : Kekule structure and Molecular orbital structure.	02	
			Aromaticity and Huckel's rule Aromatic,	02	
			antiaromatic and non-aromatic system	02	
			Mechnism of Electrophilic Aromatic Substitution:- Nitration, Friedal Craft Alkylation and Acylation.	03	
			Nuclear and side chain halogenations, Birch reduction.	01	
			Orientation:- Effect of substituent group. Activating and deactivating group. Theory of reactivity and orientation on the basis of inductive and resonance effects (-CH_3, -OH, -NO_2 and –Cl group).	02	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
3	Aug	A] Periodic Properties:	Atomic and ionic radii. Types of atomic radii. Periodic trends in atomic and ionic radii. Ionization energy, electron affinity and electronegativity.	03	14
			Effect of ionization energy and electronegativity on different properties of elements namely metallic and non-metallic character, relative reactivity, oxidizing and reducing properties., Scales of electronegativity Pauling scale and Mulliken Scales. Electronegativity and partial ionic character of a covalent bond.	03	
		B] Ionic bonding:	Screening effect, screening constant and effective nuclear charge. Slater's rules for calcul. screening constant. Problems.	02	
			Definition of ionic bond, types of cations. Factors affecting ionic bond formation. Born Lande equation to cal. lattice energy. Born-Haber's cycle to determine lattice energy	03	
			Solvation and salvation energy, factors affecting salvation energy, Det^{n} of salvation energy. Solubility of ionic solids, lattice energy and salvation energy.	03	
4	Aug-Sept	Thermodynamics	Adiabatic and Isothermal processes. Work done in Adiabatic and isothermal processes, relationship between pressure, volume and temperature.	03	14
			First law of Thermodynamics and its limitations, Need of Second law.	02	
			Carnot's heat engine, derivation of expression for the work done and efficiency of Carnot's engine. Statements of Second law of thermodynamics.	03	
			Concept of Entropy, Physical significance of Entropy, Derivation of expression for the Entropy change for an ideal gas Entropy change for an ideal gas for isothermal, isobaric and isochoric processes,	03	
			Entropy of fusion, sublimation, vapourization, transition and its calculations. Entropy change as a criterion for spontaneity. Numericals.	03	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
5	Sept-Oct	A] S-Block element:	Comparative study of 1st and 2nd group elements with reference to electronic configuration, ionisation energy, oxidation states.	03	14
			Reactivity and flame colouration. Diagonal relationship between Li and Mg.	02	
		B] P-Block element:	Comparative study of 13th, 14th and 15th group elements with reference to electronic configuration,	03	
			ionisation energy, oxidation states. Concept of inert pair effect. Diagonal relationship between Be and Al. Structure of diamond and graphite.	03	
			Abnormal behaviour of nitrogen. Hydrides of boron-preparation (from BCl3 and NaBH4two), properties (action of heat, water, alkali and oxygen), structure and bonding in diborane. Carbides, types of carbides and fullerenes.	03	
6	Oct	A] Gaseous State:	Postulates of Kinetic theory of gases, Derivation of Kinetic gas equation.	02	14
			RMS, Average and Most probable velocities and their relationship. Maxwell-Boltzmann distribution law of molecular velocities (only qualitative treatment), Mean free path, collision number and collision diameter.	03	
			Deviation of real gases from ideal gas behavior. Vander waal's equation of state and its derivation for real gases.	02	
			Critical phenomenon, Andrew's experiment - isotherm of CO2. Critical state, critical constant, Pc, Vc and Tc in terms of Vanderwaal's constants 'a' and 'b'. Law of Corresponding state. Numericals.	03	
		B] Phase Rule:	Statement of phase rule, explanation of phase, number of Components and degree of freedom.	02	
			Application of phase rule to water and sulfur system.	02	

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Department of Chemistry

Teaching Plan Session-2017-18

B.Sc.-III[rd] Semester-V[th]

Name of Faculty:- Mr. Kamalakar K. Wavhal

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lect.
1	July	**Coordination Compounds-I:**	Important terms namely-molecular or addition compounds, double salts, complex ion, ligand, coordination number, central metal ion etc. Werner's theory of coordination and experimental evidences on the basis of conduction data and formation of AgCl precipitate in case of cobaltamines.	03	
			Sidgwick's electronic interpretation & its drawbacks. EAN rule. IUPAC rules for nomenclature of coordination. Structural linkage & coordination isomerism in complexes.	03	
			Geometrical isomerism in octahedral complexes of type Ma4b2, Ma4bc, Ma3b3, M(AA)2b2. Square planar complexes of type Ma2b2 and Ma2bc. Optical isomerism in octahedral complexes of type Ma2b2c2, Mabcdef, M(AA)3, M(AA)2b2	03	14
		B) Chelates:	Tetrahedral complexes of type Mabcd and M(AA)2. Optical isomerism in square planar complexes. VBT as applied to structure and bonding in complexes and Magnetic properties of complexes of 3d series elements. Limitations of VB theory.	03	
			Definition, classification & applications of chelates	02	
2	July-Aug	**A] Crystal Field Theory (CFT):**	Postulates of CFT, Crystal field splitting in octahedral, distorted octahedral, square planar tetrahedral complexes,	03	
			concept of CFSE, high spin and low spin complexes on the basis of $\Delta 0$ and pairing energy, distribution of electrons in t2g	03	
			orbitals in high spin and low spin octahedral complexes. Factor affecting magnitude of CF splitting in octahedral complexes.	02	14
		B] Electronic Spectra of Transition Metal Complexes	Introduction to spectra, selection rules for d-d transitions, spectroscopic terms-determination of ground term symbols for d1 to d10, spectra of d1 and d9 octahedral complexes,	03	
			Orgel diagram for d1 and d9 states, electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion. Spectrochemical series.	03	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Tot. Lect.
3	Aug	A] Heterocyclic compounds	Nomenclature, Pyrrole: Synthesis from acetylene, succinimide and furan, Basicity, acetaldehyde, acetone, ethylene oxide & CO_2.	02	
			Electrophilic substitution reactions (orientation) – nitration, sulphonation, acetylation and halogenation , Molecular orbital structure.	02	14
			Pyridine: Synthesis from acetylene and pentamethylene diamine hydrochloride, Basicity, Electrophilic substitution reactions (orientation) – nitration, sulphonation, Nucleophilic substitution reactions (orientation)- with NaNH2, C6H5Li and KOH.	03	
		B] Organometallic compounds::	Grignard reagents: Methyl magnesium bromide- Synthesis from methyl bromide (only reaction) Synthetic applications: Electrophilic substitution reactions-formation of alkanes, alkenes, higher alkynes and other organometallic compounds,	02	
			Nucleophilic substitution reactions- Reaction with aldehydes & ketones, ethylene oxide, acetyl chloride, methyl cyanide & CO_2.	02	
			Methyl lithium-Synthesis and reaction with water, formaldehyde, acetaldehyde, acetone, ethylene oxide and CO_2.	03	
4	Aug-Sept	A] Dyes:	Classification on the basis of structure and mode of application, Preparation and uses of Methyl orange,	03	
			Crystal violet, Phenolphthalein , Alizarin and Indigo.	02	
		B] Drugs:	Analgesic and antipyretics: Synthesis and uses of phenylbutazone. Sulpha drugs: Synthesis and uses of sulphanilamide and sulphadiazine.	03	
			Antimalarials: Synthesis of chloroquine from 4,7-dichloroquinoline and its uses.	02	
		C] Pesticides:	Insecticides:Synthesis and uses of malathion. Herbicides: Synthesis and uses of 2,4-dichloro phenoxy acetic acid (2,4-D)..	03	
			Fungicides: Synthesis and uses of thiram (tetramethyl thiuram disulphide	02	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lect.
5	Sept-Oct	Photochemistry	(i) Photochemical and thermal reactions. (ii) Lambert's law - Statement and derivation.	02	
			Beer's law - Statement and derivation. Reasons for deviation from Beer's law. (iii) Laws of photochemistry.	02	
			(iv) Quantum yield of photochemical reaction. Reasons for high and low quantum yield. Experimental determination of quantum yield. Photosensitized reaction.	02	
			(v) Kinetics of photochemical decomposition of HI. (vi) Fluorescence and Phosphorescence.	02	
			Selection rule for electronic transition. Internal conversion and inter-system crossing. Explanation of fluorescence and phosphorescence on the basis of Joblonski diagram	03	
			(vii) Chemiluminescence and Bioluminescence with examples. (viii) Numericals.	03	
6	Oct	Molecular Spectroscopy	(i) Electromagnetic radiation, characteristics of electromagnetic radiation in terms of wavelength, wave number, frequency and energy of photon. Spectrum of electromagnetic radiation. (ii) Types of spectra - Emission and absorption spectra, atomic and molecular spectra, line and band spectra	03	
			(iii) Translational, vibrational, rotational and electronic motion. The degree of freedom in each motion. (iv) Energy level diagram of a molecule indicating electronic, vibrational and rotational transitions. (v) Condition for pure rotational spectrum, selection rule for rotational transition.	02	
			Derivation of expression for moment of inertia of a diatomic rigid rotor. Isotope effect. Applications of microwave spectroscopy for the determination of moment of inertia and bonding. (vi) Condition for exhibiting vibrational spectra (i.e. IR active molecule),	03	
			selection rule for vibrational transition. Vibrational energy levels of a simple harmonic oscillator. Zero point energy, position of a spectral line. Determination of force constant of a covalent bond.	02	
			(v) Raman effect - Raman's spectrum of a molecule. Condition for exhibiting Raman spectrum (i.e. Raman active molecule), selection rule for rotational transitions.	02	
			Pure rotational spectrum of diatomic molecule, vibrational Raman spectrum of a diatomic molecule. (vii) Numericals.	02	

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Department of Chemistry

Teaching Plan Session-2017-18

B.Sc.-II[nd] Semester-III[rd]

Name of Faculty:-Mr. Shivshankar P. More

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total Lects
1	June-July	A] Aldehydes and Ketones:	Preparation of acetaldehyde from ethanol, ethylidene chloride and acetylene. Preparation of benzaldehyde from benzene (Gattermann-Koch reaction) and toluene.	02	14
			Preparation of acetone from isopropyl alcohol, isopropylidene chloride and propyne. Preparation of acetophenone from benzene and ethyl benzene.	02	
			Structure of carbonyl group, acidity of á-hydrogen in carbonyl compounds. Reactions of aldehydes &/or ketones: Cannizaro's,	02	
			Reformatsky, Perkin with mechanism, Mannich reaction, Benzoin and Aldol condensations. Clemmensen, Wolf-Kishner, MPV and LiAlH4 reductions.	02	
		B] Carboxylic acids:	Structure and reactivity of carboxylic groups. Acidity of carboxylic acids, effects of substituents on acids strength. Oxalic acid: Preparation from ethylene glycol and cyanogen. Reactions: Reaction with ethyl alcohol, ammonia, glycerol and action of heat. Lactic acid: Preparation from acetaldehyde and pyruvic acid.	02	
			Reactions: Reaction with ethanol,PCl_5, action of heat, oxidation and reduction. Benzoic acid: Preparation from toluene, benzyl alcohol, phenyl cyanide and benzamide.	02	
			Reactions: Reaction with ethanol, PCl_5 and ammonia. Salicylic acid: Preparation by Reimer-Tiemann reaction. Reactions: Reaction with CH_3COCl, CH_3OH and C_6H_5OH.	02	
2	July	A] Optical isomerism:	Element of symmetry, chirality, asymetric carbon atom, enantiomers, diastereoisomers,	02	14
			relative and absolute configurations, DL and RS nomenclature, racemisation and resolution.	02	
		B] Geometrical isomerism:	Cis-trans & *E-Z* nomenclature, Methods of structure determination.	03	
		C] Conformational isomerism:	Bayer's Strain theory and its limitations. Stability of cycloalkanes, conformational isomers of ethane	03	
			conformational isomers of, n-butane & cyclohexane, their energy level diagrams.	02	
			Newman & Sawhorse projection formulae.	02	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	
3	Aug	A] Covalent Bonding:	Molecular Orbital Theory. Postulates of MO theory. LCAO approximation. Formation of bonding and antibonding MOs. Rules for LCAO. MO energy level diagram. MO structure of homonuclear diatomic molecules of namely He_2, H_2, N_2 and O_2. Stability sequence of species of O2	03	14
		B] Metallic Bonding:	Paramagnetic nature of O2. MO structure of heteronuclear diatomic molecules viz. NO, HF &CO. properties of CO viz. – triple 15 16 bond, almost nonpolar nature, edonor & acceptor behaviour. Comparison of VB and MO theories.	03	
			Free electron theory and properties of metals such as electrical and thermal conduction, malleability, ductility and metallic lusture. VB theory or Resonance theory of metals. Band theory to explain nature of conductors, insulators and semiconductors.	03	
		C] VSEPR Theory:	Various rules under VSEPR theory to explain molecular geometry various rules- $BeCl_2$, BF_3, CH_4 , NH_4 + , PCl_5 , SF_6, IF_7, $SnCl_2$, NH_3, H_2O, SF_4,	03	
			Various rules under VSEPR theory to explain molecular geometry Limitations of VSEPR theory.	02	
4	Aug-Sept	Theory of Quantitative Inorganic Analysis	**(a) Introduction**:-Volumetric analysis, titrant, titrate, end point, equivalence point, indicator etc. Requirements of volumetric analysis. Definition of standard solution, primary standard substance.	02	14
		A] Volumetric Analysis:	Terms to express concentrations namely- molarity, normality, molality, mole fraction and percentage. **(b) Acid-Base titrations**:- Types of acid base titrations. pH variations during acid base titration. Acid base indicators. Choice of suitable indicators for different acid base titrations.	02	
			(c) Redox Titrations:-Pinciples involved in redox titrations. Brief idea about use of $KMnO_4$, $K_2Cr_2O_7$as oxidants in acidic medium in redox titrations.	02	
			Use of I_2 in iodometry & iodimetry. Redox indicators-external & internal indicators. iodometric estimation of Cu (II).	02	
		B] Gravimetric Analysis:	Definition. Theoretical principles underlying various steps involved in gravimetric analysis with reference to estimation of barium as $BaSO_4$	04	
			Coprecipitation and post precipitation	02	

Requ. To Lect. Lect.	No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
	5	Sept	A) Liquid State:-	Surface tension – Determination and its S.I. unit, Effect of temperature on surface tension, Derivation of expression for relative surface tension by Drop number method. Application of surface tension.	02	
				Viscosity- Determination and its S.I. unit, Effect of temperature on viscosity, derivation of expression for relative viscosity by Ostwald's viscometer method. Application of viscosity.	02	
			B) Electrochemistry:	Conductance of electrolyte solutions. Specific, equivalent & molar conductance. Detn of conductance of electrolyte soln.	02	14
				Variation of specific and equivalent Conductance with dilution for strong electrolyte Conductometric titrations, Application of Conductometric titrations.	02	
				Migration of ions under the influence of electric field. Transport number of ions. Determ. of Transport number of ions by Hottorf's method & Moving boundary method.	02	
				Kohlrausch's law of independent migration of ions. Determ^{n} of $\lambda\infty$ & degree of α dissociation of a week elect.	02	
				Determination of constant of a week electrolyte. Numerical.	02	
	6	Oct	A) Thermodynamics and Equilibrium:	Definition and physical significance of Helmholtz work function (A) and Gibbs free energy. Change in free energy (ΔG) as a criteria of spontaneity and equilibrium.	02	
				Variation of free energy G with 'P' & 'T'. Gibbs-Helmholtz equation in terms of G and its applications.	02	
				Partial molal function, chemical potential, derivations of Gibb's-Duhem equation. Chemical potential of an ideal gas in gaseous mixture.	03	
				Derivation of Gibbs-Duhem equation. Derivation of Van't Hoff reaction of isotherm & its application to equil. state.	02	14
			B) Phase Equilibrium:	Derivation of Van't Hoff equn & its applications. Numericals.	01	
				Immiscible liquids, Nerst distribution law and its application to association and dissociation of solute in one of the solvent Process of extraction, derivation of formula for the amount of solute left unextracted after nth extraction.	02	
				Phase transition- Clausius-clyperon. Partially miscible liquids- Phase diagram of phenol-water, triethyl amine-water & nicotine–water systems. Numerical.	02	

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Department of Chemistry

Teaching Plan Session-2017-18

B.Sc.-Ist Semester-IInd

Name of Faculty:- Prof. Suryakant B. Borul

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
1	Dec-Jan	A] Alkyl Halides:	Introduction, Synthe sis of vinyl chloride from acetylene and allyl chloride from propylene,	02	14
			Reactions of both with aqueous and alcoholic KOH, Comparison of reactivity of vinyl an allyl chloride.	02	
		B] Aryl Halides:	Synthesis chlorobenzene from benzene, phenol and benzene diazonium chloride, Synthesis of benzyl chloride from toluene and benzyl alcohol,	02	
			Reactions of both with aqueous KOH, NH_3 and sodium ethoxide, Comparison of reactivity of chlorobenzene and benzyl chloride. Benzyne intermediate mechanism.	02	
		C] Alcohols:	Dihydric alcohols: Ethylene glycol- Preparation from ethylene, ethylene chloride and ethylene oxide,	02	
			R eactions- with Na, PCl5 , CH3COOH, ZnCl2, conc. H2SO4 and dehydration with heat. Trihydric alcohols: Glycerol- Preparation from propylene,	02	
			Reactions- with Na, HCl, PCl5, HNO3 and KHSO4. Pinacol- pinacolone rearrangement (mechanism).	02	
2	Jan	A] Phenols:	Introduction, Methods of formations a) from aniline b) from Cumene. Acidic character,	02	14
			Reaction of Phenols- a) Carboxylation (Kolb's reaction), b) Fries Rearrangement,	02	
			c) Claisen Rearrengement d) Reimer-Tiemann reaction.	02	
		B] Ethers:	Introduction, Diethyl ether- Preparation by Williamson's synthesis and continuous etherification process,	02	
			Reactions-with cold and hot HI	02	
		C] Epoxides:	Introduction, Synthesis of ethylene oxide from ethylene and styrene oxide from styrene.	02	
			Ring opening reactions of both catalyzed by acid and alkali.	02	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	To Lec
3	Jan-Feb	**Chemical Kinetics**	Explanation of terms like rate of reaction, order of a reaction and molecularity. Definition zero, first and second order reaction. Half life period of a reaction.	02	14
			Derivation of rate equation for first and second order reaction with equal initial concentration and different initial concentration of a reactant. Characteristics of first and second order reaction.	03	
			Examples of first and second order reaction viz. the reactions (i) decomposition of H_2O_2, (ii) reaction between $K_2S_2O_8$ and KI,	03	
			(iii) Hydrolysis of methyl acetate catalyzed by acid, (iv) saponification of ethyl acetate by NaOH and (v) inversion of cane sugar. Determination of order of a reaction by integration, graphical, equifractional change, etc. method.	03	
			Effect of temperature on reaction rates. Arrhenius equation, activation energy and its determination using Arrhenius equation. Numericals.	03	
4	Feb	**UNIT-I** **A] Polarisation-** **B] Covalent bonding-** **C] Intermolecular forces-** **D] Acids and Base-**	Defn, polarising power, polarizability. Effect of polarization on nature of bond. Fajan's rules of polarisation & its applications.	02	14
			Directional nature of covalent bond. Hybridization, types of hybridization to explain geometries of NH^{4+} ion, PCl_5, SF_6 & IF_7.	02	
			Dipole-dipole, dipole-induced-dipole, induced dipole-induced dipole interactions. Ion - dipole interactions.	03	
			Theory of solvent sys. & Lux-Flood concept of acids & bases.	03	
			Hard and soft acids and bases. Pearsons HSAB principle with imp applications.	04	

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5	Feb-March	A]Electrical Properties:	(i) Polar and non-polar molecules. Dipole moment. (ii) Induced polarization & orientation polarization. Clausius-Mossotti equation	03	
			(iii) Measurement of dipole moment by temperature and refractivity methods.	01	
			(iv)Applications of dipole moment for the determination of molecular structure. i.e. percentage ionic character of covalent bonding, molecular geometry, cis-trans isomers, ortho, meta and para isomers of a disubstituted benzene.	03	
		B]Magnetic Properties:	(i) Paramagnetic and diamagnetic substances, origin of paramagnetism, diamagnetism, ferromagnetism and antiferromagnetism.(ii) Volume, specific, mass and molar susceptibility. Relationship between.	03	
			(iii) Relationship between magnetic moment and number of unpaired electrons. (iv) Gouy's balance method for determination of magnetic susceptibility.	02	
			(v) Application of magnetic moment in the determination of molecular structure.(vi) Numericals.	02	
6	March	A] P-Block Elements-	Comparative study of 16^{th} and 17^{th} group elements with reference to electronic configuration,	02	14
			Ionisation energy & oxidation states. Oxidising properties of halogens with reference to oxidation potential.	02	
		B] Noble Gases-	Basic properties of halogens with special reference to iodine. Interhalogen compounds. Introduction to fluorocarbons.	02	
			Inertness of noble gases. Compounds of noble gases-only str. & bonding in XeF_2, XeF_4, $XeOF_4$, XeO_2F_2 XeO_3 and XeO_4	02	
		C] Non-aqueous Solvents-	Requirements of a good solvent. Water as a universal solv. Physical prop of solvents namely liq. range, dielectric constant, dipole moment, heat of vaporisation & solubility behaviour.	02	
			Classification of solvents. Reactions in liquid ammonia acid base, precipitation, redox, solvolysis	02	
			solutions of metals in liquid ammonia.	02	

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Teaching Plan Session-2017-18

B.Sc.-II[nd] Semester-IV[th]

Name of Faculty:- Mr. Shivshankar P. More

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total
1	Dec-Jan	Colligative Properties of Dilute Solutions:	(i) Defination and examples of colligative properties.	02	14
			(ii Elevation of boiling point, thermodynamic derivation o the relationship between elevation of boiling point and molar mass of a non-volatile solute.	02	
			Cotrell's method for determination of elevation of boiling point.	02	
			(iii) Depression of freezing point, thermodynamic derivation of the relationship between depression of freezing point and molar mass of a non-volatile solute.	02	
			Rast's method for determination of depression of freezing point.	02	
			(iv) Abnormal behavior of solution. Van't Hoff's factor 'i'.	02	
			Determination of degree of association and dissociation from Van't Hoff's factor.(v) Numerical.	02	
2	Jan	Crystalline state	Symmetry in crystal, plane of symmetry, axis of symmetry and point of symmetry. Law of constancy of interfacial angles.	02	14
			Elements of symmetry in cubic crystals. Laws of symmetry. Law of rational indices, Weiss and Miller indices of a lattice planes, calculation of interplaner distance d(h,k,l) from Miller indices in a cubic system.	02	
			Seven crystal systems and fourteen Bravais lattices, Bravais lattices of cubic system. Simple cubic system (S.C.C.), body centered cubic system (B.C.C.) and face centered cubic system (F.C.C.).	02	
			Calculation of number of constituent units in S.C.C., B.C.C. and F.C.C.	02	
			Ratio of interplaner distances for 100, 110 and 111 lattice plane in S.C.C., B.C.C. and F.C.C.	02	
			Derivation of Bragg's equation for X-ray diffraction, Bragg's X-ray spectrometer method for the determination of crystal structure of NaCl and KCl.	02	
			Anomalous behaviour of KCl towards X-ray. Numericals.	02	

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3	Jan-Feb	A] Chemistry of elements of transition serits:	Definition of transition elements. General characteristics of transition elements. Comparative study of first transition series elements (3d) with reference to following properties: (i) Electronic configuration	02	14
			(ii) Atomic and ionic size (iii) Ionization energy (iv) Metallic nature (v) Oxidation states (vi) Magnetic properties (vii) Color of salts (viii) Catalytic properties (ix) Complex formation behaviour.	03	
			Study of 4d and 5d series elements-Electronic configuration.	03	
		B] Extraction of elements:	Comparison of 3d series elements with 4d and 5dseries elements with respect to size, oxidation states, magnetic properties and color.	03	
			Principles involved in extraction of elements. Major methods of extraction of elements. Factors affecting choice of extraction method. Thermodynamics of reduction processes-Ellingham diagrams for oxides and importance of this diagram	03	
4	Feb	A] Inner transition elements:	Definition, Lanthanides and Actinides. Comparative study of Lanthanides with respect to following properties:(i) Electronic configuration	02	14
			(ii) Atomic and ionic radii lanthanide contraction definition, cause and effect of lanthanide contraction	02	
			(iii) Oxidation states (iv) Magnetic properties	02	
			(v) Color of salts vi) Complex formation behavior.	02	
		B] General Principles of Metallurgy:	Occurrence of lanthanides. Isolation of lanthanides by ion exchange method. Actinides- Electronic configuration and oxidation states. Comparison of lanthanides and actinides.	03	
			Definition of metallurgy, steps in metallurgy. Ore dressing by gravity separation, froath floatation and electromagnetic separation. Calcinations, roasting, smelting and refining of metals. Meaning of termshydrometallurgy and pyrometallurgy.	03	

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5	Feb-March	A] Aromatic nitro compounds: B] Amino Compounds: C] Diazonium Salts: D] Amino acids and Proteins:	Nitrobenzene: Synthesis from benzene, Reduction of nitrobenzene in acidic, neutral and alkaline medium.	03	14
			Basicity and effect of substituents. Methods of preparation of aniline from nitrobenzene, Reactions: with acetyl and benzoyl chlorides, Br2(aq) and Br2(CS2),	02	
			Carbylamine reaction, alkylation,Hoffmann's exhaustive methylation and its mechanism.	02	
			Preparation benzene diazonium chloride, Synthetic applications- Preparation of benzene,phenol, halobenzene,nitrobenzene,benzonitrile, coupling with phenol and aniline.	03	
			Classification, Strecker and Gabrial phthalimide synthesis, Zwitterion structure, Isoelectric point,	02	
			peptide synthesis, Structure determination of polypeptides by end group analysis.	02	
6	March	A] Polynuclear hydrocarbons: B] Reactive methylene compounds: C] Carbohydrates:	Naphthalene - Haworth synthesis,orbital picture, Reactions – electrophilic substitution	02	14
			Preparation of naphthols from naphthalene sulphonic acids and naphthylamines from naphthols.	02	
			Malonic Ester: Synthesis from acetic acid, Synthetic applications- Synthesis of acetic acid , succinic acid, glutaric acid, crotonic acid and malonyl urea.	03	
			Acetoacetic ester: Synthesis from ethyl acetate, Synthetic applications- Synthesis of acetic acid, propionic acid, isobutyric acid, succinic acid, glutaric acid, crotonic acid, acetyl acetone and 4-methyl uracil.	03	
			Constitution of glucose, cyclic structure, Pyranose and Furanose structure, Epimerization, conversion of glucose to fructose and vice-versa,	02	
			Introduction to fructose, ribose, 2- deoxyribose, maltose, sucrose. (their structures only determination not needed).	02	

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Department of Chemistry

Teaching Plan Session-2017-18

B.Sc.-IIIrdSemester-VIth

Name of Faculty:- Wavhal Kamalakar K.

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total Lects.
1	Dec-Jan	A) Kinetic Aspects of Metal Complexes:	Types of reactions of coordination compounds. Brief idea about substitution reactions. SN1 dissociative and SN2 associative mechanism of substitution in octahedral complexes. Labile and inert complexes.	03	14
		B) Analytical Chemistry:	Factors affecting lability of complexes viz. arrangement of d-electrons (VB theory),. Mechanism of substitution reactions in square planar complexes.	03	
		1. Colorimetry Spectrophotometry	Concept of □max. Beer-Lambert's law Verification of Beer's law. Block diagrams of colorimeter and spectrophotometer	02	
		2. Paper Chromatography	Difference between colorimeter and spectrophotometer. Application of colorimetric &spectrophotometric technique for determination of concentration of metal.	02	
			Definition and classification of chromatography. Principle of ifferential migration.	02	
			Principle and technique of paper chromatography, Rf value and factors affecting Rf value	02	
2	Jan	A] Organometallic Chemistry :	Definition, nomenclature and classification of organometallic compounds. Metal carbonyls- definition and classification.	02	14
			Preparation, properties, structure and bonding in $Ni(CO)_4$, $Fe(CO)_5$, $Cr(CO)_6$. Nature of M-C bond in metal carbonyls.	03	
			Definition and classification. Silicones: preparation, properties structure and bonding and applications.	03	
		B] Inorganic Polymers:	Phosphonitrile halides polymers- preparation, properties, structure and bonding in cyclic polymers.	02	
			Essential and trace elements in biological processes.	02	
		C] Bio-inorganic Chemistry	Biological role of Na+, K+, Ca2+ and Mg2+ ions. Metalloporphyrins- Haemoglobin and Myoglobin and their role in oxygen transport.	02	

Chem Dept. 2018-19

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total Lects.
3	Jan-Feb	A) Electronic Spectroscopy :	Introduction, radiation source, spectral range, types of electronic transitions, chromophore, auxochrome, bathochromic, hypsochromic,	02	14
			Hyperchromic and hypochromic effects. Applications to the structure determination of compounds like dines, aldehydes, ketones & aromatic systems.	03	
		B) Infrared Spectroscopy	Types of vibrational modes, stretching and bending, spectrum range, radiation source, presentation of IR spectrum, characteristic frequencies of various groups,	03	
		C) Purification of Organic Compounds:	Finger print region. Structure of organic compounds (IR spectra of simple compounds: H_2O, CO_2, CH□CH, CH_3COCH_3).	02	
			Sublimation, crystallization.	02	
			Paper chromatography: Principle and Rf value.	02	
4	Feb	Unit IV : A) Nuclear Magnetic Resonance Spectroscopy :	Introduction, spin quantum number, instrumentation, Aspects of NMR- number of signals(equivalent & non-equivalent protons),	03	14
			Positions of signals(chemical shift), intensities of signals,	02	
			Splitting of signals (spin-spin coupling), coupling constant, and applications.	03	
		B)- Mass Spectrometry:	Introduction, theory, instrumentation-(ion sources),	02	
			Mass spectra of neopentane and methanol, molecular ion peak, base peak, metastable peak,	02	
			Rules of fragmentation, applications.	02	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total Lects.
5	Feb-March	A] Electrochemistry:	(i) Types of electrode - Standard hydrogen electrode, Calomel electrode, Quinhydrone electrode and Glass electrode. Principle of Potentiometric titration. Study of acid-base, redox and precipitation titration.	02	14
			(ii) pH of a solution and pH scale. Determination of pH of a solution using hydrogen, quinhydrone and glass electrodes. Advantage and disadvantage of these electrodes. pH-metric titrations. Determination of pka of a weak acid by pH-metric measurement.	02	
			(iii) Concentration cells - Types of concentration cells, concentration cell without transfer and determination of its emf. (iv) Numericals	02	
			(i) Shell model of a nucleus - Assumptions, evidences for existence of magic numbers, advantages and limitations. (ii) Liquid drop model of a nucleus - Assumptions, similarities between nucleus and liquid drop, advantages and limitations, explanation of nuclear fission reaction on the basis of liquid	02	

			drop model.		
		B] Nuclear Chemistry:	(iii) Nuclear force and its explanation on the basis of Meson theory. (iv) Characteristics of nuclear reaction, difference between nuclear and chemical reactions. Calculation of Q value of a nuclear reaction. (v) Characteristics of nuclear fission reaction, fission yield. Fission reaction as an alternative source of energy.	02	
			vi) Nuclear fusion reaction - Characteristic of a nuclear fusion reaction. Thermonuclear reactions as a source of energy of sun and other stars. Fusion reactions as a potential future source of energy.	02	
			vii) Applications of radio isotopes in industry, agriculture, medicines and bio-sciences with two examples each. (viii) Numericals.	02	
6	March	**Elementary Quantum Mechanics**	(i) Limitations of classical mechanics. Plank's quantum theory (postulates only)	02	
			Photoelectric effect - Experiments, observation and Einstein's explanation. Compton effect and its explanation. (ii) de Broglie hypothesis of matter waves	03	
			De-Broglie's equation. Heisenberg's uncertainty principle. (iii) Classical wave equation, derivation of time independent Schrodinger's wave equation in one-dimension and its extension to a three-dimensional space.	02	14
			Well behaved wave function, physical significance of wave function (Born interpretation).	02	
			(iv) Application of Schrodinger wave equation to a particle in one-dimensional box & its extension to a three-dimensional box.	03	
			Concept of atomic orbital. (v) Numericals	02	

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Department of Chemistry

Teaching Plan Session-2018-19

B.Sc.-Ist Semester-Ist

Name of Faculty:- Mr. Suryakant B. Borul

Sr. No.	Month	Name of Unit	Topics Names	Required Lecture	Total Lects.
1	July	A) Electronic displacements: B) Reactive Intermediates: C) Aliphatic Hydrocarbon:	Inductive effect, electromeric effect, Resonance & Hyperconjugation (Definition and Applications)	02	14
			Carbocations, Carbanions and Free radicals, their generation stability & reactions.	02	
			Alkanes- Methods of formation: i) Wurtz reaction and ii) Corey-House reaction, reactions i) Halogenation mechanism ii) Aromatisation.	03	
			Alkenes Method of formation mechanism- i) dehyhrogenation of alkyl halides (E_1 & E_2) ii) Dehydration of alcohols.	02	
			Reactions-Electrophilic and free radical addition of HX and X_2 (with mechanism)	01	
			Alkynes- Preparations from vicinal and germinal dihalides, Reaction-Hydrogenation.	02	
			Alkadienes:-Classification 1, 3-Butadiene- Preparation from cyclohexene, reactions-Addition of H_2, Br_2 & HBr	02	
2	July-Aug	Aromatic Hydrocarbons A) B) C) D)	Introduction, Nomenclature and Isomerism of Aromatic Compounds.	02	14
			Structure of Benzene of Benzene : Kekule structure and Molecular orbital structure.	02	
			Aromaticity and Huckel's rule Aromatic,	02	
			antiaromatic and non-aromatic system	02	
			Mechnism of Electrophilic Aromatic Substitution:- Nitration, Friedal Craft Alkylation and Acylation.	03	
			Nuclear and side chain halogenations, Birch reduction.	01	
			Orientation:- Effect of substituent group. Activating and deactivating group. Theory of reactivity and orientation on the basis of inductive and resonance effects (-CH_3, -OH, -NO_2 and –Cl group).	02	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
3	Aug	A] Periodic Properties:	Atomic and ionic radii. Types of atomic radii. Periodic trends in atomic and ionic radii. Ionization energy, electron affinity and electronegativity.	03	14
			Effect of ionization energy and electronegativity on different properties of elements namely metallic and non-metallic character, relative reactivity, oxidizing and reducing properties., Scales of electronegativity Pauling scale and Mulliken Scales. Electronegativity and partial ionic character of a covalent bond.	03	
		B] Ionic bonding:	Screening effect, screening constant and effective nuclear charge. Slater's rules for calcul. screening constant. Problems.	02	
			Definition of ionic bond, types of cations. Factors affecting ionic bond formation. Born Lande equation to cal. lattice energy. Born-Haber's cycle to determine lattice energy	03	
			Solvation and salvation energy, factors affecting salvation energy, Det^{n} of salvation energy. Solubility of ionic solids, lattice energy and salvation energy.	03	
4	Aug-Sept	Thermodynamics	Adiabatic and Isothermal processes. Work done in Adiabatic and isothermal processes, relationship between pressure, volume and temperature.	03	14
			First law of Thermodynamics and its limitations, Need of Second law.	02	
			Carnot's heat engine, derivation of expression for the work done and efficiency of Carnot's engine. Statements of Second law of thermodynamics.	03	
			Concept of Entropy, Physical significance of Entropy, Derivation of expression for the Entropy change for an ideal gas Entropy change for an ideal gas for isothermal, isobaric and isochoric processes,	03	
			Entropy of fusion, sublimation, vapourization, transition and its calculations. Entropy change as a criterion for spontaneity. Numericals.	03	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
5	Sept-Oct	A] S-Block element:	Comparative study of 1st and 2nd group elements with reference to electronic configuration, ionisation energy, oxidation states.	03	14
			Reactivity and flame colouration. Diagonal relationship between Li and Mg.	02	
		B] P-Block element:	Comparative study of 13th, 14th and 15th group elements with reference to electronic configuration,	03	
			ionisation energy, oxidation states. Concept of inert pair effect. Diagonal relationship between Be and Al. Structure of diamond and graphite.	03	
			Abnormal behaviour of nitrogen. Hydrides of boron-preparation (from BCl3 and NaBH4two), properties (action of heat, water, alkali and oxygen), structure and bonding in diborane. Carbides, types of carbides and fullerenes.	03	
6	Oct	A] Gaseous State:	Postulates of Kinetic theory of gases, Derivation of Kinetic gas equation.	02	14
			RMS, Average and Most probable velocities and their relationship. Maxwell-Boltzmann distribution law of molecular velocities (only qualitative treatment), Mean free path, collision number and collision diameter.	03	
			Deviation of real gases from ideal gas behavior. Vander waal's equation of state and its derivation for real gases.	02	
			Critical phenomenon, Andrew's experiment - isotherm of CO2. Critical state, critical constant, Pc, Vc and Tc in terms of Vanderwaal's constants 'a' and 'b'. Law of Corresponding state. Numericals.	03	
		B] Phase Rule:	Statement of phase rule, explanation of phase, number of Components and degree of freedom.	02	
			Application of phase rule to water and sulfur system.	02	

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Teaching Plan Session-2018-19

B.Sc.-II[nd] Semester-III[rd]

Name of Faculty:-Mr. Shivshankar P. More

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total Lects
1	June-July	A] Aldehydes and Ketones:	Preparation of acetaldehyde from ethanol, ethylidene chloride and acetylene. Preparation of benzaldehyde from benzene (Gattermann-Koch reaction) and toluene.	02	14
			Preparation of acetone from isopropyl alcohol, isopropylidene chloride and propyne. Preparation of acetophenone from benzene and ethyl benzene.	02	
			Structure of carbonyl group, acidity of á-hydrogen in carbonyl compounds. Reactions of aldehydes &/or ketones: Cannizaro's,	02	
			Reformatsky, Perkin with mechanism, Mannich reaction, Benzoin and Aldol condensations. Clemmensen, Wolf-Kishner, MPV and LiAlH4 reductions.	02	
		B] Carboxylic acids:	Structure and reactivity of carboxylic groups. Acidity of carboxylic acids, effects of substituents on acids strength. Oxalic acid: Preparation from ethylene glycol and cyanogen. Reactions: Reaction with ethyl alcohol, ammonia, glycerol and action of heat. Lactic acid: Preparation from acetaldehyde and pyruvic acid.	02	
			Reactions: Reaction with ethanol,PCl_5, action of heat, oxidation and reduction. Benzoic acid: Preparation from toluene, benzyl alcohol, phenyl cyanide and benzamide.	02	
			Reactions: Reaction with ethanol, PCl_5 and ammonia. Salicylic acid: Preparation by Reimer-Tiemann reaction. Reactions: Reaction with CH_3COCl, CH_3OH and C_6H_5OH.	02	
2	July	A] Optical isomerism:	Element of symmetry, chirality, asymetric carbon atom, enantiomers, diastereoisomers,	02	14
			relative and absolute configurations, DL and RS nomenclature, racemisation and resolution.	02	
		B] Geometrical isomerism:	Cis-trans & *E-Z* nomenclature, Methods of structure determination.	03	
		C] Conformational isomerism:	Bayer's Strain theory and its limitations. Stability of cycloalkanes, conformational isomers of ethane	03	
			conformational isomers of, n-butane & cyclohexane, their energy level diagrams.	02	
			Newman & Sawhorse projection formulae.	02	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects
3	Aug	A] Covalent Bonding:	Molecular Orbital Theory. Postulates of MO theory. LCAO approximation. Formation of bonding and antibonding MOs. Rules for LCAO. MO energy level diagram. MO structure of homonuclear diatomic molecules of namely He_2, H_2, N_2 and O_2. Stability sequence of species of O2	03	14
		B] Metallic Bonding:	Paramagnetic nature of O2. MO structure of heteronuclear diatomic molecules viz. NO, HF &CO. properties of CO viz. – triple 15 16 bond, almost nonpolar nature, edonor & acceptor behaviour. Comparison of VB and MO theories.	03	
			Free electron theory and properties of metals such as electrical and thermal conduction, malleability, ductility and metallic lusture. VB theory or Resonance theory of metals. Band theory to explain nature of conductors, insulators and semiconductors.	03	
		C] VSEPR Theory:	Various rules under VSEPR theory to explain molecular geometry various rules- $BeCl_2$, BF_3, CH_4 , NH_4 + , PCl_5 , SF_6, IF_7, $SnCl_2$, NH_3, H_2O, SF_4,	03	
			Various rules under VSEPR theory to explain molecular geometry Limitations of VSEPR theory.	02	
4	Aug-Sept	Theory of Quantitative Inorganic Analysis	**(a) Introduction**:-Volumetric analysis, titrant, titrate, end point, equivalence point, indicator etc. Requirements of volumetric analysis. Definition of standard solution, primary standard substance.	02	14
		A] Volumetric Analysis:	Terms to express concentrations namely- molarity, normality, molality, mole fraction and percentage. **(b) Acid-Base titrations**:- Types of acid base titrations. pH variations during acid base titration. Acid base indicators. Choice of suitable indicators for different acid base titrations.	02	
			(c) Redox Titrations:-Pinciples involved in redox titrations. Brief idea about use of $KMnO_4$, $K_2Cr_2O_7$as oxidants in acidic medium in redox titrations.	02	
			Use of I_2 in iodometry & iodimetry. Redox indicators-external & internal indicators. iodometric estimation of Cu (II).	02	
		B] Gravimetric Analysis:	Definition. Theoretical principles underlying various steps involved in gravimetric analysis with reference to estimation of barium as $BaSO_4$	04	
			Coprecipitation and post precipitation	02	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
5	Sept-Oct	A] S-Block element:	Comparative study of 1st and 2nd group elements with reference to electronic configuration, ionisation energy, oxidation states.	03	14
			Reactivity and flame colouration. Diagonal relationship between Li and Mg.	02	
		B] P-Block element:	Comparative study of 13th, 14th and 15th group elements with reference to electronic configuration,	03	
			ionisation energy, oxidation states. Concept of inert pair effect. Diagonal relationship between Be and Al. Structure of diamond and graphite.	03	
			Abnormal behaviour of nitrogen. Hydrides of boron-preparation (from BCl3 and NaBH4two), properties (action of heat, water, alkali and oxygen), structure and bonding in diborane. Carbides, types of carbides and fullerenes.	03	
6	Oct	A] Gaseous State:	Postulates of Kinetic theory of gases, Derivation of Kinetic gas equation.	02	14
			RMS, Average and Most probable velocities and their relationship. Maxwell-Boltzmann distribution law of molecular velocities (only qualitative treatment), Mean free path, collision number and collision diameter.	03	
			Deviation of real gases from ideal gas behavior. Vander waal's equation of state and its derivation for real gases.	02	
			Critical phenomenon, Andrew's experiment - isotherm of CO2. Critical state, critical constant, Pc, Vc and Tc in terms of Vanderwaal's constants 'a' and 'b'. Law of Corresponding state. Numericals.	03	
		B] Phase Rule:	Statement of phase rule, explanation of phase, number of Components and degree of freedom.	02	
			Application of phase rule to water and sulfur system.	02	

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Department of Chemistry

Teaching Plan Session-2018-19

B.Sc.-IIIrd Semester-Vth

Name of Faculty:- Mr. Kamalakar K. Wavhal

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lect.
1	July	Coordination Compounds-I:	Important terms namely-molecular or addition compounds, double salts, complex ion, ligand, coordination number, central metal ion etc. Werner's theory of coordination and experimental evidences on the basis of conduction data and formation of AgCl precipitate in case of cobaltamines.	03	
			Sidgwick's electronic interpretation & its drawbacks. EAN rule. IUPAC rules for nomenclature of coordination. Structural linkage & coordination isomerism in complexes.	03	
			Geometrical isomerism in octahedral complexes of type Ma4b2, Ma4bc, Ma3b3, M(AA)2b2. Square planar complexes of type Ma2b2 and Ma2bc. Optical isomerism in octahedral complexes of type Ma2b2c2, Mabcdef, M(AA)3, M(AA)2b2	03	14
		B) Chelates:	Tetrahedral complexes of type Mabcd and M(AA)2. Optical isomerism in square planar complexes. VBT as applied to structure and bonding in complexes and Magnetic properties of complexes of 3d series elements. Limitations of VB theory.	03	
			Definition, classification & applications of chelates	02	
2	July-Aug	A] Crystal Field Theory (CFT):	Postulates of CFT, Crystal field splitting in octahedral, distorted octahedral, square planar tetrahedral complexes,	03	
			concept of CFSE, high spin and low spin complexes on the basis of $\Delta 0$ and pairing energy, distribution of electrons in t2g	03	
			orbitals in high spin and low spin octahedral complexes. Factor affecting magnitude of CF splitting in octahedral complexes.	02	14
		B] Electronic Spectra of Transition Metal Complexes	Introduction to spectra, selection rules for d-d transitions, spectroscopic terms-determination of ground term symbols for d1 to d10, spectra of d1 and d9 octahedral complexes,	03	
			Orgel diagram for d1 and d9 states, electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion. Spectrochemical series.	03	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lect.
		B] Drugs:	Analgesic and antipyretics: Synthesis and uses of phenylbutazone. Sulpha drugs: Synthesis and uses of sulphanilamide and sulphadiazine.	03	
			Antimalarials: Synthesis of chloroquine from 4,7-dichloroquinoline and its uses.	02	
		C] Pesticides:	Insecticides:Synthesis and uses of malathion. Herbicides: Synthesis and uses of 2,4-dichloro phenoxy acetic acid (2,4-D)..	03	
			Fungicides: Synthesis and uses of thiram (tetramethyl thiuram disulphide	02	
5	**Sept-Oct**	**Photochemistry**	(i) Photochemical and thermal reactions. (ii) Lambert's law - Statement and derivation.	02	
			Beer's law - Statement and derivation. Reasons for deviation from Beer's law. (iii) Laws of photochemistry.	02	
			(iv) Quantum yield of photochemical reaction. Reasons for high and low quantum yield. Experimental determination of quantum yield. Photosensitized reaction.	02	
			(v) Kinetics of photochemical decomposition of HI. (vi) Fluorescence and Phosphorescence.	02	
			Selection rule for electronic transition. Internal conversion and inter-system crossing. Explanation of fluorescence and phosphorescence on the basis of Joblonski diagram	03	
			(vii) Chemiluminescence and Bioluminescence with examples. (viii) Numericals.	03	

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6	**Sept-Oct**	**Molecular Spectroscopy**	(i) Electromagnetic radiation, characteristics of electromagnetic radiation in terms of wavelength, wave number, frequency and energy of photon. Spectrum of electromagnetic radiation. (ii) Types of spectra - Emission and absorption spectra, atomic and molecular spectra, line and band spectra	03	
			(iii) Translational, vibrational, rotational and electronic motion. The degree of freedom in each motion. (iv) Energy level diagram of a molecule indicating electronic, vibrational and rotational transitions. (v) Condition for pure rotational spectrum, selection rule for rotational transition.	02	
			Derivation of expression for moment of inertia of a diatomic rigid rotor. Isotope effect. Applications of microwave spectroscopy for the determination of moment of inertia and bonding. (vi) Condition for exhibiting vibrational spectra (i.e. IR active molecule),	03	
			selection rule for vibrational transition. Vibrational energy levels of a simple harmonic oscillator. Zero point energy, position of a spectral line. Determination of force constant of a covalent bond.	02	
			(v) Raman effect - Raman's spectrum of a molecule. Condition for exhibiting Raman spectrum (i.e. Raman active molecule), selection rule for rotational transitions.	02	
			Pure rotational spectrum of diatomic molecule, vibrational Raman spectrum of a diatomic molecule. (vii) Numericals.	02	

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Department of Chemistry

Teaching Plan Session-2018-19

B.Sc.-Ist Semester-IInd

Name of Faculty:- Prof. Suryakant B. Borul

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
1	Dec-18 Jan-19	A] Alkyl Halides:	Introduction, Synthesis of vinyl chloride from acetylene and allyl chloride from propylene,	02	14
			Reactions of both with aqueous and alcoholic KOH, Comparison of reactivity of vinyl an allyl chloride.	02	
		B] Aryl Halides:	Synthesis chlorobenzene from benzene, phenol and benzene diazonium chloride, Synthesis of benzyl chloride from toluene and benzyl alcohol,	02	
			Reactions of both with aqueous KOH, NH_3 and sodium ethoxide, Comparison of reactivity of chlorobenzene and benzyl chloride. Benzyne intermediate mechanism.	02	
		C] Alcohols:	Dihydric alcohols: Ethylene glycol- Preparation from ethylene, ethylene chloride and ethylene oxide,	02	
			R eactions- with Na, PCl5 , CH3COOH, ZnCl2, conc. H2SO4 and dehydration with heat. Trihydric alcohols: Glycerol- Preparation from propylene,	02	
			Reactions- with Na, HCl, PCl5, HNO3 and KHSO4. Pinacol- pinacolone rearrangement (mechanism).	02	
2	Jan	A] Phenols:	Introduction, Methods of formations a) from aniline b) from Cumene. Acidic character,	02	14
			Reaction of Phenols- a) Carboxylation (Kolb's reaction), b) Fries Rearrangement,	02	
			c) Claisen Rearrengement d) Reimer-Tiemann reaction.	02	
		B] Ethers:	Introduction, Diethyl ether- Preparation by Williamson's synthesis and continuous etherification process,	02	
			Reactions-with cold and hot HI	02	
		C] Epoxides:	Introduction, Synthesis of ethylene oxide from ethylene and styrene oxide from styrene.	02	
			Ring opening reactions of both catalyzed by acid and alkali.	02	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
3	Jan-Feb	**Chemical Kinetics**	Explanation of terms like rate of reaction, order of a reaction and molecularity. Definition zero, first and second order reaction. Half life period of a reaction.	02	14
			Derivation of rate equation for first and second order reaction with equal initial concentration and different initial concentration of a reactant. Characteristics of first and second order reaction.	03	
			Examples of first and second order reaction viz. the reactions (i) decomposition of H_2O_2, (ii) reaction between $K_2S_2O_8$ and KI,	03	
			(iii) Hydrolysis of methyl acetate catalyzed by acid, (iv) saponification of ethyl acetate by NaOH and (v) inversion of cane sugar. Determination of order of a reaction by integration, graphical, equifractional change, etc. method.	03	
			Effect of temperature on reaction rates. Arrhenius equation, activation energy and its determination using Arrhenius equation. Numericals.	03	
4	Feb	**UNIT-I** **A] Polarisation-** **B] Covalent bonding-** **C] Intermolecular forces-** **D] Acids and Base-**	Defn, polarising power, polarizability. Effect of polarization on nature of bond. Fajan's rules of polarisation & its applications.	02	14
			Directional nature of covalent bond. Hybridization, types of hybridization to explain geometries of NH^{4+} ion, PCl_5, SF_6 & IF_7.	02	
			Dipole-dipole, dipole-induced-dipole, induced dipole-induced dipole interactions. Ion - dipole interactions.	03	
			Theory of solvent sys. & Lux-Flood concept of acids & bases.	03	
			Hard and soft acids and bases. Pearsons HSAB principle with imp applications.	04	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
5	Feb-March	A]Electrical Properties:	(i) Polar and non-polar molecules. Dipole moment. (ii) Induced polarization & orientation polarization. Clausius-Mossotti equation	03	
			(iii) Measurement of dipole moment by temperature and refractivity methods.	01	
			(iv)Applications of dipole moment for the determination of molecular structure. i.e. percentage ionic character of covalent bonding, molecular geometry, cis-trans isomers, ortho, meta and para isomers of a disubstituted benzene.	03	
		B]Magnetic Properties:	(i) Paramagnetic and diamagnetic substances, origin of paramagnetism, diamagnetism, ferromagnetism and antiferromagnetism.(ii) Volume, specific, mass and molar susceptibility. Relationship between.	03	
			(iii) Relationship between magnetic moment and number of unpaired electrons. (iv) Gouy's balance method for determination of magnetic susceptibility.	02	
			(v) Application of magnetic moment in the determination of molecular structure.(vi) Numericals.	02	
6	March	A] P-Block Elements-	Comparative study of 16^{th} and 17^{th} group elements with reference to electronic configuration,	02	14
			Ionisation energy & oxidation states. Oxidising properties of halogens with reference to oxidation potential.	02	
		B] Noble Gases-	Basic properties of halogens with special reference to iodine. Interhalogen compounds. Introduction to fluorocarbons.	02	
			Inertness of noble gases. Compounds of noble gases-only str. & bonding in XeF_2, XeF_4, $XeOF_4$,XeO_2F_2 XeO_3 and XeO_4	02	
		C] Non-aqueous Solvents-	Requirements of a good solvent. Water as a universal solv. Physical prop of solvents namely liq. range, dielectric constant, dipole moment, heat of vaporisation & solubility behaviour.	02	
			Classification of solvents. Reactions in liquid ammonia acid base, precipitation, redox, solvolysis	02	
			solutions of metals in liquid ammonia.	02	

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Department of Chemistry

Teaching Plan Session-2018-19

B.Sc.-IInd Semester-IVth

Name of Faculty:- Mr. Shivshankar P. More

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total
1	Dec-Jan	Colligative Properties of Dilute Solutions:	(i) Definition and examples of colligative properties.	02	14
			(ii Elevation of boiling point, thermodynamic derivation of the relationship between elevation of boiling point and molar mass of a non-volatile solute.	02	
			Cotrell's method for determination of elevation of boiling point.	02	
			(iii) Depression of freezing point, thermodynamic derivation of the relationship between depression of freezing point and molar mass of a non-volatile solute.	02	
			Rast's method for determination of depression of freezing point.	02	
			(iv) Abnormal behavior of solution. Van't Hoff's factor 'i'.	02	
			Determination of degree of association and dissociation from Van't Hoff's factor(v) Numerical.	02	
2	Jan	Crystalline state	Symmetry in crystal, plane of symmetry, axis of symmetry and point of symmetry. Law of constancy of interfacial angles.	02	14
			Elements of symmetry in cubic crystals. Laws of symmetry. Law of rational indices, Weiss and Miller indices of a lattice planes, calculation of interplaner distance d(h,k,l) from Miller indices in a cubic system.	02	
			Seven crystal systems and fourteen Bravais lattices, Bravais lattices of cubic system. Simple cubic system (S.C.C.), body centered cubic system (B.C.C.) and face centered cubic system (F.C.C.).	02	
			Calculation of number of constituent units in S.C.C., B.C.C. and F.C.C.	02	
			Ratio of interplaner distances for 100, 110 and 111 lattice plane in S.C.C., B.C.C. and F.C.C.	02	
			Derivation of Bragg's equation for X-ray diffraction, Bragg's X-ray spectrometer method for the determination of crystal structure of NaCl and KCl.	02	
			Anomalous behaviour of KCl towards X-ray. Numericals.	02	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total
3	Jan-Feb	A] Chemistry of elements of transition series:	Definition of transition elements. General characteristics of transition elements. Comparative study of first transition series elements (3d) with reference to following properties: (i) Electronic configuration	02	14
			(ii) Atomic and ionic size (iii) Ionization energy (iv) Metallic nature (v) Oxidation states (vi) Magnetic properties (vii) Color of salts (viii) Catalytic properties (ix) Complex formation behaviour.	03	
			Study of 4d and 5d series elements-Electronic configuration.	03	
		B] Extraction of elements:	Comparison of 3d series elements with 4d and 5dseries elements with respect to size, oxidation states, magnetic properties and color.	03	
			Principles involved in extraction of elements. Major methods of extraction of elements. Factors affecting choice of extraction method. Thermodynamics of reduction processes-Ellingham diagrams for oxides and importance of this diagram	03	
4	Feb	A] Inner transition elements:	Definition, Lanthanides and Actinides. Comparative study of Lanthanides with respect to following properties:(i) Electronic configuration	02	14
			(ii) Atomic and ionic radii lanthanide contraction definition, cause and effect of lanthanide contraction	02	
			(iii) Oxidation states (iv) Magnetic properties	02	
			(v) Color of salts vi) Complex formation behavior.	02	
		B] General Principles of Metallurgy:	Occurrence of lanthanides. Isolation of lanthanides by ion exchange method. Actinides- Electronic configuration and oxidation states. Comparison of lanthanides and actinides.	03	
			Definition of metallurgy, steps in metallurgy. Ore dressing by gravity separation, froath floatation and electromagnetic separation. Calcinations, roasting, smelting and refining of metals. Meaning of termshydrometallurgy and pyrometallurgy.	03	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total
5	Feb-March	A] Aromatic nitro compounds: B] Amino Compounds: C] Diazonium Salts: D] Amino acids and Proteins:	Nitrobenzene: Synthesis from benzene, Reduction of nitrobenzene in acidic, neutral and alkaline medium.	03	14
			Basicity and effect of substituents. Methods of preparation of aniline from nitrobenzene, Reactions: with acetyl and benzoyl chlorides, Br2(aq) and Br2(CS2),	02	
			Carbylamine reaction, alkylation,Hoffmann's exhaustive methylation and its mechanism.	02	
			Preparation benzene diazonium chloride, Synthetic applications- Preparation of benzene,phenol, halobenzene,nitrobenzene,benzonitrile, coupling with phenol and aniline.	03	
			Classification, Strecker and Gabrial phthalimide synthesis, Zwitterion structure, Isoelectric point,	02	
			peptide synthesis, Structure determination of polypeptides by end group analysis.	02	
6	March	A] Polynuclear hydrocarbons: B] Reactive methylene compounds: C] Carbohydrates:	Naphthalene - Haworth synthesis,orbital picture, Reactions – electrophilic substitution	02	14
			Preparation of naphthols from naphthalene sulphonic acids and naphthylamines from naphthols.	02	
			Malonic Ester: Synthesis from acetic acid, Synthetic applications- Synthesis of acetic acid , succinic acid, glutaric acid, crotonic acid and malonyl urea.	03	
			Acetoacetic ester: Synthesis from ethyl acetate, Synthetic applications- Synthesis of acetic acid, propionic acid, isobutyric acid, succinic acid, glutaric acid, crotonic acid, acetyl acetone and 4-methyl uracil.	03	
			Constitution of glucose, cyclic structure, Pyranose and Furanose structure, Epimerization, conversion of glucose to fructose and vice-versa,	02	
			Introduction to fructose, ribose, 2- deoxyribose, maltose, sucrose. (their structures only determination not needed).	02	

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Department of Chemistry

Teaching Plan Session-2018-19

B.Sc.-III[rd]Semester-VI[th]

Name of Faculty:- Wavhal Kamalakar K.

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total Lects.
1	Dec-Jan	A) Kinetic Aspects of Metal Complexes:	Types of reactions of coordination compounds. Brief idea about substitution reactions. SN1 dissociative and SN2 associative mechanism of substitution in octahedral complexes. Labile and inert complexes.	03	14
			Factors affecting lability of complexes viz. arrangement of d-electrons (VB theory),. Mechanism of substitution reactions in square planar complexes.	03	
		B) Analytical Chemistry: 1. Colorimetry Spectrophotometry	Concept of □max. Beer-Lambert's law Verification of Beer's law. Block diagrams of colorimeter and spectrophotometer	02	
		2. Paper Chromatography	Difference between colorimeter and spectrophotometer. Application of colorimetric &spectrophotometric technique for determination of concentration of metal.	02	
			Definition and classification of chromatography. Principle of ifferential migration.	02	
			Principle and technique of paper chromatography, Rf value and factors affecting Rf value	02	
2	Jan	A] Organometallic Chemistry :	Definition, nomenclature and classification of organometallic compounds. Metal carbonyls- definition and classification.	02	14
			Preparation, properties, structure and bonding in Ni(CO)4, $Fe(CO)_5$, $Cr(CO)_6$. Nature of M-C bond in metal carbonyls.	03	
			Definition and classification. Silicones: preparation, properties structure and bonding and applications.	03	
		B] Inorganic Polymers:	Phosphonitrile halides polymers- preparation, properties, structure and bonding in cyclic polymers.	02	
		C] Bio-inorganic Chemistry	Essential and trace elements in biological processes.	02	
			Biological role of Na+, K+, Ca2+ and Mg2+ ions. Metalloporphyrins- Haemoglobin and Myoglobin and their role in oxygen transport.	02	

Wavhal

Wavhal K.K

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total Lects.
3	Jan-Feb	A) Electronic Spectroscopy :	Introduction, radiation source, spectral range, types of electronic transitions, chromophore, auxochrome, bathochromic, hypsochromic,	02	14
			Hyperchromic and hypochromic effects. Applications to the structure determination of compounds like dines, aldehydes, ketones & aromatic systems.	03	
		B) Infrared Spectroscopy	Types of vibrational modes, stretching and bending, spectrum range, radiation source, presentation of IR spectrum, characteristic frequencies of various groups,	03	
		C) Purification of Organic Compounds:	Finger print region. Structure of organic compounds (IR spectra of simple compounds: H_2O, CO_2, CH□CH, CH_3COCH_3).	02	
			Sublimation, crystallization.	02	
			Paper chromatography: Principle and Rf value.	02	
4	Feb	Unit IV : A) Nuclear Magnetic Resonance Spectroscopy :	Introduction, spin quantum number, instrumentation, Aspects of NMR- number of signals(equivalent & non-equivalent protons),	03	14
			Positions of signals(chemical shift), intensities of signals,	02	
			Splitting of signals (spin-spin coupling), coupling constant, and applications.	03	
		B) Mass Spectrometry:	Introduction, theory, instrumentation-(ion sources),	02	
			Mass spectra of neopentane and methanol, molecular ion peak, base peak, metastable peak,	02	
			Rules of fragmentation, applications.	02	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total Lects.
5	Feb-March	A] Electrochemistry:	(i) Types of electrode - Standard hydrogen electrode, Calomel electrode, Quinhydrone electrode and Glass electrode. Principle of Potentiometric titration. Study of acid-base, redox and precipitation titration.	02	14
			(ii) pH of a solution and pH scale. Determination of pH of a solution using hydrogen, quinhydrone and glass electrodes. Advantage and disadvantage of these electrodes. pH-metric titrations. Determination of pka of a weak acid by pH-metric measurement.	02	
			(iii) Concentration cells - Types of concentration cells, concentration cell without transfer and determination of its emf. (iv) Numericals	02	
			(i) Shell model of a nucleus - Assumptions, evidences for existence of magic numbers, advantages and limitations. (ii) Liquid drop model of a nucleus - Assumptions, similarities between nucleus and liquid drop, advantages and limitations, explanation of nuclear fission reaction on the basis of liquid	02	

			drop model.		
		B] Nuclear Chemistry:	(iii) Nuclear force and its explanation on the basis of Meson theory. (iv) Characteristics of nuclear reaction, difference between nuclear and chemical reactions. Calculation of Q value of a nuclear reaction. (v) Characteristics of nuclear fission reaction, fission yield. Fission reaction as an alternative source of energy.	02	
			vi) Nuclear fusion reaction - Characteristic of a nuclear fusion reaction. Thermonuclear reactions as a source of energy of sun and other stars. Fusion reactions as a potential future source of energy.	02	
			vii) Applications of radio isotopes in industry, agriculture, medicines and bio-sciences with two examples each. (viii) Numericals.	02	

6	**March**	**Elementary Quantum Mechanics**	(i) Limitations of classical mechanics. Plank's quantum theory (postulates only)	02	**14**
			Photoelectric effect - Experiments, observation and Einstein's explanation. Compton effect and its explanation. (ii) de Broglie hypothesis of matter waves	03	
			De-Broglie's equation. Heisenberg's uncertainty principle. (iii) Classical wave equation, derivation of time independent Schrodinger's wave equation in one-dimension and its extension to a three-dimensional space.	02	
			Well behaved wave function, physical significance of wave function (Born interpretation).	02	
			(iv) Application of Schrodinger wave equation to a particle in one-dimensional box & its extension to a three-dimensional box.	03	
			Concept of atomic orbital. (v) Numericals	02	

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Department of Chemistry

Teaching Plan Session-2019-20

B.Sc.-I[st] Semester-I[st]

Name of Faculty:- Mr. Suryakant B. Borul

Sr. No.	Month	Name of Unit	Topics Names	Required Lecture	Total Lects.
1	July	A) Electronic displacements: B) Reactive Intermediates: C) Aliphatic Hydrocarbon:	Inductive effect, electromeric effect, Resonance & Hyperconjugation (Definition and Applications)	02	14
			Carbocations, Carbanions and Free radicals, their generation stability & reactions.	02	
			Alkanes- Methods of formation: i) Wurtz reaction and ii) Corey-House reaction, reactions i) Halogenation mechanism ii) Aromatisation.	03	
			Alkenes Method of formation mechanism- i) dehyhrogenation of alkyl halides (E_1 & E_2) ii) Dehydration of alcohols.	02	
			Reactions-Electrophilic and free radical addition of HX and X_2 (with mechanism)	01	
			Alkynes- Preparations from vicinal and germinal dihalides, Reaction-Hydrogenation.	02	
			Alkadienes:-Classification 1, 3-Butadiene- Preparation from cyclohexene, reactions-Addition of H_2, Br_2 & HBr	02	
2	July-Aug	Aromatic Hydrocarbons A) B) C) D)	Introduction, Nomenclature and Isomerism of Aromatic Compounds.	02	14
			Structure of Benzene of Benzene : Kekule structure and Molecular orbital structure.	02	
			Aromaticity and Huckel's rule Aromatic,	02	
			antiaromatic and non-aromatic system	02	
			Mechnism of Electrophilic Aromatic Substitution:- Nitration, Friedal Craft Alkylation and Acylation.	03	
			Nuclear and side chain halogenations, Birch reduction.	01	
			Orientation:- Effect of substituent group. Activating and deactivating group. Theory of reactivity and orientation on the basis of inductive and resonance effects (-CH_3, -OH, -NO_2 and –Cl group).	02	

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Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
3	Aug	A] Periodic Properties:	Atomic and ionic radii. Types of atomic radii. Periodic trends in atomic and ionic radii. Ionization energy, electron affinity and electronegativity.	03	14
			Effect of ionization energy and electronegativity on different properties of elements namely metallic and non-metallic character, relative reactivity, oxidizing and reducing properties., Scales of electronegativity Pauling scale and Mulliken Scales. Electronegativity and partial ionic character of a covalent bond.	03	
		B] Ionic bonding:	Screening effect, screening constant and effective nuclear charge. Slater's rules for calcul. screening constant. Problems.	02	
			Definition of ionic bond, types of cations. Factors affecting ionic bond formation. Born Lande equation to cal. lattice energy. Born-Haber's cycle to determine lattice energy	03	
			Solvation and salvation energy, factors affecting salvation energy, Det^{n} of salvation energy. Solubility of ionic solids, lattice energy and salvation energy.	03	
4	Aug-Sept	Thermodynamics	Adiabatic and Isothermal processes. Work done in Adiabatic and isothermal processes, relationship between pressure, volume and temperature.	03	14
			First law of Thermodynamics and its limitations, Need of Second law.	02	
			Carnot's heat engine, derivation of expression for the work done and efficiency of Carnot's engine. Statements of Second law of thermodynamics.	03	
			Concept of Entropy, Physical significance of Entropy, Derivation of expression for the Entropy change for an ideal gas Entropy change for an ideal gas for isothermal, isobaric and isochoric processes,	03	
			Entropy of fusion, sublimation, vapourization, transition and its calculations. Entropy change as a criterion for spontaneity. Numericals.	03	

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Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
5	Sept-Oct	A] S-Block element:	Comparative study of 1st and 2nd group elements with reference to electronic configuration, ionisation energy, oxidation states.	03	14
			Reactivity and flame colouration. Diagonal relationship between Li and Mg.	02	
		B] P-Block element:	Comparative study of 13th, 14th and 15th group elements with reference to electronic configuration,	03	
			ionisation energy, oxidation states. Concept of inert pair effect. Diagonal relationship between Be and Al. Structure of diamond and graphite.	03	
			Abnormal behaviour of nitrogen. Hydrides of boron-preparation (from BCl3 and NaBH4two), properties (action of heat, water, alkali and oxygen), structure and bonding in diborane. Carbides, types of carbides and fullerenes.	03	
6	Oct	A] Gaseous State:	Postulates of Kinetic theory of gases, Derivation of Kinetic gas equation.	02	14
			RMS, Average and Most probable velocities and their relationship. Maxwell-Boltzmann distribution law of molecular velocities (only qualitative treatment), Mean free path, collision number and collision diameter.	03	
			Deviation of real gases from ideal gas behavior. Vander waal's equation of state and its derivation for real gases.	02	
			Critical phenomenon, Andrew's experiment - isotherm of CO2. Critical state, critical constant, Pc, Vc and Tc in terms of Vanderwaal's constants 'a' and 'b'. Law of Corresponding state. Numericals.	03	
		B] Phase Rule:	Statement of phase rule, explanation of phase, number of Components and degree of freedom.	02	
			Application of phase rule to water and sulfur system.	02	

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Department of Chemistry

Teaching Plan Session-2019-20

B.Sc.-II[nd] Semester-III[rd]

Name of Faculty:-Mr. Shivshankar P. More

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total Lects
1	June-July	A] Aldehydes and Ketones:	Preparation of acetaldehyde from ethanol, ethylidene chloride and acetylene. Preparation of benzaldehyde from benzene (Gattermann-Koch reaction) and toluene.	02	14
			Preparation of acetone from isopropyl alcohol, isopropylidene chloride and propyne. Preparation of acetophenone from benzene and ethyl benzene.	02	
			Structure of carbonyl group, acidity of á-hydrogen in carbonyl compounds. Reactions of aldehydes &/or ketones: Cannizaro's,	02	
			Reformatsky, Perkin with mechanism, Mannich reaction, Benzoin and Aldol condensations. Clemmensen, Wolf-Kishner, MPV and LiAlH4 reductions.	02	
		B] Carboxylic acids:	Structure and reactivity of carboxylic groups. Acidity of carboxylic acids, effects of substituents on acids strength. Oxalic acid: Preparation from ethylene glycol and cyanogen. Reactions:	02	
			Reaction with ethyl alcohol, ammonia, glycerol and action of heat. Lactic acid: Preparation from acetaldehyde and pyruvic acid.	02	
			Reactions: Reaction with ethanol,PCl_5, action of heat, oxidation and reduction. Benzoic acid: Preparation from toluene, benzyl alcohol, phenyl cyanide and benzamide.	02	
			Reactions: Reaction with ethanol, PCl_5 and ammonia. Salicylic acid: Preparation by Reimer-Tiemann reaction. Reactions: Reaction with CH_3COCl, CH_3OH and C_6H_5OH.	02	
2	July	A] Optical isomerism:	Element of symmetry, chirality, asymetric carbon atom, enantiomers, diastereoisomers,	02	14
			relative and absolute configurations, DL and RS nomenclature, racemisation and resolution.	02	
		B] Geometrical isomerism:	Cis-trans & *E-Z* nomenclature, Methods of structure determination.	03	
		C] Conformational isomerism:	Bayer's Strain theory and its limitations. Stability of cycloalkanes, conformational isomers of ethane	03	
			conformational isomers of, n-butane & cyclohexane, their energy level diagrams.	02	
			Newman & Sawhorse projection formulae.	02	

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Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects
3	Aug	A] **Covalent Bonding:**	Molecular Orbital Theory. Postulates of MO theory. LCAO approximation. Formation of bonding and antibonding MOs. Rules for LCAO. MO energy level diagram. MO structure of homonuclear diatomic molecules of namely He_2, H_2, N_2 and O_2. Stability sequence of species of O2	03	14
		B] Metallic Bonding:	Paramagnetic nature of O2. MO structure of heteronuclear diatomic molecules viz. NO, HF &CO. properties of CO viz. – triple 15 16 bond, almost nonpolar nature, edonor & acceptor behaviour. Comparison of VB and MO theories.	03	
			Free electron theory and properties of metals such as electrical and thermal conduction, malleability, ductility and metallic lusture. VB theory or Resonance theory of metals. Band theory to explain nature of conductors, insulators and semiconductors.	03	
		C] **VSEPR Theory:**	Various rules under VSEPR theory to explain molecular geometry various rules- $BeCl_2$, BF_3, CH_4 , NH_4 + , PCl_5 , SF_6, IF_7, $SnCl_2$, NH_3, H_2O, SF_4, ClF_3, BrF_5 XeF_6 SOF_4	03	
			Various rules under VSEPR theory to explain molecular geometry Limitations of VSEPR theory.	02	
4	Aug-Sept	**Theory of Quantitative Inorganic Analysis**	**(a) Introduction**:-Volumetric analysis, titrant, titrate, end point, equivalence point, indicator etc. Requirements of volumetric analysis. Definition of standard solution, primary standard substance.	02	14
		A] Volumetric Analysis:	Terms to express concentrations namely- molarity, normality, molality, mole fraction and percentage. **(b) Acid-Base titrations**:- Types of acid base titrations. pH variations during acid base titration. Acid base indicators. Choice of suitable indicators for different acid base titrations.	02	
			(c) Redox Titrations:-Pinciples involved in redox titrations. Brief idea about use of $KMnO_4$, $K_2Cr_2O_7$as oxidants in acidic medium in redox titrations.	02	
			Use of I_2 in iodometry & iodimetry. Redox indicators-external & internal indicators. iodometric estimation of Cu (II).	02	
		B] Gravimetric Analysis:	Definition. Theoretical principles underlying various steps involved in gravimetric analysis with reference to estimation of barium as $BaSO_4$	04	
			Coprecipitation and post precipitation	02	

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Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
5	Sept	A) Liquid State:-	Surface tension – Determination and its S.I. unit, Effect of temperature on surface tension, Derivation of expression for relative surface tension by Drop number method. Application of surface tension.	02	
			Viscosity- Determination and its S.I. unit, Effect of temperature on viscosity, derivation of expression for relative viscosity by Ostwald's viscometer method. Application of viscosity.	02	
		B) Electrochemistry:	Conductance of electrolyte solutions. Specific, equivalent & molar conductance. Detn of conductance of electrolyte soln.	02	14
			Variation of specific and equivalent Conductance with dilution for strong electrolyte Conductometric titrations, Application of Conductometric titrations.	02	
			Migration of ions under the influence of electric field. Transport number of ions. Determ. of Transport number of ions by Hottorf's method & Moving boundary method.	02	
			Kohlrausch's law of independent migration of ions. Determ^{n} of $\lambda\infty$ & degree of α dissociation of a week elect.	02	
			Determination of constant of a week electrolyte. Numerical.	02	
6	Oct	A) Thermodynamics and Equilibrium:	Definition and physical significance of Helmholtz work function (A) and Gibbs free energy. Change in free energy (ΔG) as a criteria of spontaneity and equilibrium.	02	
			Variation of free energy G with 'P' & 'T'. Gibbs-Helmholtz equation in terms of G and its applications.	02	
			Partial molal function, chemical potential, derivations of Gibb's-Duhem equation. Chemical potential of an ideal gas in gaseous mixture.	03	
			Derivation of Gibbs-Duhem equation. Derivation of Van't Hoff reaction of isotherm & its application to equil. state.	02	14
		B) Phase Equilibrium:	Derivation of Van't Hoff equn & its applications. Numericals.	01	
			Immiscible liquids, Nerst distribution law and its application to association and dissociation of solute in one of the solvent Process of extraction, derivation of formula for the amount of solute left unextracted after nth extraction.	02	
			Phase transition- Clausius-clyperon. Partially miscible liquids- Phase diagram of phenol-water, tri-ethyl amine-water & nicotine–water systems. Numerical.	02	

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Department of Chemistry

Teaching Plan Session-2019-20

B.Sc.-III[rd]Semester-VI[th]

Name of Faculty:- Mr. Suryakant B. Borul

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total Lects.
4	Feb	Unit IV : A) Nuclear Magnetic Resonance Spectroscopy:	Introduction, spin quantum number, instrumentation, Aspects of NMR- number of signals(equivalent & non-equivalent protons),	03	14
			Positions of signals(chemical shift), intensities of signals,	02	
			Splitting of signals (spin-spin coupling), coupling constant, and applications.	03	
		B) Mass Spectrometry:	Introduction, theory, instrumentation-(ion sources),	02	
			Mass spectra of neopentane and methanol, molecular ion peak, base peak, metastable peak,	02	
			Rules of fragmentation, applications.	02	
5	Feb-March	A] Electrochemistry:	(i) Types of electrode - Standard hydrogen electrode, Calomel electrode, Quinhydrone electrode and Glass electrode. Principle of Potentiometric titration. Study of acid-base, redox and precipitation titration.	02	14
			(ii) pH of a solution and pH scale. Determination of pH of a solution using hydrogen, quinhydrone and glass electrodes. Advantage and disadvantage of these electrodes. pH-metric titrations. Determination of pka of a weak acid by pH-metric measurement.	02	
			(iii) Concentration cells - Types of concentration cells, concentration cell without transfer and determination of its emf. (iv) Numericals	02	
		B] Nuclear Chemistry:	(i) Shell model of a nucleus-Assumptions, evidences for existence of magic numbers, advantages and limitations. (ii) Liquid drop model of a nucleus-Assumptions, similarities between nucleus & liquid drop, advantages & limitations, explanation of nuclear fission reaction on the basis of liquid drop model.	02	
			(iii) Nuclear force and its explanation on the basis of Meson theory. (iv) Characteristics of nuclear reaction, difference between nuclear and chemical reactions. Calculation of Q value of a nuclear reaction. (v) Characteristics of nuclear fission reaction, fission yield. Fission reaction as an alternative source of energy.	02	
			vi) Nuclear fusion reaction - Characteristic of a nuclear fusion reaction. Thermonuclear reactions as a source of energy of sun and other stars. Fusion reactions as a potential future source of energy.	02	
			vii) Applications of radio isotopes in industry, agriculture, medicines & bio-sciences with two ex. each. (viii) Numericals.	02	

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Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total Lects.
6	March	Elementary Quantum Mechanics	(i) Limitations of classical mechanics. Plank's quantum theory (postulates only)	02	14
			Photoelectric effect - Experiments, observation and Einstein's explanation. Compton effect and its explanation. (ii) de Broglie hypothesis of matter waves	03	
			De-Broglie's equation. Heisenberg's uncertainty principle. (iii) Classical wave equation, derivation of time independent Schrodinger's wave equation in one-dimension and its extension to a three-dimensional space.	02	
			Well behaved wave function, physical significance of wave function (Born interpretation).	02	
			(iv) Application of Schrodinger wave equation to a particle in one-dimensional box & its extension to a three-dimensional box.	03	
			Concept of atomic orbital. (v) Numericals	02	

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Amrut Sevabhavi Sanstha's Parbhani

Late Ku. Durga K. Banmeru Science College, Lonar Dist- Buldana

Department of Chemistry

Teaching Plan Session-2019-20

B.Sc.-III[rd]Semester-VI[th]

Name of Faculty:- Wavhal Kamalakar K.

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total Lects.
1	Dec-Jan	A) Kinetic Aspects of Metal Complexes:	Types of reactions of coordination compounds. Brief idea about substitution reactions. SN1 dissociative and SN2 associative mechanism of substitution in octahedral complexes. Labile and inert complexes.	03	14
		B) Analytical Chemistry:	Factors affecting lability of complexes viz. arrangement of d-electrons (VB theory),. Mechanism of substitution reactions in square planar complexes.	03	
		1. Colorimetry Spectrophotometry	Concept of □max. Beer-Lambert's law Verification of Beer's law. Block diagrams of colorimeter and spectrophotometer	02	
		2. Paper Chromatography	Difference between colorimeter and spectrophotometer. Application of colorimetric &spectrophotometric technique for determination of concentration of metal.	02	
			Definition and classification of chromatography. Principle of ifferential migration.	02	
			Principle and technique of paper chromatography, Rf value and factors affecting Rf value	02	
2	Jan	A] Organometallic Chemistry :	Definition, nomenclature and classification of organometallic compounds. Metal carbonyls- definition and classification.	02	14
			Preparation, properties, structure and bonding in Ni(CO)4, $Fe(CO)_5$, $Cr(CO)_6$. Nature of M-C bond in metal carbonyls.	03	
			Definition and classification. Silicones: preparation, properties structure and bonding and applications.	03	
		B] Inorganic Polymers:	Phosphonitrile halides polymers- preparation, properties, structure and bonding in cyclic polymers.	02	
		C] Bio-inorganic Chemistry	Essential and trace elements in biological processes.	02	
			Biological role of Na+, K+, Ca2+ and Mg2+ ions. Metalloporphyrins- Haemoglobin and Myoglobin and their role in oxygen transport.	02	

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Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total Lects.
3	Jan-Feb	A) Electronic Spectroscopy :	Introduction, radiation source, spectral range, types of electronic transitions, chromophore, auxochrome, bathochromic, hypsochromic,	02	14
		B) Infrared Spectroscopy	Hyperchromic and hypochromic effects. Applications to the structure determination of compounds like dines, aldehydes, ketones & aromatic systems.	03	
		C) Purification of Organic Compounds:	Types of vibrational modes, stretching and bending, spectrum range, radiation source, presentation of IR spectrum, characteristic frequencies of various groups,	03	
			Finger print region. Structure of organic compounds (IR spectra of simple compounds: H_2O, CO_2, CH□CH, CH_3COCH_3).	02	
			Sublimation, crystallization.	02	
			Paper chromatography: Principle and Rf value.	02	

Incharge Teacher-
Wavhal Kamalakar k.

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Late Ku. Durga K. Banmeru Science College, Lonar Dist- Buldana

Department of Chemistry

Teaching Plan Session-2019-20

B.Sc.-IIIrd Semester-Vth

Name of Faculty:- Mr. Suryakant B. Borul

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lect.
3	July	A] Heterocyclic compounds	Nomenclature, Pyrrole: Synthesis from acetylene, succinimide and furan, Basicity, acetaldehyde, acetone, ethylene oxide & CO_2.	02	14
			Electrophilic substitution reactions (orientation) – nitration, sulphonation, acetylation and halogenation , Molecular orbital structure.	02	
			Pyridine: Synthesis from acetylene and pentamethylene diamine hydrochloride, Basicity, Electrophilic substitution reactions (orientation) – nitration, sulphonation, Nucleophilic substitution reactions (orientation)- with NaNH2, C6H5Li and KOH.	03	
		B] Organometallic compounds::	Grignard reagents: Methyl magnesium bromide- Synthesis from methyl bromide (only reaction) Synthetic applications: Electrophilic substitution reactions-formation of alkanes, alkenes, higher alkynes and other organometallic compounds,	02	
			Nucleophilic substitution reactions- Reaction with aldehydes & ketones, ethylene oxide, acetyl chloride, methyl cyanide & CO_2.	02	
			Methyl lithium-Synthesis and reaction with water, formaldehyde, acetaldehyde, acetone, ethylene oxide and CO_2.	03	

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Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lect.
4	Aug	A] Dyes:	Classification on the basis of structure and mode of application, Preparation and uses of Methyl orange,	03	
			Crystal violet, Phenolphthalein , Alizarin and Indigo.	02	
		B] Drugs:	Analgesic and antipyretics: Synthesis and uses of phenylbutazone. Sulpha drugs: Synthesis and uses of sulphanilamide and sulphadiazine.	03	
			Antimalarials: Synthesis of chloroquine from 4,7-dichloroquinoline and its uses.	02	
		C] Pesticides:	Insecticides:Synthesis and uses of malathion. Herbicides: Synthesis and uses of 2,4-dichloro phenoxy acetic acid (2,4-D)..	03	
			Fungicides: Synthesis and uses of thiram (tetramethyl thiuram disulphide	02	
5	Aug-Sept	Photochemistry	(i) Photochemical and thermal reactions. (ii) Lambert's law - Statement and derivation.	02	
			Beer's law - Statement and derivation. Reasons for deviation from Beer's law. (iii) Laws of photochemistry.	02	
			(iv) Quantum yield of photochemical reaction. Reasons for high and low quantum yield. Experimental determination of quantum yield. Photosensitized reaction.	02	
			(v) Kinetics of photochemical decomposition of HI. (vi) Fluorescence and Phosphorescence.	02	
			Selection rule for electronic transition. Internal conversion and inter-system crossing. Explanation of fluorescence and phosphorescence on the basis of Joblonski diagram	03	
			(vii) Chemiluminescence and Bioluminescence with examples. (viii) Numericals.	03	

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Late Ku. Durga K. Banmeru Science College, Lonar Dist- Buldana

Department of Chemistry

Teaching Plan Session-2019-20

B.Sc.-III[rd] Semester-V[th]

Name of Faculty:- Mr. Kamalakar K. Wavhal

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lect.
1	July	Coordination Compounds-I:	Important terms namely-molecular or addition compounds, double salts, complex ion, ligand, coordination number, central metal ion etc. Werner's theory of coordination and experimental evidences on the basis of conduction data and formation of AgCl precipitate in case of cobaltamines.	03	14
			Sidgwick's electronic interpretation & its drawbacks. EAN rule. IUPAC rules for nomenclature of coordination. Structural linkage & coordination isomerism in complexes.	03	
			Geometrical isomerism in octahedral complexes of type Ma4b2, Ma4bc, Ma3b3, M(AA)2b2. Square planar complexes of type Ma2b2 and Ma2bc. Optical isomerism in octahedral complexes of type Ma2b2c2, Mabcdef, M(AA)3, M(AA)2b2	03	
		B) Chelates:	Tetrahedral complexes of type Mabcd and M(AA)2. Optical isomerism in square planar complexes. VBT as applied to structure and bonding in complexes and Magnetic properties of complexes of 3d series elements. Limitations of VB theory.	03	
			Definition, classification & applications of chelates	02	
2	July-Aug	A] Crystal Field Theory (CFT):	Postulates of CFT, Crystal field splitting in octahedral, distorted octahedral, square planar tetrahedral complexes,	03	14
			concept of CFSE, high spin and low spin complexes on the basis of $\Delta 0$ and pairing energy, distribution of electrons in t2g	03	
			orbitals in high spin and low spin octahedral complexes. Factor affecting magnitude of CF splitting in octahedral complexes.	02	
		B] Electronic Spectra of Transition Metal Complexes	Introduction to spectra, selection rules for d-d transitions, spectroscopic terms-determination of ground term symbols for d1 to d10, spectra of d1 and d9 octahedral complexes,	03	
			Orgel diagram for d1 and d9 states, electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion. Spectrochemical series.	03	

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6	**Sept-Oct**	**Molecular Spectroscopy**	(i) Electromagnetic radiation, characteristics of electromagnetic radiation in terms of wavelength, wave number, frequency and energy of photon. Spectrum of electromagnetic radiation. (ii) Types of spectra - Emission and absorption spectra, atomic and molecular spectra, line and band spectra	03	
			(iii) Translational, vibrational, rotational and electronic motion. The degree of freedom in each motion. (iv) Energy level diagram of a molecule indicating electronic, vibrational and rotational transitions. (v) Condition for pure rotational spectrum, selection rule for rotational transition.	02	
			Derivation of expression for moment of inertia of a diatomic rigid rotor. Isotope effect. Applications of microwave spectroscopy for the determination of moment of inertia and bonding. (vi) Condition for exhibiting vibrational spectra (i.e. IR active molecule),	03	
			selection rule for vibrational transition. Vibrational energy levels of a simple harmonic oscillator. Zero point energy, position of a spectral line. Determination of force constant of a covalent bond.	02	
			(v) Raman effect - Raman's spectrum of a molecule. Condition for exhibiting Raman spectrum (i.e. Raman active molecule), selection rule for rotational transitions.	02	
			Pure rotational spectrum of diatomic molecule, vibrational Raman spectrum of a diatomic molecule. (vii) Numericals.	02	

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Department of Chemistry

Teaching Plan Session-2019-20

B.Sc.-I[st] Semester-II[nd]

Name of Faculty:- Prof. Suryakant B. Borul

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
1	Dec-19 Jan-20	A] Alkyl Halides:	Introduction, Synthesis of vinyl chloride from acetylene and allyl chloride from propylene,	02	14
			Reactions of both with aqueous and alcoholic KOH, Comparison of reactivity of vinyl an allyl chloride.	02	
		B] Aryl Halides:	Synthesis chlorobenzene from benzene, phenol and benzene diazonium chloride, Synthesis of benzyl chloride from toluene and benzyl alcohol,	02	
			Reactions of both with aqueous KOH, NH_3 and sodium ethoxide, Comparison of reactivity of chlorobenzene and benzyl chloride. Benzyne intermediate mechanism.	02	
		C] Alcohols:	Dihydric alcohols: Ethylene glycol- Preparation from ethylene, ethylene chloride and ethylene oxide,	02	
			R eactions- with Na, PCl5 , CH3COOH, ZnCl2, conc. H2SO4 and dehydration with heat. Trihydric alcohols: Glycerol- Preparation from propylene,	02	
			Reactions- with Na, HCl, PCl5, HNO3 and KHSO4. Pinacol- pinacolone rearrangement (mechanism).	02	
2	Jan	A] Phenols:	Introduction, Methods of formations a) from aniline b) from Cumene. Acidic character,	02	14
			Reaction of Phenols- a) Carboxylation (Kolb's reaction), b) Fries Rearrangement,	02	
			c) Claisen Rearrengement d) Reimer-Tiemann reaction.	02	
		B] Ethers:	Introduction, Diethyl ether- Preparation by Williamson's synthesis and continuous etherification process,	02	
			Reactions-with cold and hot HI	02	
		C] Epoxides:	Introduction, Synthesis of ethylene oxide from ethylene and styrene oxide from styrene.	02	
			Ring opening reactions of both catalyzed by acid and alkali.	02	

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Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
3	Jan-Feb	Chemical Kinetics	Explanation of terms like rate of reaction, order of a reaction and molecularity. Definition zero, first and second order reaction. Half life period of a reaction.	02	14
			Derivation of rate equation for first and second order reaction with equal initial concentration and different initial concentration of a reactant. Characteristics of first and second order reaction.	03	
			Examples of first and second order reaction viz. the reactions (i) decomposition of H_2O_2, (ii) reaction between $K_2S_2O_8$ and KI,	03	
			(iii) Hydrolysis of methyl acetate catalyzed by acid, (iv) saponification of ethyl acetate by NaOH and (v) inversion of cane sugar. Determination of order of a reaction by integration, graphical, equifractional change, etc. method.	03	
			Effect of temperature on reaction rates. Arrhenius equation, activation energy and its determination using Arrhenius equation. Numericals.	03	
4	Feb	UNIT-I A] Polarisation- B] Covalent bonding- C] Intermolecular forces- D] Acids and Base-	Defn, polarising power, polarizability. Effect of polarization on nature of bond. Fajan's rules of polarisation & its applications.	02	14
			Directional nature of covalent bond. Hybridization, types of hybridization to explain geometries of NH^{4+} ion, PCl_5, SF_6 & IF_7.	02	
			Dipole-dipole, dipole-induced-dipole, induced dipole-induced dipole interactions. Ion - dipole interactions.	03	
			Theory of solvent sys. & Lux-Flood concept of acids & bases.	03	
			Hard and soft acids and bases. Pearsons HSAB principle with imp applications.	04	

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Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
5	Feb-March	A]Electrical Properties:	(i) Polar and non-polar molecules. Dipole moment. (ii) Induced polarization & orientation polarization. Clausius-Mossotti equation	03	
			(iii) Measurement of dipole moment by temperature and refractivity methods.	01	
			(iv)Applications of dipole moment for the determination of molecular structure. i.e. percentage ionic character of covalent bonding, molecular geometry, cis-trans isomers, ortho, meta and para isomers of a disubstituted benzene.	03	
		B]Magnetic Properties:	(i) Paramagnetic and diamagnetic substances, origin of paramagnetism, diamagnetism, ferromagnetism and antiferromagnetism.(ii) Volume, specific, mass and molar susceptibility. Relationship between.	03	
			(iii) Relationship between magnetic moment and number of unpaired electrons. (iv) Gouy's balance method for determination of magnetic susceptibility.	02	
			(v) Application of magnetic moment in the determination of molecular structure.(vi) Numericals.	02	
6	March	A] P-Block Elements-	Comparative study of 16^{th} and 17^{th} group elements with reference to electronic configuration,	02	14
			Ionisation energy & oxidation states. Oxidising properties of halogens with reference to oxidation potential.	02	
		B] Noble Gases-	Basic properties of halogens with special reference to iodine. Interhalogen compounds. Introduction to fluorocarbons.	02	
			Inertness of noble gases. Compounds of noble gases-only str. & bonding in XeF_2, XeF_4, $XeOF_4$,XeO_2F_2 XeO_3 and XeO_4	02	
		C] Non-aqueous Solvents-	Requirements of a good solvent. Water as a universal solv. Physical prop of solvents namely liq. range, dielectric constant, dipole moment, heat of vaporisation & solubility behaviour.	02	
			Classification of solvents. Reactions in liquid ammonia acid base, precipitation, redox, solvolysis	02	
			solutions of metals in liquid ammonia.	02	

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Department of Chemistry

Teaching Plan Session-2019-20

B.Sc.-II[nd] Semester-IV[th]

Name of Faculty:- Mr. Shivshankar P. More

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total
1	Dec-Jan	Colligative Properties of Dilute Solutions:	(i) Definition and examples of colligative properties.	02	14
			(ii Elevation of boiling point, thermodynamic derivation of the relationship between elevation of boiling point and molar mass of a non-volatile solute.	02	
			Cotrell's method for determination of elevation of boiling point.	02	
			(iii) Depression of freezing point, thermodynamic derivation of the relationship between depression of freezing point and molar mass of a non-volatile solute.	02	
			Rast's method for determination of depression of freezing point.	02	
			(iv) Abnormal behavior of solution. Van't Hoff's factor 'i'.	02	
			Determination of degree of association and dissociation from Van't Hoff's factor(v) Numerical.	02	
2	Jan	Crystalline state	Symmetry in crystal, plane of symmetry, axis of symmetry and point of symmetry. Law of constancy of interfacial angles.	02	14
			Elements of symmetry in cubic crystals. Laws of symmetry. Law of rational indices, Weiss and Miller indices of a lattice planes, calculation of interplaner distance d(h,k,l) from Miller indices in a cubic system.	02	
			Seven crystal systems and fourteen Bravais lattices, Bravais lattices of cubic system. Simple cubic system (S.C.C.), body centered cubic system (B.C.C.) and face centered cubic system (F.C.C.).	02	
			Calculation of number of constituent units in S.C.C., B.C.C. and F.C.C.	02	
			Ratio of interplaner distances for 100, 110 and 111 lattice plane in S.C.C., B.C.C. and F.C.C.	02	
			Derivation of Bragg's equation for X-ray diffraction, Bragg's X-ray spectrometer method for the determination of crystal structure of NaCl and KCl.	02	
			Anomalous behaviour of KCl towards X-ray. Numericals.	02	

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Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total
3	Jan-Feb	A] Chemistry of elements of transition series:	Definition of transition elements. General characteristics of transition elements. Comparative study of first transition series elements (3d) with reference to following properties: (i) Electronic configuration	02	14
			(ii) Atomic and ionic size (iii) Ionization energy (iv) Metallic nature (v) Oxidation states (vi) Magnetic properties (vii) Color of salts (viii) Catalytic properties (ix) Complex formation behaviour.	03	
			Study of 4d and 5d series elements-Electronic configuration.	03	
		B] Extraction of elements:	Comparison of 3d series elements with 4d and 5dseries elements with respect to size, oxidation states, magnetic properties and color.	03	
			Principles involved in extraction of elements. Major methods of extraction of elements. Factors affecting choice of extraction method. Thermodynamics of reduction processes-Ellingham diagrams for oxides and importance of this diagram	03	
4	Feb	A] Inner transition elements:	Definition, Lanthanides and Actinides. Comparative study of Lanthanides with respect to following properties:(i) Electronic configuration	02	14
			(ii) Atomic and ionic radii lanthanide contraction definition, cause and effect of lanthanide contraction	02	
			(iii) Oxidation states (iv) Magnetic properties	02	
			(v) Color of salts vi) Complex formation behavior.	02	
		B] General Principles of Metallurgy:	Occurrence of lanthanides. Isolation of lanthanides by ion exchange method. Actinides- Electronic configuration and oxidation states. Comparison of lanthanides and actinides.	03	
			Definition of metallurgy, steps in metallurgy. Ore dressing by gravity separation, froath floatation and electromagnetic separation. Calcinations, roasting, smelting and refining of metals. Meaning of termshydrometallurgy and pyrometallurgy.	03	

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Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total
5	Feb-March	A] Aromatic nitro compounds: B] Amino Compounds: C] Diazonium Salts: D] Amino acids and Proteins:	Nitrobenzene: Synthesis from benzene, Reduction of nitrobenzene in acidic, neutral and alkaline medium.	03	14
			Basicity and effect of substituents. Methods of preparation of aniline from nitrobenzene, Reactions: with acetyl and benzoyl chlorides, Br2(aq) and Br2(CS2),	02	
			Carbylamine reaction, alkylation,Hoffmann's exhaustive methylation and its mechanism.	02	
			Preparation benzene diazonium chloride, Synthetic applications- Preparation of benzene,phenol, halobenzene,nitrobenzene,benzonitrile, coupling with phenol and aniline.	03	
			Classification, Strecker and Gabrial phthalimide synthesis, Zwitterion structure, Isoelectric point,	02	
			peptide synthesis, Structure determination of polypeptides by end group analysis.	02	
6	March	A] Polynuclear hydrocarbons: B] Reactive methylene compounds: C] Carbohydrates:	Naphthalene - Haworth synthesis,orbital picture, Reactions – electrophilic substitution	02	14
			Preparation of naphthols from naphthalene sulphonic acids and naphthylamines from naphthols.	02	
			Malonic Ester: Synthesis from acetic acid, Synthetic applications- Synthesis of acetic acid , succinic acid, glutaric acid, crotonic acid and malonyl urea.	03	
			Acetoacetic ester: Synthesis from ethyl acetate, Synthetic applications- Synthesis of acetic acid, propionic acid, isobutyric acid, succinic acid, glutaric acid, crotonic acid, acetyl acetone and 4-methyl uracil.	03	
			Constitution of glucose, cyclic structure, Pyranose and Furanose structure, Epimerization, conversion of glucose to fructose and vice-versa,	02	
			Introduction to fructose, ribose, 2- deoxyribose, maltose, sucrose. (their structures only determination not needed).	02	

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Late Ku. Durga K. Banmeru Science College, Lonar Dist- Buldana

Department of Chemistry

Teaching Plan Session-2020-21

B.Sc.-Ist Semester-Ist

Name of Faculty:- Mr. Suryakant B. Borul

Sr. No.	Month	Name of Unit	Topics Names	Required Lecture	Total Lects.
1	July	A) Electronic displacements: B) Reactive Intermediates: C) Aliphatic Hydrocarbon:	Inductive effect, electromeric effect, Resonance & Hyperconjugation (Definition and Applications)	02	14
			Carbocations, Carbanions and Free radicals, their generation stability & reactions.	02	
			Alkanes- Methods of formation: i) Wurtz reaction and ii) Corey-House reaction, reactions i) Halogenation mechanism ii) Aromatisation.	03	
			Alkenes Method of formation mechanism- i) dehyhrogenation of alkyl halides (E_1 & E_2) ii) Dehydration of alcohols.	02	
			Reactions-Electrophilic and free radical addition of HX and X_2 (with mechanism)	01	
			Alkynes- Preparations from vicinal and germinal dihalides, Reaction-Hydrogenation.	02	
			Alkadienes:-Classification 1, 3-Butadiene- Preparation from cyclohexene, reactions-Addition of H_2, Br_2 & HBr	02	
2	July-Aug	**Aromatic Hydrocarbons** A) B) C) D)	Introduction, Nomenclature and Isomerism of Aromatic Compounds.	02	14
			Structure of Benzene of Benzene : Kekule structure and Molecular orbital structure.	02	
			Aromaticity and Huckel's rule Aromatic,	02	
			antiaromatic and non-aromatic system	02	
			Mechnism of Electrophilic Aromatic Substitution:- Nitration, Friedal Craft Alkylation and Acylation.	03	
			Nuclear and side chain halogenations, Birch reduction.	01	
			Orientation:- Effect of substituent group. Activating and deactivating group. Theory of reactivity and orientation on the basis of inductive and resonance effects (-CH_3, -OH, -NO_2 and –Cl group).	02	

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Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Tot. Lects.
3	Aug	A] Periodic Properties:	Atomic and ionic radii. Types of atomic radii. Periodic trends in atomic and ionic radii. Ionization energy, electron affinity and electronegativity.	03	14
			Effect of ionization energy and electronegativity on different properties of elements namely metallic and non-metallic character, relative reactivity, oxidizing and reducing properties., Scales of electronegativity Pauling scale and Mulliken Scales. Electronegativity and partial ionic character of a covalent bond.	03	
		B] Ionic bonding:	Screening effect, screening constant and effective nuclear charge. Slater's rules for calcul. screening constant. Problems.	02	
			Definition of ionic bond, types of cations. Factors affecting ionic bond formation. Born Lande equation to cal. lattice energy. Born-Haber's cycle to determine lattice energy	03	
			Solvation and salvation energy, factors affecting salvation energy, Det^{n} of salvation energy. Solubility of ionic solids, lattice energy and salvation energy.	03	
4	Aug-Sept	Thermodynamics	Adiabatic and Isothermal processes. Work done in Adiabatic and isothermal processes, relationship between pressure, volume and temperature.	03	14
			First law of Thermodynamics and its limitations, Need of Second law.	02	
			Carnot's heat engine, derivation of expression for the work done and efficiency of Carnot's engine. Statements of Second law of thermodynamics.	03	
			Concept of Entropy, Physical significance of Entropy, Derivation of expression for the Entropy change for an ideal gas Entropy change for an ideal gas for isothermal, isobaric and isochoric processes,	03	
			Entropy of fusion, sublimation, vapourization, transition and its calculations. Entropy change as a criterion for spontaneity. Numericals.	03	

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S No.		Name of Unit	Topics Names	Requ. Lect.	Total Lects.
5	Sept-Oct	A] S-Block element:	Comparative study of 1st and 2nd group elements with reference to electronic configuration, ionisation energy, oxidation states.	03	14
			Reactivity and flame colouration. Diagonal relationship between Li and Mg.	02	
		B] P-Block element:	Comparative study of 13th, 14th and 15th group elements with reference to electronic configuration,	03	
			ionisation energy, oxidation states. Concept of inert pair effect. Diagonal relationship between Be and Al. Structure of diamond and graphite.	03	
			Abnormal behaviour of nitrogen. Hydrides of boron-preparation (from BCl3 and NaBH4two), properties (action of heat, water, alkali and oxygen), structure and bonding in diborane. Carbides, types of carbides and fullerenes.	03	
6	Oct	A] Gaseous State:	Postulates of Kinetic theory of gases, Derivation of Kinetic gas equation.	02	14
			RMS, Average and Most probable velocities and their relationship. Maxwell-Boltzmann distribution law of molecular velocities (only qualitative treatment), Mean free path, collision number and collision diameter.	03	
			Deviation of real gases from ideal gas behavior. Vander waal's equation of state and its derivation for real gases.	02	
			Critical phenomenon, Andrew's experiment - isotherm of CO2. Critical state, critical constant, Pc, Vc and Tc in terms of Vanderwaal's constants 'a' and 'b'. Law of Corresponding state. Numericals.	03	
		B] Phase Rule:	Statement of phase rule, explanation of phase, number of Components and degree of freedom.	02	
			Application of phase rule to water and sulfur system.	02	

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Department of Chemistry

Teaching Plan Session-2020-21

B.Sc.-II[nd] Semester-III[rd]

Name of Faculty:-Mr. Shivshankar P. More

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total Lects
1	June-July	A] Aldehydes and Ketones:	Preparation of acetaldehyde from ethanol, ethylidene chloride and acetylene. Preparation of benzaldehyde from benzene (Gattermann-Koch reaction) and toluene.	02	14
			Preparation of acetone from isopropyl alcohol, isopropylidene chloride and propyne. Preparation of acetophenone from benzene and ethyl benzene.	02	
			Structure of carbonyl group, acidity of á-hydrogen in carbonyl compounds. Reactions of aldehydes &/or ketones: Cannizaro's,	02	
			Reformatsky, Perkin with mechanism, Mannich reaction, Benzoin and Aldol condensations. Clemmensen, Wolf-Kishner, MPV and LiAlH4 reductions.	02	
		B] Carboxylic acids:	Structure and reactivity of carboxylic groups. Acidity of carboxylic acids, effects of substituents on acids strength. Oxalic acid: Preparation from ethylene glycol and cyanogen. Reactions: Reaction with ethyl alcohol, ammonia, glycerol and action of heat. Lactic acid: Preparation from acetaldehyde and pyruvic acid.	02	
			Reactions: Reaction with ethanol,PCl_5, action of heat, oxidation and reduction. Benzoic acid: Preparation from toluene, benzyl alcohol, phenyl cyanide and benzamide.	02	
			Reactions: Reaction with ethanol, PCl_5 and ammonia. Salicylic acid: Preparation by Reimer-Tiemann reaction. Reactions: Reaction with CH_3COCl, CH_3OH and C_6H_5OH.	02	
2	July	A] Optical isomerism:	Element of symmetry, chirality, asymetric carbon atom, enantiomers, diastereoisomers,	02	14
			relative and absolute configurations, DL and RS nomenclature, racemisation and resolution.	02	
		B] Geometrical isomerism:	Cis-trans & *E-Z* nomenclature, Methods of structure determination.	03	
		C] Conformational isomerism:	Bayer's Strain theory and its limitations. Stability of cycloalkanes, conformational isomers of ethane	03	
			conformational isomers of, n-butane & cyclohexane, their energy level diagrams.	02	
			Newman & Sawhorse projection formulae.	02	

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Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects
3	Aug	A] Covalent Bonding:	Molecular Orbital Theory. Postulates of MO theory. LCAO approximation. Formation of bonding and antibonding MOs. Rules for LCAO. MO energy level diagram. MO structure of homonuclear diatomic molecules of namely He_2, H_2, N_2 and O_2. Stability sequence of species of O2	03	14
		B] Metallic Bonding:	Paramagnetic nature of O2. MO structure of heteronuclear diatomic molecules viz. NO, HF &CO. properties of CO viz. – triple 15 16 bond, almost nonpolar nature, edonor & acceptor behaviour. Comparison of VB and MO theories.	03	
			Free electron theory and properties of metals such as electrical and thermal conduction, malleability, ductility and metallic lusture. VB theory or Resonance theory of metals. Band theory to explain nature of conductors, insulators and semiconductors.	03	
		C] VSEPR Theory:	Various rules under VSEPR theory to explain molecular geometry various rules- $BeCl_2$, BF_3, CH_4 , NH_4 + , PCl_5 , SF_6, IF_7, $SnCl_2$, NH_3, H_2O, SF_4,	03	
			Various rules under VSEPR theory to explain molecular geometry Limitations of VSEPR theory.	02	
4	Aug-Sept	Theory of Quantitative Inorganic Analysis	**(a) Introduction**:-Volumetric analysis, titrant, titrate, end point, equivalence point, indicator etc. Requirements of volumetric analysis. Definition of standard solution, primary standard substance.	02	14
		A] Volumetric Analysis:	Terms to express concentrations namely- molarity, normality, molality, mole fraction and percentage. **(b) Acid-Base titrations**:- Types of acid base titrations. pH variations during acid base titration. Acid base indicators. Choice of suitable indicators for different acid base titrations.	02	
			(c) Redox Titrations:-Pinciples involved in redox titrations. Brief idea about use of $KMnO_4$, $K_2Cr_2O_7$as oxidants in acidic medium in redox titrations.	02	
			Use of I_2 in iodometry & iodimetry. Redox indicators-external & internal indicators. iodometric estimation of Cu (II).	02	
		B] Gravimetric Analysis:	Definition. Theoretical principles underlying various steps involved in gravimetric analysis with reference to estimation of barium as $BaSO_4$	04	
			Coprecipitation and post precipitation	02	

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Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
5	Sept	A) Liquid State:-	Surface tension – Determination and its S.I. unit, Effect of temperature on surface tension, Derivation of expression for relative surface tension by Drop number method. Application of surface tension.	02	14
			Viscosity- Determination and its S.I. unit, Effect of temperature on viscosity, derivation of expression for relative viscosity by Ostwald's viscometer method. Application of viscosity.	02	
		B) Electrochemistry:	Conductance of electrolyte solutions. Specific, equivalent & molar conductance. Detn of conductance of electrolyte soln.	02	
			Variation of specific and equivalent Conductance with dilution for strong electrolyte Conductometric titrations, Application of Conductometric titrations.	02	
			Migration of ions under the influence of electric field. Transport number of ions. Determ. of Transport number of ions by Hottorf's method & Moving boundary method.	02	
			Kohlrausch's law of independent migration of ions. Determ^{n} of $\lambda\infty$ & degree of α dissociation of a week elect.	02	
			Determination of constant of a week electrolyte. Numerical.	02	
6	Oct	A) Thermodynamics and Equilibrium:	Definition and physical significance of Helmholtz work function (A) and Gibbs free energy. Change in free energy (ΔG) as a criteria of spontaneity and equilibrium.	02	14
			Variation of free energy G with 'P' & 'T'. Gibbs-Helmholtz equation in terms of G and its applications.	02	
			Partial molal function, chemical potential, derivations of Gibb's-Duhem equation. Chemical potential of an ideal gas in gaseous mixture.	03	
			Derivation of Gibbs-Duhem equation. Derivation of Van't Hoff reaction of isotherm & its application to equil. state.	02	
		B) Phase Equilibrium:	Derivation of Van't Hoff equn & its applications. Numericals.	01	
			Immiscible liquids, Nerst distribution law and its application to association and dissociation of solute in one of the solvent Process of extraction, derivation of formula for the amount of solute left unextracted after nth extraction.	02	
			Phase transition- Clausius-clyperon. Partially miscible liquids- Phase diagram of phenol-water, triethyl amine-water & nicotine–water systems. Numerical.	02	

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Department of Chemistry

Teaching Plan Session-2020-21

B.Sc.-IIIrd Semester-Vth

Name of Faculty:- Mr. Kamalakar K. Wavhal

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lect.
1	July	Coordination Compounds-I:	Important terms namely-molecular or addition compounds, double salts, complex ion, ligand, coordination number, central metal ion etc. Werner's theory of coordination and experimental evidences on the basis of conduction data and formation of AgCl precipitate in case of cobaltamines.	03	
			Sidgwick's electronic interpretation & its drawbacks. EAN rule. IUPAC rules for nomenclature of coordination. Structural linkage & coordination isomerism in complexes.	03	
			Geometrical isomerism in octahedral complexes of type Ma4b2, Ma4bc, Ma3b3, M(AA)2b2. Square planar complexes of type Ma2b2 and Ma2bc. Optical isomerism in octahedral complexes of type Ma2b2c2, Mabcdef, M(AA)3, M(AA)2b2	03	14
		B) Chelates:	Tetrahedral complexes of type Mabcd and M(AA)2. Optical isomerism in square planar complexes. VBT as applied to structure and bonding in complexes and Magnetic properties of complexes of 3d series elements. Limitations of VB theory.	03	
			Definition, classification & applications of chelates	02	
2	July-Aug	A] Crystal Field Theory (CFT):	Postulates of CFT, Crystal field splitting in octahedral, distorted octahedral, square planar tetrahedral complexes,	03	
			concept of CFSE, high spin and low spin complexes on the basis of $\Delta 0$ and pairing energy, distribution of electrons in t2g	03	
			orbitals in high spin and low spin octahedral complexes. Factor affecting magnitude of CF splitting in octahedral complexes.	02	14
		B] Electronic Spectra of Transition Metal Complexes	Introduction to spectra, selection rules for d-d transitions, spectroscopic terms-determination of ground term symbols for d1 to d10, spectra of d1 and d9 octahedral complexes,	03	
			Orgel diagram for d1 and d9 states, electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion. Spectrochemical series.	03	

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Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lect,
3	Aug	A] Heterocyclic compounds	Nomenclature, Pyrrole: Synthesis from acetylene, succinimide and furan, Basicity, acetaldehyde, acetone, ethylene oxide & CO_2.	02	14
			Electrophilic substitution reactions (orientation) – nitration, sulphonation, acetylation and halogenation , Molecular orbital structure.	02	
		B] Organometallic compounds::	Pyridine: Synthesis from acetylene and pentamethylene diamine hydrochloride, Basicity, Electrophilic substitution reactions (orientation) – nitration, sulphonation, Nucleophilic substitution reactions (orientation)- with NaNH2, C6H5Li and KOH.	03	
			Grignard reagents: Methyl magnesium bromide- Synthesis from methyl bromide (only reaction) Synthetic applications: Electrophilic substitution reactions-formation of alkanes, alkenes, higher alkynes and other organometallic compounds,	02	
			Nucleophilic substitution reactions- Reaction with aldehydes & ketones, ethylene oxide, acetyl chloride, methyl cyanide & CO_2.	02	
			Methyl lithium-Synthesis and reaction with water, formaldehyde, acetaldehyde, acetone, ethylene oxide and CO_2.	03	
4	Aug-Sept	A] Dyes:	Classification on the basis of structure and mode of application, Preparation and uses of Methyl orange,	03	
			Crystal violet, Phenolphthalein , Alizarin and Indigo.	02	
		B] Drugs:	Analgesic and antipyretics: Synthesis and uses of phenylbutazone. Sulpha drugs: Synthesis and uses of sulphanilamide and sulphadiazine.	03	
			Antimalarials: Synthesis of chloroquine from 4,7-dichloroquinoline and its uses.	02	
		C] Pesticides:	Insecticides:Synthesis and uses of malathion. Herbicides: Synthesis and uses of 2,4-dichloro phenoxy acetic acid (2,4-D)..	03	
			Fungicides: Synthesis and uses of thiram (tetramethyl thiuram disulphide	02	

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Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lect.
5	Sept-Oct	Photochemistry	(i) Photochemical and thermal reactions. (ii) Lambert's law - Statement and derivation.	02	
			Beer's law - Statement and derivation. Reasons for deviation from Beer's law. (iii) Laws of photochemistry.	02	
			(iv) Quantum yield of photochemical reaction. Reasons for high and low quantum yield. Experimental determination of quantum yield. Photosensitized reaction.	02	
			(v) Kinetics of photochemical decomposition of HI. (vi) Fluorescence and Phosphorescence.	02	
			Selection rule for electronic transition. Internal conversion and inter-system crossing. Explanation of fluorescence and phosphorescence on the basis of Joblonski diagram	03	
			(vii) Chemiluminescence and Bioluminescence with examples. (viii) Numericals.	03	
6	Oct	Molecular Spectroscopy	(i) Electromagnetic radiation, characteristics of electromagnetic radiation in terms of wavelength, wave number, frequency and energy of photon. Spectrum of electromagnetic radiation. (ii) Types of spectra - Emission and absorption spectra, atomic and molecular spectra, line and band spectra	03	
			(iii) Translational, vibrational, rotational and electronic motion. The degree of freedom in each motion. (iv) Energy level diagram of a molecule indicating electronic, vibrational and rotational transitions. (v) Condition for pure rotational spectrum, selection rule for rotational transition.	02	
			Derivation of expression for moment of inertia of a diatomic rigid rotor. Isotope effect. Applications of microwave spectroscopy for the determination of moment of inertia and bonding. (vi) Condition for exhibiting vibrational spectra (i.e. IR active molecule),	03	
			selection rule for vibrational transition. Vibrational energy levels of a simple harmonic oscillator. Zero point energy, position of a spectral line. Determination of force constant of a covalent bond.	02	
			(v) Raman effect - Raman's spectrum of a molecule. Condition for exhibiting Raman spectrum (i.e. Raman active molecule), selection rule for rotational transitions.	02	
			Pure rotational spectrum of diatomic molecule, vibrational Raman spectrum of a diatomic molecule. (vii) Numericals.	02	

Incharge Teacher
Wavhal Kamalakar K.

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Department of Chemistry

Teaching Plan Session-2020-21

B.Sc.-I[st] Semester-II[nd]

Name of Faculty:- Prof. Suryakant B. Borul

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
1	Dec-20 Jan-21	A] Alkyl Halides:	Introduction, Synthe'sis of vinyl chloride from acetylene and allyl chloride from propylene,	02	14
			Reactions of both with aqueous and alcoholic KOH, Comparison of reactivity of vinyl an allyl chloride.	02	
		B] Aryl Halides:	Synthesis chlorobenzene from benzene, phenol and benzene diazonium chloride, Synthesis of benzyl chloride from toluene and benzyl alcohol,	02	
			Reactions of both with aqueous KOH, NH_3 and sodium ethoxide, Comparison of reactivity of chlorobenzene and benzyl chloride. Benzyne intermediate mechanism.	02	
		C] Alcohols:	Dihydric alcohols: Ethylene glycol- Preparation from ethylene, ethylene chloride and ethylene oxide,	02	
			R eactions- with Na, PCl5 , CH3COOH, ZnCl2, conc. H2SO4 and dehydration with heat. Trihydric alcohols: Glycerol- Preparation from propylene,	02	
			Reactions- with Na, HCl, PCl5, HNO3 and KHSO4. Pinacol- pinacolone rearrangement (mechanism).	02	
2	Jan	A] Phenols:	Introduction, Methods of formations a) from aniline b) from Cumene. Acidic character,	02	14
			Reaction of Phenols- a) Carboxylation (Kolb's reaction), b) Fries Rearrangement,	02	
			c) Claisen Rearrengement d) Reimer-Tiemann reaction.	02	
		B] Ethers:	Introduction, Diethyl ether- Preparation by Williamson's synthesis and continuous etherification process,	02	
			Reactions-with cold and hot HI	02	
		C] Epoxides:	Introduction, Synthesis of ethylene oxide from ethylene and styrene oxide from styrene.	02	
			Ring opening reactions of both catalyzed by acid and alkali.	02	

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Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
3	Jan-Feb	**Chemical Kinetics**	Explanation of terms like rate of reaction, order of a reaction and molecularity. Definition zero, first and second order reaction. Half life period of a reaction.	02	14
			Derivation of rate equation for first and second order reaction with equal initial concentration and different initial concentration of a reactant. Characteristics of first and second order reaction.	03	
			Examples of first and second order reaction viz. the reactions (i) decomposition of H_2O_2, (ii) reaction between $K_2S_2O_8$ and KI,	03	
			(iii) Hydrolysis of methyl acetate catalyzed by acid, (iv) saponification of ethyl acetate by NaOH and (v) inversion of cane sugar. Determination of order of a reaction by integration, graphical, equifractional change, etc. method.	03	
			Effect of temperature on reaction rates. Arrhenius equation, activation energy and its determination using Arrhenius equation. Numericals.	03	
4	Feb	**UNIT-I** **A] Polarisation-** **B] Covalent bonding-** **C] Intermolecular forces-** **D] Acids and Base-**	Defn, polarising power, polarizability. Effect of polarization on nature of bond. Fajan's rules of polarisation & its applications.	02	14
			Directional nature of covalent bond. Hybridization, types of hybridization to explain geometries of NH^{4+} ion, PCl_5, SF_6 & IF_7.	02	
			Dipole-dipole, dipole-induced-dipole, induced dipole-induced dipole interactions. Ion - dipole interactions.	03	
			Theory of solvent sys. & Lux-Flood concept of acids & bases.	03	
			Hard and soft acids and bases. Pearsons HSAB principle with imp applications.	04	

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Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
5	Feb-March	A]Electrical Properties:	(i) Polar and non-polar molecules. Dipole moment. (ii) Induced polarization & orientation polarization. Clausius-Mossotti equation	03	
			(iii) Measurement of dipole moment by temperature and refractivity methods.	01	
			(iv)Applications of dipole moment for the determination of molecular structure. i.e. percentage ionic character of covalent bonding, molecular geometry, cis-trans isomers, ortho, meta and para isomers of a disubstituted benzene.	03	
		B]Magnetic Properties:	(i) Paramagnetic and diamagnetic substances, origin of paramagnetism, diamagnetism, ferromagnetism and antiferromagnetism.(ii) Volume, specific, mass and molar susceptibility. Relationship between.	03	
			(iii) Relationship between magnetic moment and number of unpaired electrons. (iv) Gouy's balance method for determination of magnetic susceptibility.	02	
			(v) Application of magnetic moment in the determination of molecular structure.(vi) Numericals.	02	
6	March	A] P-Block Elements-	Comparative study of 16^{th} and 17^{th} group elements with reference to electronic configuration,	02	14
			Ionisation energy & oxidation states. Oxidising properties of halogens with reference to oxidation potential.	02	
		B] Noble Gases-	Basic properties of halogens with special reference to iodine. Interhalogen compounds. Introduction to fluorocarbons.	02	
			Inertness of noble gases. Compounds of noble gases-only str. & bonding in XeF_2, XeF_4, $XeOF_4$,XeO_2F_2 XeO_3 and XeO_4	02	
		C] Non-aqueous Solvents-	Requirements of a good solvent. Water as a universal solv. Physical prop of solvents namely liq. range, dielectric constant, dipole moment, heat of vaporisation & solubility behaviour.	02	
			Classification of solvents. Reactions in liquid ammonia acid base, precipitation, redox, solvolysis	02	
			solutions of metals in liquid ammonia.	02	

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Department of Chemistry

Teaching Plan Session-2020-21

B.Sc.-II[nd] Semester-IV[th]

Name of Faculty:- Mr. Shivshankar P. More

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total
1	Dec-Jan	Colligative Properties of Dilute Solutions:	(i) Defination and examples of colligative properties.	02	14
			(ii Elevation of boiling point, thermodynamic derivation o the relationship between elevation of boiling point and molar mass of a non-volatile solute.	02	
			Cotrell's method for determination of elevation of boiling point.	02	
			(iii) Depression of freezing point, thermodynamic derivation of the relationship between depression of freezing point and molar mass of a non-volatile solute.	02	
			Rast's method for determination of depression of freezing point.	02	
			(iv) Abnormal behavior of solution. Van't Hoff's factor 'i'.	02	
			Determination of degree of association and dissociation from Van't Hoff's factor.(v) Numerical.	02	
2	Jan	Crystalline state	Symmetry in crystal, plane of symmetry, axis of symmetry and point of symmetry. Law of constancy of interfacial angles.	02	14
			Elements of symmetry in cubic crystals. Laws of symmetry. Law of rational indices, Weiss and Miller indices of a lattice planes, calculation of interplaner distance d(h,k,l) from Miller indices in a cubic system.	02	
			Seven crystal systems and fourteen Bravais lattices, Bravais lattices of cubic system. Simple cubic system (S.C.C.), body centered cubic system (B.C.C.) and face centered cubic system (F.C.C.).	02	
			Calculation of number of constituent units in S.C.C., B.C.C. and F.C.C.	02	
			Ratio of interplaner distances for 100, 110 and 111 lattice plane in S.C.C., B.C.C. and F.C.C.	02	
			Derivation of Bragg's equation for X-ray diffraction, Bragg's X-ray spectrometer method for the determination of crystal structure of NaCl and KCl.	02	
			Anomalous behaviour of KCl towards X-ray. Numericals.	02	

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Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total
3	Jan-Feb	**A] Chemistry of elements of transition series:**	Definition of transition elements. General characteristics of transition elements. Comparative study of first transition series elements (3d) with reference to following properties: (i) Electronic configuration	02	14
			(ii) Atomic and ionic size (iii) Ionization energy (iv) Metallic nature (v) Oxidation states (vi) Magnetic properties (vii) Color of salts (viii) Catalytic properties (ix) Complex formation behaviour.	03	
			Study of 4d and 5d series elements-Electronic configuration.	03	
		B] Extraction of elements:	Comparison of 3d series elements with 4d and 5dseries elements with respect to size, oxidation states, magnetic properties and color.	03	
			Principles involved in extraction of elements. Major methods of extraction of elements. Factors affecting choice of extraction method. Thermodynamics of reduction processes-Ellingham diagrams for oxides and importance of this diagram	03	
4	Feb	**A] Inner transition elements:**	Definition, Lanthanides and Actinides. Comparative study of Lanthanides with respect to following properties:(i) Electronic configuration	02	14
			(ii) Atomic and ionic radii lanthanide contraction definition, cause and effect of lanthanide contraction	02	
			(iii) Oxidation states (iv) Magnetic properties	02	
			(v) Color of salts vi) Complex formation behavior.	02	
		B] General Principles of Metallurgy:	Occurrence of lanthanides. Isolation of lanthanides by ion exchange method. Actinides- Electronic configuration and oxidation states. Comparison of lanthanides and actinides.	03	
			Definition of metallurgy, steps in metallurgy. Ore dressing by gravity separation, froath floatation and electromagnetic separation. Calcinations, roasting, smelting and refining of metals. Meaning of termshydrometallurgy and pyrometallurgy.	03	

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Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total
5	Feb-March	A] Aromatic nitro compounds: B] Amino Compounds: C] Diazonium Salts: D] Amino acids and Proteins:	Nitrobenzene: Synthesis from benzene, Reduction of nitrobenzene in acidic, neutral and alkaline medium.	03	14
			Basicity and effect of substituents. Methods of preparation of aniline from nitrobenzene, Reactions: with acetyl and benzoyl chlorides, Br2(aq) and Br2(CS2),	02	
			Carbylamine reaction, alkylation,Hoffmann's exhaustive methylation and its mechanism.	02	
			Preparation benzene diazonium chloride, Synthetic applications- Preparation of benzene,phenol, halobenzene,nitrobenzene,benzonitrile, coupling with phenol and aniline.	03	
			Classification, Strecker and Gabrial phthalimide synthesis, Zwitterion structure, Isoelectric point,	02	
			peptide synthesis, Structure determination of polypeptides by end group analysis.	02	
6	March	A] Polynuclear hydrocarbons: B] Reactive methylene compounds: C] Carbohydrates:	Naphthalene - Haworth synthesis,orbital picture, Reactions – electrophilic substitution	02	14
			Preparation of naphthols from naphthalene sulphonic acids and naphthylamines from naphthols.	02	
			Malonic Ester: Synthesis from acetic acid, Synthetic applications- Synthesis of acetic acid , succinic acid, glutaric acid, crotonic acid and malonyl urea.	03	
			Acetoacetic ester: Synthesis from ethyl acetate, Synthetic applications- Synthesis of acetic acid, propionic acid, isobutyric acid, succinic acid, glutaric acid, crotonic acid, acetyl acetone and 4-methyl uracil.	03	
			Constitution of glucose, cyclic structure, Pyranose and Furanose structure, Epimerization, conversion of glucose to fructose and vice-versa,	02	
			Introduction to fructose, ribose, 2- deoxyribose, maltose, sucrose. (their structures only determination not needed).	02	

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Department of Chemistry

Teaching Plan Session-2020-21

B.Sc.-IIIrdSemester-VIth

Name of Faculty:- Wavhal Kamalakar K.

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total Lects.
1	Dec-Jan	A) Kinetic Aspects of Metal Complexes:	Types of reactions of coordination compounds. Brief idea about substitution reactions. SN1 dissociative and SN2 associative mechanism of substitution in octahedral complexes. Labile and inert complexes.	03	14
		B) Analytical Chemistry:	Factors affecting lability of complexes viz. arrangement of d-electrons (VB theory),. Mechanism of substitution reactions in square planar complexes.	03	
		1. Colorimetry Spectrophotometry	Concept of □max. Beer-Lambert's law Verification of Beer's law. Block diagrams of colorimeter and spectrophotometer	02	
		2. Paper Chromatography	Difference between colorimeter and spectrophotometer. Application of colorimetric &spectrophotometric technique for determination of concentration of metal.	02	
			Definition and classification of chromatography. Principle of ifferential migration.	02	
			Principle and technique of paper chromatography, Rf value and factors affecting Rf value	02	
2	Jan	A] Organometallic Chemistry :	Definition, nomenclature and classification of organometallic compounds. Metal carbonyls- definition and classification.	02	14
			Preparation, properties, structure and bonding in $Ni(CO)_4$, $Fe(CO)_5$, $Cr(CO)_6$. Nature of M-C bond in metal carbonyls.	03	
			Definition and classification. Silicones: preparation, properties structure and bonding and applications.	03	
		B] Inorganic Polymers:	Phosphonitrile halides polymers- preparation, properties, structure and bonding in cyclic polymers.	02	
		C] Bio-inorganic Chemistry	Essential and trace elements in biological processes.	02	
			Biological role of Na+, K+, Ca2+ and Mg2+ ions. Metalloporphyrins- Haemoglobin and Myoglobin and their role in oxygen transport.	02	

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Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total Lects.
3	Jan-Feb	A) Electronic Spectroscopy :	Introduction, radiation source, spectral range, types of electronic transitions, chromophore, auxochrome, bathochromic, hypsochromic,	02	14
			Hyperchromic and hypochromic effects. Applications to the structure determination of compounds like dines, aldehydes, ketones & aromatic systems.	03	
		B) Infrared Spectroscopy	Types of vibrational modes, stretching and bending, spectrum range, radiation source, presentation of IR spectrum, characteristic frequencies of various groups,	03	
		C) Purification of Organic Compounds:	Finger print region. Structure of organic compounds (IR spectra of simple compounds: H_2O, CO_2, CH□CH, CH_3COCH_3).	02	
			Sublimation, crystallization.	02	
			Paper chromatography: Principle and Rf value.	02	
4	Feb	Unit IV : A) Nuclear Magnetic Resonance Spectroscopy :	Introduction, spin quantum number, instrumentation, Aspects of NMR- number of signals(equivalent & non-equivalent protons),	03	14
			Positions of signals(chemical shift), intensities of signals,	02	
			Splitting of signals (spin-spin coupling), coupling constant, and applications.	03	
		B) Mass Spectrometry:	Introduction, theory, instrumentation-(ion sources),	02	
			Mass spectra of neopentane and methanol, molecular ion peak, base peak, metastable peak,	02	
			Rules of fragmentation, applications.	02	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total Lects.
5	Feb-March	A] Electrochemistry:	(i) Types of electrode - Standard hydrogen electrode, Calomel electrode, Quinhydrone electrode and Glass electrode. Principle of Potentiometric titration. Study of acid-base, redox and precipitation titration.	02	14
			(ii) pH of a solution and pH scale. Determination of pH of a solution using hydrogen, quinhydrone and glass electrodes. Advantage and disadvantage of these electrodes. pH-metric titrations. Determination of pka of a weak acid by pH-metric measurement.	02	
			(iii) Concentration cells - Types of concentration cells, concentration cell without transfer and determination of its emf. (iv) Numericals	02	
			(i) Shell model of a nucleus - Assumptions, evidences for existence of magic numbers, advantages and limitations. (ii) Liquid drop model of a nucleus - Assumptions, similarities between nucleus and liquid drop, advantages and limitations, explanation of nuclear fission reaction on the basis of liquid	02	

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Late Ku. Durga K. Banmeru Science College, Lonar Dist- Buldana

Department of Chemistry

Teaching Plan Session-2021-22

B.Sc.-I[st] Semester-I[st]

Name of Faculty:- Mr. Suryakant B. Borul

Sr. No.	Month	Name of Unit	Topics Names	Required Lecture	Total Lects.
1	Oct	**A) Electronic displacements:**	Inductive effect, electromeric effect, Resonance & Hyperconjugation (Definition and Applications)	02	14
		B) Reactive Intermediates:	Carbocations, Carbanions and Free radicals, their generation stability & reactions.	02	
		C) Aliphatic Hydrocarbon:	**Alkanes-** Methods of formation: i) Wurtz reaction and ii) Corey-House reaction, reactions i) Halogenation mechanism ii) Aromatisation.	03	
			Alkenes Method of formation mechanism- i) dehyhrogenation of alkyl halides (E_1 & E_2) ii) Dehydration of alcohols.	02	
			Reactions-Electrophilic and free radical addition of HX and X_2 (with mechanism)	01	
			Alkynes- Preparations from vicinal and germinal dihalides, Reaction-Hydrogenation.	02	
			Alkadienes:-Classification 1, 3-Butadiene- Preparation from cyclohexene, reactions-Addition of H_2, Br_2 & HBr	02	
2	Oct	**Aromatic Hydrocarbons**	Introduction, Nomenclature and Isomerism of Aromatic Compounds.	02	14
		A)	Structure of Benzene of Benzene : Kekule structure and Molecular orbital structure.	02	
			Aromaticity and Huckel's rule Aromatic,	02	
		B)	antiaromatic and non-aromatic system	02	
			Mechnism of Electrophilic Aromatic Substitution:- Nitration, Friedal Craft Alkylation and Acylation.	03	
		C)	Nuclear and side chain halogenations, Birch reduction.	01	
		D)	Orientation:- Effect of substituent group. Activating and deactivating group. Theory of reactivity and orientation on the basis of inductive and resonance effects (-CH_3, -OH, -NO_2 and –Cl group).	02	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
3	NOV	A] Periodic Properties:	Atomic and ionic radii. Types of atomic radii. Periodic trends in atomic and ionic radii. Ionization energy, electron affinity and electronegativity.	03	14
			Effect of ionization energy and electronegativity on different properties of elements namely metallic and non-metallic character, relative reactivity, oxidizing and reducing properties., Scales of electronegativity Pauling scale and Mulliken Scales. Electronegativity and partial ionic character of a covalent bond.	03	
			Screening effect, screening constant and effective nuclear charge. Slater's rules for calcul. screening constant. Problems.	02	
		B] Ionic bonding:	Definition of ionic bond, types of cations. Factors affecting ionic bond formation. Born Lande equation to cal. lattice energy. Born-Haber's cycle to determine lattice energy	03	
			Solvation and salvation energy, factors affecting salvation energy, Det^{n} of salvation energy. Solubility of ionic solids, lattice energy and salvation energy.	03	
4	Dec	Thermodynamics	Adiabatic and Isothermal processes. Work done in Adiabatic and isothermal processes, relationship between pressure, volume and temperature.	03	14
			First law of Thermodynamics and its limitations, Need of Second law.	02	
			Carnot's heat engine, derivation of expression for the work done and efficiency of Carnot's engine. Statements of Second law of thermodynamics.	03	
			Concept of Entropy, Physical significance of Entropy, Derivation of expression for the Entropy change for an ideal gas Entropy change for an ideal gas for isothermal, isobaric and isochoric processes,	03	
			Entropy of fusion, sublimation, vapourization, transition and its calculations. Entropy change as a criterion for spontaneity. Numericals.	03	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
5	Dec 2021	A] S-Block element:	Comparative study of 1st and 2nd group elements with reference to electronic configuration, ionisation energy, oxidation states.	03	14
			Reactivity and flame colouration. Diagonal relationship between Li and Mg.	02	
		B] P-Block element:	Comparative study of 13th, 14th and 15th group elements with reference to electronic configuration,	03	
			ionisation energy, oxidation states. Concept of inert pair effect. Diagonal relationship between Be and Al. Structure of diamond and graphite.	03	
			Abnormal behaviour of nitrogen. Hydrides of boron-preparation (from BCl3 and NaBH4two), properties (action of heat, water, alkali and oxygen), structure and bonding in diborane. Carbides, types of carbides and fullerenes.	03	
6	Jan 22	A] Gaseous State:	Postulates of Kinetic theory of gases, Derivation of Kinetic gas equation.	02	14
			RMS, Average and Most probable velocities and their relationship. Maxwell-Boltzmann distribution law of molecular velocities (only qualitative treatment), Mean free path, collision number and collision diameter.	03	
			Deviation of real gases from ideal gas behavior. Vander waal's equation of state and its derivation for real gases.	02	
			Critical phenomenon, Andrew's experiment - isotherm of CO2. Critical state, critical constant, Pc, Vc and Tc in terms of Vanderwaal's constants 'a' and 'b'. Law of Corresponding state. Numericals.	03	
		B] Phase Rule:	Statement of phase rule, explanation of phase, number of Components and degree of freedom.	02	
			Application of phase rule to water and sulfur system.	02	

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Department of Chemistry

Teaching Plan Session-2021-22

B.Sc.-IInd Semester-IIIrd

Name of Faculty:-Mr. Shivshankar P. More

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total Lects
1	OCt 21	**A] Aldehydes and Ketones:**	Preparation of acetaldehyde from ethanol, ethylidene chloride and acetylene. Preparation of benzaldehyde from benzene (Gattermann-Koch reaction) and toluene.	02	**14**
			Preparation of acetone from isopropyl alcohol, isopropylidene chloride and propyne. Preparation of acetophenone from benzene and ethyl benzene.	02	
			Structure of carbonyl group, acidity of á-hydrogen in carbonyl compounds. Reactions of aldehydes &/or ketones: Cannizaro's,	02	
			Reformatsky, Perkin with mechanism, Mannich reaction, Benzoin and Aldol condensations. Clemmensen, Wolf-Kishner, MPV and LiAlH4 reductions.	02	
		B] Carboxylic acids:	Structure and reactivity of carboxylic groups. Acidity of carboxylic acids, effects of substituents on acids strength. Oxalic acid: Preparation from ethylene glycol and cyanogen. Reactions: Reaction with ethyl alcohol, ammonia, glycerol and action of heat. Lactic acid: Preparation from acetaldehyde and pyruvic acid.	02	
			Reactions: Reaction with ethanol,PCl_5, action of heat, oxidation and reduction. Benzoic acid: Preparation from toluene, benzyl alcohol, phenyl cyanide and benzamide.	02	
			Reactions: Reaction with ethanol, PCl_5 and ammonia. Salicylic acid: Preparation by Reimer-Tiemann reaction. Reactions: Reaction with CH_3COCl, CH_3OH and C_6H_5OH.	02	
2	OCt	**A] Optical isomerism:**	Element of symmetry, chirality, asymetric carbon atom, enantiomers, diastereoisomers,	02	**14**
			relative and absolute configurations, DL and RS nomenclature, racemisation and resolution.	02	
		B] Geometrical isomerism:	Cis-trans & *E-Z* nomenclature, Methods of structure determination.	03	
		C] Conformational isomerism:	Bayer's Strain theory and its limitations. Stability of cycloalkanes, conformational isomers of ethane	03	
			conformational isomers of, n-butane & cyclohexane, their energy level diagrams.	02	
			Newman & Sawhorse projection formulae.	02	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects
3	NOV	A] Covalent Bonding:	Molecular Orbital Theory. Postulates of MO theory. LCAO approximation. Formation of bonding and antibonding MOs. Rules for LCAO. MO energy level diagram. MO structure of homonuclear diatomic molecules of namely He_2, H_2, N_2 and O_2. Stability sequence of species of O2	03	14
		B] Metallic Bonding:	Paramagnetic nature of O2. MO structure of heteronuclear diatomic molecules viz. NO, HF &CO. properties of CO viz. – triple 15 16 bond, almost nonpolar nature, edonor & acceptor behaviour. Comparison of VB and MO theories.	03	
			Free electron theory and properties of metals such as electrical and thermal conduction, malleability, ductility and metallic lusture. VB theory or Resonance theory of metals. Band theory to explain nature of conductors, insulators and semiconductors.	03	
		C] VSEPR Theory:	Various rules under VSEPR theory to explain molecular geometry various rules- $BeCl_2$, BF_3, CH_4 , NH_4 + , PCl_5 , SF_6, IF_7, $SnCl_2$, NH_3, H_2O, SF_4,	03	
			Various rules under VSEPR theory to explain molecular geometry Limitations of VSEPR theory.	02	
4	Dec	Theory of Quantitative Inorganic Analysis	**(a) Introduction**:-Volumetric analysis, titrant, titrate, end point, equivalence point, indicator etc. Requirements of volumetric analysis. Definition of standard solution, primary standard substance.	02	14
		A] Volumetric Analysis:	Terms to express concentrations namely- molarity, normality, molality, mole fraction and percentage. **(b) Acid-Base titrations**:- Types of acid base titrations. pH variations during acid base titration. Acid base indicators. Choice of suitable indicators for different acid base titrations.	02	
			(c) Redox Titrations:-Pinciples involved in redox titrations. Brief idea about use of $KMnO_4$, $K_2Cr_2O_7$as oxidants in acidic medium in redox titrations.	02	
			Use of I_2 in iodometry & iodimetry. Redox indicators-external & internal indicators. iodometric estimation of Cu .	02	
		B] Gravimetric Analysis:	Definition. Theoretical principles underlying various steps involved in gravimetric analysis with reference to estimation of barium as $BaSO_4$	04	
			Coprecipitation and post precipitation	02	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
5	Dec 21	A) Liquid State:-	Surface tension – Determination and its S.I. unit, Effect of temperature on surface tension, Derivation of expression for relative surface tension by Drop number method. Application of surface tension.	02	
			Viscosity- Determination and its S.I. unit, Effect of temperature on viscosity, derivation of expression for relative viscosity by Ostwald's viscometer method. Application of viscosity.	02	
		B) Electrochemistry:	Conductance of electrolyte solutions. Specific, equivalent & molar conductance. Detn of conductance of electrolyte soln.	02	14
			Variation of specific and equivalent Conductance with dilution for strong electrolyte Conductometric titrations, Application of Conductometric titrations.	02	
			Migration of ions under the influence of electric field. Transport number of ions. Determ. of Transport number of ions by Hottorf's method & Moving boundary method.	02	
			Kohlrausch's law of independent migration of ions. Determ^{n} of $\lambda\infty$ & degree of α dissociation of a week elect.	02	
			Determination of constant of a week electrolyte. Numerical.	02	
6	Jan 22	A) Thermodynamics and Equilibrium:	Definition and physical significance of Helmholtz work function (A) and Gibbs free energy. Change in free energy (ΔG) as a criteria of spontaneity and equilibrium.	02	
			Variation of free energy G with 'P' & 'T'. Gibbs-Helmholtz equation in terms of G and its applications.	02	
			Partial molal function, chemical potential, derivations of Gibb's-Duhem equation. Chemical potential of an ideal gas in gaseous mixture.	03	
			Derivation of Gibbs-Duhem equation. Derivation of Van't Hoff reaction of isotherm & its application to equil. state.	02	14
		B) Phase Equilibrium:	Derivation of Van't Hoff equn & its applications. Numericals.	01	
			Immiscible liquids, Nerst distribution law and its application to association and dissociation of solute in one of the solvent Process of extraction, derivation of formula for the amount of solute left unextracted after nth extraction.	02	
			Phase transition- Clausius-clyperon. Partially miscible liquids- Phase diagram of phenol-water, triethyl amine-water & nicotine–water systems. Numerical.	02	

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Department of Chemistry

Teaching Plan Session-2021-22

B.Sc.-IIIrd Semester-Vth

Name of Faculty:- Mr. Kamalakar K. Wavhal

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lect.
1	Oct 21	**Coordination Compounds-I:**	Important terms namely-molecular or addition compounds, double salts, complex ion, ligand, coordination number, central metal ion etc. Werner's theory of coordination and experimental evidences on the basis of conduction data and formation of AgCl precipitate in case of cobaltamines.	03	
			Sidgwick's electronic interpretation & its drawbacks. EAN rule. IUPAC rules for nomenclature of coordination. Structural linkage & coordination isomerism in complexes.	03	
			Geometrical isomerism in octahedral complexes of type Ma4b2, Ma4bc, Ma3b3, M(AA)2b2. Square planar complexes of type Ma2b2 and Ma2bc. Optical isomerism in octahedral complexes of type Ma2b2c2, Mabcdef, M(AA)3, M(AA)2b2	03	14
		B) Chelates:	Tetrahedral complexes of type Mabcd and M(AA)2. Optical isomerism in square planar complexes. VBT as applied to structure and bonding in complexes and Magnetic properties of complexes of 3d series elements. Limitations of VB theory.	03	
			Definition, classification & applications of chelates	02	
2	Oct	**A] Crystal Field Theory (CFT):**	Postulates of CFT, Crystal field splitting in octahedral, distorted octahedral, square planar tetrahedral complexes,	03	
			concept of CFSE, high spin and low spin complexes on the basis of $\Delta 0$ and pairing energy, distribution of electrons in t2g	03	
			orbitals in high spin and low spin octahedral complexes. Factor affecting magnitude of CF splitting in octahedral complexes.	02	14
		B] Electronic Spectra of Transition Metal Complexes	Introduction to spectra, selection rules for d-d transitions, spectroscopic terms-determination of ground term symbols for d1 to d10, spectra of d1 and d9 octahedral complexes,	03	
			Orgel diagram for d1 and d9 states, electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion. Spectrochemical series.	03	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lect.
3	NOV	A] Heterocyclic compounds	Nomenclature, Pyrrole: Synthesis from acetylene, succinimide and furan, Basicity, acetaldehyde, acetone, ethylene oxide & CO_2.	02	14
			Electrophilic substitution reactions (orientation) – nitration, sulphonation, acetylation and halogenation , Molecular orbital structure.	02	
			Pyridine: Synthesis from acetylene and pentamethylene diamine hydrochloride, Basicity, Electrophilic substitution reactions (orientation) – nitration, sulphonation, Nucleophilic substitution reactions (orientation)- with NaNH2, C6H5Li and KOH.	03	
		B] Organometallic compounds::	Grignard reagents: Methyl magnesium bromide- Synthesis from methyl bromide (only reaction) Synthetic applications: Electrophilic substitution reactions-formation of alkanes, alkenes, higher alkynes and other organometallic compounds,	02	
			Nucleophilic substitution reactions- Reaction with aldehydes & ketones, ethylene oxide, acetyl chloride, methyl cyanide & CO_2.	02	
			Methyl lithium-Synthesis and reaction with water, formaldehyde, acetaldehyde, acetone, ethylene oxide and CO_2.	03	
4	Dec 21	A] Dyes:	Classification on the basis of structure and mode of application, Preparation and uses of Methyl orange,	03	
			Crystal violet, Phenolphthalein , Alizarin and Indigo.	02	
		B] Drugs:	Analgesic and antipyretics: Synthesis and uses of phenylbutazone. Sulpha drugs: Synthesis and uses of sulphanilamide and sulphadiazine.	03	
			Antimalarials: Synthesis of chloroquine from 4,7-dichloroquinoline and its uses.	02	
		C] Pesticides:	Insecticides:Synthesis and uses of malathion. Herbicides: Synthesis and uses of 2,4-dichloro phenoxy acetic acid (2,4-D)..	03	
			Fungicides: Synthesis and uses of thiram (tetramethyl thiuram disulphide	02	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lect.
5	Dec 21	**Photochemistry**	(i) Photochemical and thermal reactions. (ii) Lambert's law - Statement and derivation.	02	
			Beer's law - Statement and derivation. Reasons for deviation from Beer's law. (iii) Laws of photochemistry.	02	
			(iv) Quantum yield of photochemical reaction. Reasons for high and low quantum yield. Experimental determination of quantum yield. Photosensitized reaction.	02	
			(v) Kinetics of photochemical decomposition of HI. (vi) Fluorescence and Phosphorescence.	02	
			Selection rule for electronic transition. Internal conversion and inter-system crossing. Explanation of fluorescence and phosphorescence on the basis of Joblonski diagram	03	
			(vii) Chemiluminescence and Bioluminescence with examples. (viii) Numericals.	03	
6	Jan 22	**Molecular Spectroscopy**	(i) Electromagnetic radiation, characteristics of electromagnetic radiation in terms of wavelength, wave number, frequency and energy of photon. Spectrum of electromagnetic radiation. (ii) Types of spectra - Emission and absorption spectra, atomic and molecular spectra, line and band spectra	03	
			(iii) Translational, vibrational, rotational and electronic motion. The degree of freedom in each motion. (iv) Energy level diagram of a molecule indicating electronic, vibrational and rotational transitions. (v) Condition for pure rotational spectrum, selection rule for rotational transition.	02	
			Derivation of expression for moment of inertia of a diatomic rigid rotor. Isotope effect. Applications of microwave spectroscopy for the determination of moment of inertia and bonding. (vi) Condition for exhibiting vibrational spectra (i.e. IR active molecule),	03	
			selection rule for vibrational transition. Vibrational energy levels of a simple harmonic oscillator. Zero point energy, position of a spectral line. Determination of force constant of a covalent bond.	02	
			(v) Raman effect - Raman's spectrum of a molecule. Condition for exhibiting Raman spectrum (i.e. Raman active molecule), selection rule for rotational transitions.	02	
			Pure rotational spectrum of diatomic molecule, vibrational Raman spectrum of a diatomic molecule. (vii) Numericals.	02	

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Department of Chemistry

Teaching Plan Session-2021-22

B.Sc.-Ist Semester-IInd

Name of Faculty:- Prof. Suryakant B. Borul

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
1	Feb 22	A] Alkyl Halides:	Introduction, Synthe`sis of vinyl chloride from acetylene and allyl chloride from propylene,	02	14
			Reactions of both with aqueous and alcoholic KOH, Comparison of reactivity of vinyl an allyl chloride.	02	
		B] Aryl Halides:	Synthesis chlorobenzene from benzene, phenol and benzene diazonium chloride, Synthesis of benzyl chloride from toluene and benzyl alcohol,	02	
			Reactions of both with aqueous KOH, NH_3 and sodium ethoxide, Comparison of reactivity of chlorobenzene and benzyl chloride. Benzyne intermediate mechanism.	02	
		C] Alcohols:	Dihydric alcohols: Ethylene glycol- Preparation from ethylene, ethylene chloride and ethylene oxide,	02	
			R eactions- with Na, PCl5 , CH3COOH, ZnCl2, conc. H2SO4 and dehydration with heat. Trihydric alcohols: Glycerol- Preparation from propylene,	02	
			Reactions- with Na, HCl, PCl5, HNO3 and KHSO4. Pinacol- pinacolone rearrangement (mechanism).	02	
2	March	A] Phenols:	Introduction, Methods of formations a) from aniline b) from Cumene. Acidic character,	02	14
			Reaction of Phenols- a) Carboxylation (Kolb's reaction), b) Fries Rearrangement,	02	
			c) Claisen Rearrengement d) Reimer-Tiemann reaction.	02	
		B] Ethers:	Introduction, Diethyl ether- Preparation by Williamson's synthesis and continuous etherification process,	02	
			Reactions-with cold and hot HI	02	
		C] Epoxides:	Introduction, Synthesis of ethylene oxide from ethylene and styrene oxide from styrene.	02	
			Ring opening reactions of both catalyzed by acid and alkali.	02	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
3	March	**Chemical Kinetics**	Explanation of terms like rate of reaction, order of a reaction and molecularity. Definition zero, first and second order reaction. Half life period of a reaction.	02	14
			Derivation of rate equation for first and second order reaction with equal initial concentration and different initial concentration of a reactant. Characteristics of first and second order reaction.	03	
			Examples of first and second order reaction viz. the reactions (i) decomposition of H_2O_2, (ii) reaction between $K_2S_2O_8$ and KI,	03	
			(iii) Hydrolysis of methyl acetate catalyzed by acid, (iv) saponification of ethyl acetate by NaOH and (v) inversion of cane sugar. Determination of order of a reaction by integration, graphical, equifractional change, etc. method.	03	
			Effect of temperature on reaction rates. Arrhenius equation, activation energy and its determination using Arrhenius equation. Numericals.	03	
4	April	**UNIT-I** **A] Polarisation-** **B] Covalent bonding-** **C] Intermolecular forces-** **D] Acids and Base-**	Defn, polarising power, polarizability. Effect of polarization on nature of bond. Fajan's rules of polarisation & its applications.	02	14
			Directional nature of covalent bond. Hybridization, types of hybridization to explain geometries of NH^{4+} ion, PCl_5, SF_6 & IF_7.	02	
			Dipole-dipole, dipole-induced-dipole, induced dipole-induced dipole interactions. Ion - dipole interactions.	03	
			Theory of solvent sys. & Lux-Flood concept of acids & bases.	03	
			Hard and soft acids and bases. Pearsons HSAB principle with imp applications.	04	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lect.	Total Lects.
5	April	A]Electrical Properties:	(i) Polar and non-polar molecules. Dipole moment. (ii) Induced polarization & orientation polarization. Clausius-Mossotti equation	03	
			(iii) Measurement of dipole moment by temperature and refractivity methods.	01	
			(iv)Applications of dipole moment for the determination of molecular structure. i.e. percentage ionic character of covalent bonding, molecular geometry, cis-trans isomers, ortho, meta and para isomers of a disubstituted benzene.	03	
		B]Magnetic Properties:	(i) Paramagnetic and diamagnetic substances, origin of paramagnetism, diamagnetism, ferromagnetism and antiferromagnetism.(ii) Volume, specific, mass and molar susceptibility. Relationship between.	03	
			(iii) Relationship between magnetic moment and number of unpaired electrons. (iv) Gouy's balance method for determination of magnetic susceptibility.	02	
			(v) Application of magnetic moment in the determination of molecular structure.(vi) Numericals.	02	
6	May 22	A] P-Block Elements-	Comparative study of 16^{th} and 17^{th} group elements with reference to electronic configuration,	02	14
			Ionisation energy & oxidation states. Oxidising properties of halogens with reference to oxidation potential.	02	
		B] Noble Gases-	Basic properties of halogens with special reference to iodine. Interhalogen compounds. Introduction to fluorocarbons.	02	
			Inertness of noble gases. Compounds of noble gases-only str. & bonding in XeF_2, XeF_4, $XeOF_4$,XeO_2F_2 XeO_3 and XeO_4	02	
		C] Non-aqueous Solvents-	Requirements of a good solvent. Water as a universal solv. Physical prop of solvents namely liq. range, dielectric constant, dipole moment, heat of vaporisation & solubility behaviour.	02	
			Classification of solvents. Reactions in liquid ammonia acid base, precipitation, redox, solvolysis	02	
			solutions of metals in liquid ammonia.	02	

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Department of Chemistry

Teaching Plan Session-2021-22

B.Sc.-II[nd] Semester-IV[th]

Name of Faculty:- Mr. Shivshankar P. More

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total
1	Feb	Colligative Properties of Dilute Solutions:	(i) Defination and examples of colligative properties.	02	14
			(ii Elevation of boiling point, thermodynamic derivation of the relationship between elevation of boiling point and molar mass of a non-volatile solute.	02	
			Cotrell's method for determination of elevation of boiling point.	02	
			(iii) Depression of freezing point, thermodynamic derivation of the relationship between depression of freezing point and molar mass of a non-volatile solute.	02	
			Rast's method for determination of depression of freezing point.	02	
			(iv) Abnormal behavior of solution. Van't Hoff's factor 'i'.	02	
			Determination of degree of association and dissociation from Van't Hoff's factor.(v) Numerical.	02	
2	march	Crystalline state	Symmetry in crystal, plane of symmetry, axis of symmetry and point of symmetry. Law of constancy of interfacial angles.	02	14
			Elements of symmetry in cubic crystals. Laws of symmetry. Law of rational indices, Weiss and Miller indices of a lattice planes, calculation of interplaner distance d(h,k,l) from Miller indices in a cubic system.	02	
			Seven crystal systems and fourteen Bravais lattices, Bravais lattices of cubic system. Simple cubic system (S.C.C.), body centered cubic system (B.C.C.) and face centered cubic system (F.C.C.).	02	
			Calculation of number of constituent units in S.C.C., B.C.C. and F.C.C.	02	
			Ratio of interplaner distances for 100, 110 and 111 lattice plane in S.C.C., B.C.C. and F.C.C.	02	
			Derivation of Bragg's equation for X-ray diffraction, Bragg's X-ray spectrometer method for the determination of crystal structure of NaCl and KCl.	02	
			Anomalous behaviour of KCl towards X-ray. Numericals.	02	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total
3	march	**A] Chemistry of elements of transition series:**	Definition of transition elements. General characteristics of transition elements. Comparative study of first transition series elements (3d) with reference to following properties: (i) Electronic configuration	02	14
			(ii) Atomic and ionic size (iii) Ionization energy (iv) Metallic nature (v) Oxidation states (vi) Magnetic properties (vii) Color of salts (viii) Catalytic properties (ix) Complex formation behaviour.	03	
			Study of 4d and 5d series elements-Electronic configuration.	03	
		B] Extraction of elements:	Comparison of 3d series elements with 4d and 5dseries elements with respect to size, oxidation states, magnetic properties and color.	03	
			Principles involved in extraction of elements. Major methods of extraction of elements. Factors affecting choice of extraction method. Thermodynamics of reduction processes-Ellingham diagrams for oxides and importance of this diagram	03	
4	April	**A] Inner transition elements:**	Definition, Lanthanides and Actinides. Comparative study of Lanthanides with respect to following properties:(i) Electronic configuration	02	14
			(ii) Atomic and ionic radii lanthanide contraction definition, cause and effect of lanthanide contraction	02	
			(iii) Oxidation states (iv) Magnetic properties	02	
			(v) Color of salts vi) Complex formation behavior.	02	
		B] General Principles of Metallurgy:	Occurrence of lanthanides. Isolation of lanthanides by ion exchange method. Actinides- Electronic configuration and oxidation states. Comparison of lanthanides and actinides.	03	
			Definition of metallurgy, steps in metallurgy. Ore dressing by gravity separation, froath floatation and electromagnetic separation. Calcinations, roasting, smelting and refining of metals. Meaning of termshydrometallurgy and pyrometallurgy.	03	

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total
5	April	A] Aromatic nitro compounds:	Nitrobenzene: Synthesis from benzene, Reduction of nitrobenzene in acidic, neutral and alkaline medium.	03	14
		B] Amino Compounds:	Basicity and effect of substituents. Methods of preparation of aniline from nitrobenzene, Reactions: with acetyl and benzoyl chlorides, Br2(aq) and Br2(CS2),	02	
		C] Diazonium Salts:	Carbylamine reaction, alkylation,Hoffmann's exhaustive methylation and its mechanism.	02	
		D] Amino acids and Proteins:	Preparation benzene diazonium chloride, Synthetic applications- Preparation of benzene,phenol, halobenzene,nitrobenzene,benzonitrile, coupling with phenol and aniline.	03	
			Classification, Strecker and Gabrial phthalimide synthesis, Zwitterion structure, Isoelectric point,	02	
			peptide synthesis, Structure determination of polypeptides by end group analysis.	02	
6	may	A] Polynuclear hydrocarbons:	Naphthalene - Haworth synthesis,orbital picture, Reactions – electrophilic substitution	02	14
			Preparation of naphthols from naphthalene sulphonic acids and naphthylamines from naphthols.	02	
		B] Reactive methylene compounds:	Malonic Ester: Synthesis from acetic acid, Synthetic applications- Synthesis of acetic acid , succinic acid, glutaric acid, crotonic acid and malonyl urea.	03	
		C] Carbohydrates:	Acetoacetic ester: Synthesis from ethyl acetate, Synthetic applications- Synthesis of acetic acid, propionic acid, isobutyric acid, succinic acid, glutaric acid, crotonic acid, acetyl acetone and 4-methyl uracil.	03	
			Constitution of glucose, cyclic structure, Pyranose and Furanose structure, Epimerization, conversion of glucose to fructose and vice-versa,	02	
			Introduction to fructose, ribose, 2- deoxyribose, maltose, sucrose. (their structures only determination not needed).	02	

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Department of Chemistry

Teaching Plan Session-2021-22

B.Sc.-III[rd]Semester-VI[th]

Name of Faculty:- Wavhal Kamalakar K.

Sr. No.	Month	Name of Unit	Topics Names	Requ. Lecture	Total Lects.
1	Feb 22	A) Kinetic Aspects of Metal Complexes:	Types of reactions of coordination compounds. Brief idea about substitution reactions. SN1 dissociative and SN2 associative mechanism of substitution in octahedral complexes. Labile and inert complexes.	03	14
		B) Analytical Chemistry:	Factors affecting lability of complexes viz. arrangement of d-electrons (VB theory),. Mechanism of substitution reactions in square planar complexes.	03	
		1. Colorimetry Spectrophotometry	Concept of □max. Beer-Lambert's law Verification of Beer's law. Block diagrams of colorimeter and spectrophotometer	02	
		2. Paper Chromatography	Difference between colorimeter and spectrophotometer. Application of colorimetric &spectrophotometric technique for determination of concentration of metal.	02	
			Definition and classification of chromatography. Principle of ifferential migration.	02	
			Principle and technique of paper chromatography, Rf value and factors affecting Rf value	02	
2	March	A] Organometallic Chemistry :	Definition, nomenclature and classification of organometallic compounds. Metal carbonyls- definition and classification.	02	14
			Preparation, properties, structure and bonding in $Ni(CO)_4$, $Fe(CO)_5$, $Cr(CO)_6$. Nature of M-C bond in metal carbonyls.	03	
			Definition and classification. Silicones: preparation, properties structure and bonding and applications.	03	
		B] Inorganic Polymers:	Phosphonitrile halides polymers- preparation, properties, structure and bonding in cyclic polymers.	02	
		C] Bio-inorganic Chemistry	Essential and trace elements in biological processes.	02	
			Biological role of Na+, K+, Ca2+ and Mg2+ ions. Metalloporphyrins- Haemoglobin and Myoglobin and their role in oxygen transport.	02	

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3	march	**A) Electronic Spectroscopy :**	Introduction, radiation source, spectral range, types of electronic transitions, chromophore, auxochrome, bathochromic, hypsochromic,	02	14
			Hyperchromic and hypochromic effects. Applications to the structure determination of compounds like dines, aldehydes, ketones & aromatic systems.	03	
		B) Infrared Spectroscopy	Types of vibrational modes, stretching and bending, spectrum range, radiation source, presentation of IR spectrum, characteristic frequencies of various groups,	03	
		C) Purification of Organic Compounds:	Finger print region. Structure of organic compounds (IR spectra of simple compounds: H_2O, CO_2, CH□CH, CH_3COCH_3).	02	
			Sublimation, crystallization.	02	
			Paper chromatography: Principle and Rf value.	02	
4	April	**Unit IV : A) Nuclear Magnetic Resonance Spectroscopy :**	Introduction, spin quantum number, instrumentation, Aspects of NMR- number of signals(equivalent & non-equivalent protons),	03	14
			Positions of signals(chemical shift), intensities of signals,	02	
			Splitting of signals (spin-spin coupling), coupling constant, and applications.	03	
		B) Mass Spectrometry:	Introduction, theory, instrumentation-(ion sources),	02	
			Mass spectra of neopentane and methanol, molecular ion peak, base peak, metastable peak,	02	
			Rules of fragmentation, applications.	02	
5	April	**A] Electrochemistry:**	(i) Types of electrode - Standard hydrogen electrode, Calomel electrode, Quinhydrone electrode and Glass electrode. Principle of Potentiometric titration. Study of acid-base, redox and precipitation titration.	02	14
			(iii) Concentration cells - Types of concentration cells, concentration cell without transfer and determination of its emf. (iv) Numericals	02	

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5		**B] Nuclear Chemistry:**	(i) Shell model of a nucleus - Assumptions, evidences for existence of magic numbers, advantages and limitations. (ii) Liquid drop model of a nucleus - Assumptions, similarities between nucleus and liquid drop, advantages and limitations, explanation of nuclear fission reaction on the basis of liquid drop model.	02 02	
			(iii) Nuclear force and its explanation on the basis of Meson theory. (iv) Characteristics of nuclear reaction, difference between nuclear and chemical reactions. Calculation of Q value of a nuclear reaction. (v) Characteristics of nuclear fission reaction, fission yield. Fission reaction as an alternative source of energy.	02	
			vi) Nuclear fusion reaction - Characteristic of a nuclear fusion reaction. Thermonuclear reactions as a source of energy of sun and other stars. Fusion reactions as a potential future source of energy.	02	
			vii) Applications of radio isotopes in industry, agriculture, medicines and bio-sciences with two examples each. (viii) Numericals.	02	
6	may	**Elementary Quantum Mechanics**	(i) Limitations of classical mechanics. Plank's quantum theory (postulates only)	02	
			Photoelectric effect - Experiments, observation and Einstein's explanation. Compton effect and its explanation. (ii) de Broglie hypothesis of matter waves	03	
			De-Broglie's equation. Heisenberg's uncertainty principle. (iii) Classical wave equation, derivation of time independent Schrodinger's wave equation in one-dimension and its extension to a three-dimensional space.	02	14
			Well behaved wave function, physical significance of wave function (Born interpretation).	02	
			(iv) Application of Schrodinger wave equation to a particle in one-dimensional box & its extension to a three-dimensional box.	03	
			Concept of atomic orbital. (v) Numericals	02	

Incharge Teacher-
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