K.L.E. Society's
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DEPARTMENT OF CHEMISTRY
COURSE SCHEDULE 2019-20

Week Wise Activities B. Sc. I and II SEM

Week	Sem-I Activities	Week	Sem-II Activities
1	Review of Bohr's atomic model, calculation of radius and energy of nth orbital, Purification of organic compounds, Real gas isotherms, Andrew's experiment of CO2, PV-relationship.	**1**	Hybridization: Salient features of hybridization, geometry of molecules with respect to sp, sp2, sp3, dsp3, sp3d2 hybridization. a) Alkanes to alkyhalides to alcohols and vice versa. b) Alkanes to alkyl cyanides to carboxylic acids
2	Extension of bohr's theory-Sommerfield model, Method of purification of liquids, phenomenon of gases.Critical constants (Pc, Vc, Tc) – Definition, of critical temperature, critical pressure &critical volume.	**2**	VSEPR theory- Postulates, regular and irregular geometry (BF3, CH4, NH3 and H2O). c) Benzene to p-nitrobenzoic acid d) Benzene to m-bromoaniline
3	Ionic bonding: factors affecting the formation of ionic bonding, Chromatography: General principles, types, Relationship between critical constants and Vander waals constants.	**3**	Molecular orbital theory: LCAO concept , e) Naphthalene to 1,4–naphthaquinone f) Naphthalene to anthranilic acid
4	Lattice energy and its determination by Born-Haber cycle. Criteria of purity: Melting point and boiling point. experimental determination of critical constants, reduced equation of state and statement of law of corresponding states.	**4**	Calculation of bond order, stability, magnetic property etc. Hydrogen bonding: Types, significance of hydrogen bonding, isothermal and adiabatic process, expression for work done in the reversible expansion of adiabatic expansion of an ideal gas (PV^{γ}=Constant) Joule-Thomson effect, Joule Thomson experiment
5	Covalent bond: Types, factors favouring covalent bond, Stereochemistry of organic molecules, Liquification of gases(Linde's method only)	**5**	Properties explained by hydrogen bonding like a)State of H2O and H2S b) Melting and Boiling point c) Ice has less density than water. Thermochemistry - Kirchoff's equation, bond energies and bond dissociation energies,
6	Valence bond theory with respect to H2, F2, HCl molecules, Cycloalkanes: Baeyer's strain theory, calculation. Maxwell's law of distribution ofmolecular velocities.	**6**	Sensitivity, selectivity and specificity, calculation of bond energy and bond dissociation energies. Liquid State: Physical Properties of Liquids.
7	Errors in quantitative analysis,	**7**	Advantages of organic reagents over

	classification. Conformational isomerism: Basic concept of conformational analysis. effect temperature on distribution of molecular velocities.		inorganic reagents - Dimethyl glyoxime, 8 hydroxyquinoline (oxime). Surface Tension: Effect of temperature on surface tension. Determination of surface tension of liquid by drop numbers method, parachor and its application.
8	**Unit Test I**	**8**	**Unit Test I**
Week	**Sem-I Activities**	**Week**	**Sem-II Activities**
9	Accuracy, precision, standard deviation. Geometrical isomerism, Solution of gas in liquid Henry's law and limitations. Completely miscible liquid pairs.	**9**	Alkenes, Dienes and Alkynes: Alkenes: Methods of preparation of alkenes by (i) dehydration of alcohols (ii) dehydro halogenation. Saytezaff's elimination, Viscosity: Effect of temperature on viscosity.
10	T-test, significant figure and rules for computations. Optical isomerism, azeotropes, theory of azeotropic mixtures.	**10**	Hofmann orientation (Formation of least substituted alkene, 1-pentene). Refractive index of liquid: Specific and molar refractions, determination of relative, absolute and intrinsic viscosity of liquids by ostwald's viscometer method.
11	Concentration terms, normality, molarity, mole fraction, percentage, Spectroscopy, partially miscible liquid systems,	**11**	Chemical reactions of alkenes- Peroxide effect and its mechanism, hydroboration, oxidation, oxy-mercuration–reduction and mechanism, ozonolysis with respect to 2-butene and 2-methyl-2-butene, oxidation with KMnO4. determination of refractive index of liquid by Abbe's refractometer.
12	**Unit Test II**	**12**	**Unit Test II**
13	Primary standard solution, titration-acid-base, precipitation, iodometric, redox Titration, UV spectroscopy, critical solution temperature with respect to phenol water.	**13**	Dienes: Classification and Nomenclature Preparation of 1,3 butadiene; 1,2 and 1,4 addition reactions, Liquid Crystals- Types and applications.
14	Complexometric (with reference to EDTA) titrations, Woodward and Fieser rules, triethyl amine-water and nicotine- water system. Types of salts, definition of degree of hydrolysis and hydrolysis constant derive the relation between Kh, Ka & Kw.	**14**	Alkynes: Acidity of Alkynes, reactions of acetylene, Resonance in benzene, Aromaticity–Huckel's 4n +2 rule with respect to benzene, furan, pyridine and [10]–annulene. Emulsions: Types of emulsions, Preparation and emulsifiers.
15	Quantum numbers and their significance, electronic configuration of the elements up to atomic number 60. Calculation of λ_{max} taking myrcene and B-phelladrene as examples.	**15**	Mechanism of electrophilic aromatic substitution–halogenation, nitration, sulphonation and Friedel-Craft's reaction, Gels: Classification, preparation and properties, general applications of colloids. Miller indices, determination of structure of NaCl by rotating single crystal method.
16	Aufbau principle, Hund's rule, (n+l) rule, Pauli's exclusionprinciple. expression for pH in case of hydrolysis	**16**	Poly nuclear hydrocarbons: Classification, examples, constitution of naphthalene, Haworth synthesis, nitration and

	of the following - salts of weak base and strong acid, weak acid and strong base. Numerical problems, Nernst distribution law		sulphonation of naphthalene. Space lattice, unit cell, crystal systems, calculation of particles per unit cell, laws of crystallography, x-ray diffraction of crystals, derivation of Brag's equation

Week Wise Activities B.Sc. III and IV SEM

Week	Sem-III Activities	Week	Sem-IV Activities
1	Review of steps involved in metallurgical process, Introduction and nomenclature of dihydric and trihydric alcohols.	**1**	General characteristics of d block elements- Electronic configuration, oxidation states, Second order reaction with examples, derivation of rate constant equation of second order reaction when concentration of the reactions are equal (a=b),
2	Thermodynamic concepts of selection of reducing agents using Ellingham diagrams, preparation of glycol from ethene, oxidative cleavage of ethylene glycol.	**2**	Metallic property, colour, reactivity, reducing property, magnetic, catalytic and complex formation properties. Half life period, determination of order of reaction by a) Differential equation method b) Half life method
3	Relative efficiency of carbon and carbon monoxide as reducing agent. pinacol–pinacolone rearrangement, preparation of glycerol from propene, synthesis and uses of nitroglycerine, composition and uses of dynamite and cordite,	**3**	General characteristics of f block elements - Electronic configuration, cause and consequences of lanthanide contraction.
4	Reducing agents for Chromic oxide and zinc oxide. Distinction between primary, secondary and tertiary alcohols by Lucas reagent.	**4**	General features of actinides- electronic configuration, oxidation state, extraction of uranium from pitchblende. Simple collision theory of reaction rates: Derivation of rate constants of unimolecular (Lindemann hypothesis) and bimolecular reaction rates,
5	Extraction of nickel by Mond's process, lead by carbon reduction process, aluminum from bauxite. Classification and nomenclature, acidic character of phenol compared to alcohol and cyclohexenol.	**5**	Essential and trace elements in biological process, metalloporphyrins with respect to haemoglobin and chlorophyll. Limitations of collision theory.
6	Powder metallurgy - Production of tungsten powder from wolframite. mechanism of Fries rearrangement, Claisen rearrangement, Elbs persulphate oxidation and Lederer-Manasse reaction,	**6**	Types of pollutants, sources and control measures- CO, CO2, SOx, NOx, H2S, Transition state theory.
7	Types, properties of good solvents, non-aqueous solvents - Liquid NH3 and liquid HF, synthesis and uses of n-hexyl resorcinol and picric acid, structure and uses of dettol.	**7**	Hydrocarbons, CFC's and particulates, pesticides, and their adverse effects. Comparison of transition state theory and collision theory, steric factor. Chemical kinetics of complex reactions

8	**Unit Test I**	**8**	**Unit Test I**
Week	**Sem-III Activities**	**Week**	**Sem-IV Activities**
9	Water as universal solvent, leveling effect. Synthesis of methyl magnesium iodide and its synthetic applications in the preparation of alcohols(primary, secondary and tertiary)	**9**	Types of pollutants, sources and adverse effects (sewage, infectious agents, organic chemicals and inorganic mineral, oils and sediments) Treatment of sewage and industrial effluents - Preliminary, primary and secondary treatment
10	Arrhenius, Bronsted-Lowry, Lux-Flood, aldehyde, ketone, ester, carboxylic acid, amines and alkanes	**10**	Parameters of water pollution – Dissolved oxygen(DO), biological oxygen demand(BOD)
11	Solvent system and Lewis concepts of acids and bases Organo-lithium compounds: Preparation of Lithium dialkylcuprate and synthesis of higher alkane from it.	**11**	Chemical oxygen demand (COD), first order reaction, opposing, consecutive and parallel reactions.
12	**Unit Test II**	**12**	**Unit Test II**
13	Hard and soft acids and bases(HSAB) - classification of acids and bases as hard and soft, Pearson's HSAB concept, Raoult's law, concept of lowering of vapour pressure, elevation of boiling point, depression in freezing point and osmotic pressure, derivation of Kb and Kf by thermodynamic treatment,	**13**	Definitions and theirdeterminations. Debye-Huckel's theory, Debye–Huckel equation for strong electrolytes. Applications of conductance measurements.
14	Review of inductive, electromeric, resonance and hyperconjugation effects, Principle, types of vibrations, identification of following organic compounds by stretching frequencies– Alkanes, alkenes, alkynes, benzene, aldehydes	**14**	Nomenclature, structure and Bonding, mechanism of nucleophillic addition reactions-Hydrogen cyanide, hydroxyl amine, acetal formation–with ethanol and ethylene glycol.
15	Activating and deactivating groups, Statement, cyclic process, Carnot's cycle, heat engine and its efficiently, Carnot's theorem, entropy and its significance, entropy changes in reversible and irreversible process for ideas gases.	**15**	Mechanism of the following reactions a) Aldol condensation b) Cannizzarro's reaction c) Claisen-Schmidt reaction d) Perkin's reaction e) Benzoin condensation f) Baeyer-Villiger oxidation of ketones g) Mannich reaction, Synthesis of Coumarin and Vanillin.
16	Orientation of substituent in aromatic compounds with different functional groups like –OH, -NH2, -Cl, -NO2, -CH3, and -COOH in halogenation and	**16**	Nomenclature, structure and bonding, acid strengths of mono, di and t richloroacetic acids and nitro, chloro and hydroxy substituted benzoic acids,

	nitration reactions, Gibb's–Helmholtz equation, Clausius-Clapeyron equation and its applications, problems		mechanism of esterification and hydrolysis of ester, Ethers and Epoxides.

Week Wise Activities B.Sc. V Paper- I & II

Week	Sem-V Paper -I Activities	Week	Sem-V Paper -II Activities
1	Review of terms- double salts, complex salts, central metal ion, ligand, types of ligands, complex ion and coordination number. IUPAC nomenclature. Definition, source, classification and general characteristics.	**1**	Alloys-Significance, types of alloys (ferrous and non ferrous alloys), preparation (fusion and electro-deposition) and their applications. Thermodynamic treatment of law of mass action,
2	Valence bond theory of coordination compounds and its limitations. Hofmann exhaustive methylation with pyridine as an example. Isolation, constitution and confirmation by synthesis – Coniine, hygrine and nicotine.	**2**	Abrasives- Classification, Mohr scale of hardness, Manufacture and application of carborundum, alundum, tungsten carbide. van't Hoff reaction isotherm, relationship between Kp, Kc and Kx,
3	Isomerism- Ionisation, hydrate, linkage, geometrical and optical in coordination compounds with respect to coordination number 4 and 6.	**3**	Glass - physical and chemical properties of glass, raw materials, manufacture using tank furnace, Annealing of glass, types, composition and uses of glasses.
4	Principles of gravimetric analysis- super saturation, von Weimar equation, Classification of molecules, rotational spectra of rigid diatomic molecules.	**4**	Cement - Raw materials, composition of Portland cement, manufacture by rotary kiln method, mechanism of setting. variation of Kp and Kc with temperature and pressure.
5	Conditions of precipitation, coprecipitation and post precipitation, criteria for showing the spectra, energy levels of rigid rotator, selection rules (final equations only), determination of bond length and moment of inertia of HCl molecule.	**5**	Pigments - Manufacture and relative merits of white lead, Lithopone, Titanium white, constituents of paints and varnishes.
6	Separation of precipitate from mother liquor, washing, properties of wash liquid, drying and ignition of precipitate, weighing form.	**6**	Fuels - characteristic and calorific values of fuels, advantages of gaseous fuels, Manufacture of water gas and biogas.
7	Inorganic polymers, Types, comparison with organic polymers, silicones, phosphonitrilic halides- formation, structure and applications.	**7**	Preparation, mechanism of action and applications - DCC(Amide formation), LiAlH4(reduction of aldehyde, carboxylic acid and ester)
8	**Unit Test I**	**8**	**Unit Test I**
Week	**Sem-V Paper -I Activities**	**Week**	**Sem-V Paper -II Activities**
9	The need for green chemistry and eco-efficiency, green methods, green products,	**9**	DDQ(Benzylic oxidation of tetralin, aromatisation of tetralin), Lead Tetra Acetate(oxidation of 1,2-diols),

	recycling of wastes, 12 principles of green chemistry.		Examples of chain reactions, general aspects of chain reactions,
10	Classification, molecular orbital picture and Aromatic character of furan, thiophene, pyrrole and pyridine, Terminology and explanation of the terms involved.Applications of phase rule- One component system-water and sulphur systems	**10**	NBS(allylic bromination), OsO4(hydroxylation of alkenes), PCC(Pyridinium chlorochromate) in the oxidation of primary alcohols, chain length, chain transfer reactions,
11	synthesis of the following compounds. i) Furan, thiohene and pyrrole from 1,4-diketones. ii) Pyridine by Hantzch synthesis.	**11**	Principle, instrumentation, definitions of parent peak and base peak, McLafferty rearrangement with respect to butyraldehyde. chain inhibition, kinetics of branching chain reactions.
12	**Unit Test II**	**12**	**Unit Test II**
13	Electrophilic substitution reactions of pyrrole, furan and pyndine(chlorination and nitration), comparison of basicities of pyridine, piperidine and pyrrole.	**13**	Classification, requirement of a dye, colour and constitution. The synthesis of each of the followimg class of dyes- Azo dyes–Congo red,Vat dyes–Indigo,Anthraquinone dyes–Alizarin
14	Acidity of α-hydrogens, s ynthesis of ethylacetoacetate(EAA) by Claisen condensation and its mechanism, Two-component systems-Bismuth-Cadmium system and KI – water system.Eutectic and freezing mixture.	**14**	Triphenylemethane dyes–Malachite green, Crystal violet Phthalein dyes-Fluoroscein,Eosin; Synthesis of each dyes
15	Synthesis of diethyl malonate, keto-enol tautomerism of EAA Synthesis of following compounds using EAA and diethyl malonate: Simple harmonic oscillator, Hooke's law, energy level of simple harmonic oscillator model of diatomic molecule(final equations only), selection rules, zero point energy determination of force constant	**15**	Adsorption, derivation of Frendlich and Langmuir's adsorption isotherms. Forms of Langmuir's adsorption isotherms at high and low pressure regions, BET equation
16	i) ketones ii) carboxylic acids iii) heterocyclic compounds iv) dicarboxylic acids. qualitative relation between force constant and bond dissociation energies. Vibrational degrees of freedom of molecules(Linear and non linear).	**16**	Determination of surface area using BET equation. Calalysis–Theories of catalysis-intermediate and adsorption theory, enzyme catalysis-Michaelis–Menten equation, industrial applications of catalysis.

Week Wise Activities B.Sc. VI Paper- I & II

Week	Sem-VI Paper -I Activities	Week	Sem-VI Paper -II Activities
1	Crystal field theory(CFT) with reference to octahedral, distorted	**1**	Chromatography :Principle, types, stationary and mobile phases, physical factors of

	octahedral (Jahn- Tellar distortion), Introduction-dipole moment, induced dipole moment, measurement of dipole moment by temperature variation method and its applications.		separation, brief account of paper chromatography, calculation of Rf value, brief account of column chromatography and its applications.
2	Tetrahedral and square planar complexes, calculation of crystal field stabilization energy, factors affecting 10Dq, consequences of crystal field splitting on ionic radii of M+2 ions	**2**	Flame photometry: Principle, Limitations, Instrumentation, Flame photometric determination of Na and K. Reversible and irreversible cells, EMF of a chemical cell and its measurement by potentiometer, standard cell (Weston standard cell).
3	Enthalpy of hydration of M+2 ions, explanation of colour and magnetic properties of magnetic complexes, limitations of crystal field theory, calculation of magnetic moment using Gouy's method.	**3**	Thermogravimetry: Principle and applications of thermogravimetric methods (TG and DTA). Types of electrodes - Reference electrode, calomel electrode, derivation of Nernst equation for emf of a cell, concentration cells– with and without transference, liquid junction potential and its derivation, salt bridge.
4	Stability constant, stepwise and overall formation constants, trends in step wise constants, Introduction, classification, determination of molar masses of macromolecules by viscometry and Donnan membrane equilibrium.	**4**	Electrogravimetry: Principle, Instrumentation, Electrogravimetric determination of Copper. Photochemical reactions, laws of photochemistry – Beer's law, Lambart's Law, Beer-Lambart's Law.
5	Factors affecting the stability of the metal complexes with reference to the nature of metal ion and ligand. Photoelectric effect - Einstein's photoelectric equation, wave particle duality.	**5**	Macro nutrients, trace metals and organic matter in soil. Determination of pH, Determination of nitrogen by alkaline permanganate method and phosphorus by Bray's and Olsen's method present in the soil.
6	Chelates - definition, characteristics, factors influencing the stability of metal chelates and importance of chelates. de-Broglie hypothesis, de-Broglie equation(derivation), experimental verification- Davisson-Germer experiment.	**6**	Russel-Sandar's coupling in defining ground states of spectrochemical series, derivation of spectroscopic ground terms(d1 to d10 without J values), Grothus-Draper Law and Einstein's Law of photochemical equivalence, quantum efficiency or yield.
7	Introduction, classification of organotransition metal complexes, 18 electron rule, ferrocene, structure and bonding in metal olefins (Zeise's Salt).	**7**	Types of electronic transitions(d-d transitions, charge transfer transitions-MLCT and LMCT), selection rule for d-d transitions, reasons for high and low quantum efficiencies with examples, fluorescence, phosphorescence,

			photosensitization and chemiluminescence.
8	**Unit Test I**	**8**	**Unit Test I**
Week	**Sem-VI Paper -I Activities**	**Week**	**Sem-VI Paper -II Activities**
9	Haworth and conformational formulae of glucose and fructose, mutarotation and its mechanism, osazone formation, Killani's synthesis.	**9**	Orgel- energy level diagram-d1 and d2 states, discussion of the electronic spectrum of [Ti(H2O)6]3+ complex ion.
10	Ruff's degradation, epimers and epimerisation with respect to monosaccharides, interconversions of glucose and fructose.	**10**	Introduction, requirement of an ideal synthetic drug, classification, synthesis and uses of the following- Antipyretics–antipyrine, paracetamol, Anaesthetics-novacaine(local) and pentothal sodium(general)
11	Vitamins: Classification and importance of vitamin-A, B6, B12, C, D and E. Synthesis of Vitamin-C from D(+)-glucose, synthesis of vitamin-A by Vandrop etal.	**11**	Antihistamines–chlorpheniramine maleate(CPM) Antimalarials–paludrine, chloroquine, Antibiotics-chloromycetin, penicillin, tetracycline, Para pharmaceutical reagents–Benedict's reagent, sodium citrate, Barfoed reagent
12	**Unit Test II**	**12**	**Unit Test II**
13	Classification, structure and stereochemistry(D and L) of amino acids, acid-base behaviour, iso-electric point and electrophoresis, peptides-nomenclature and structure of peptides,	**13**	Soaps - Introduction, manufacture by modern process, cleaning action of soap. Detergents - anionic, cationic, nonionic, with suitable examples, distinction between soaps and detergents, emulsifiers, stabilisers and builders.
14	Synthesis of a dipeptide(Bergmann synthesis), Classification of proteins, levels of protein structure(primary, secondary and tertiary structure), protein denaturation and renaturation.	**14**	**Reaction Mechanism** a) Beckmann rearrangement b) Favorskii rearrangement c) Benzidine rearrangement d) Benzillic acid rearrangement
15	Introduction, classification of terpenes, Ingold's isoprene rule, constitution of citral with synthesis, synthesis of α and β ionones, synthesis of α-terpeniol.	**15**	NMR Spectroscopy : Principle of Proton Magnetic Resonance(1H NMR) spectroscopy, nmr spectrum, chemical shift, nuclear shielding and deshielding, spin-spin coupling(n+1) rule, intensity(height) of the signal,
16	Concept potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules, energy levels and respective transitions, Frank–Condon principle.	**16**	TMS as internal standard-advantages, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, n-propyl bromide, iso propyl bromide, ethanol, acetaldehyde and benzene.

Head of the Department

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