



K.L.E. Society's
BASAVAPRABHU KORE ARTS, SCIENCE AND COMMERCE
COLLEGE, CHIKODI – 591 201.

(Accredited at 'A' Grade)

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DEPARTMENT OF CHEMISTRY
COURSE SCHEDULE 2020-21

Week Wise Activities B. Sc. I and II SEM

Week	Sem-I Activities	Week	Sem-II Activities
1	Atomic Structure : Review of Bohr's theory and its limitations, dual behaviour of matter and radiation, de Broglie's relation, Heisenberg Uncertainty principle. Hydrogen atom spectra.	1	UNIT-I Chemical Energetics and Ionic Equilibria: I Chemical Energetics: Review of thermodynamics and the Laws of Thermodynamics. Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution.
2	Independent Schrodinger equation and meaning of various terms in it (no derivation). Significance of ψ and ψ^2 . Significance of quantum numbers, orbital angular momentum and quantum numbers m_l and m_s . Shapes of s, p and d atomic orbitals, nodal planes	2	Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature –Kirchhoff's equation. Statement of Third Law of thermodynamics and calculation of absolute entropies of substances. Joule-Thomson effect.
3	Discovery of spin, spin quantum number (s) and magnetic spin quantum number (m_s). Rules for filling electrons in various orbitals, Electronic configurations of the atoms.	3	Derivation of Joule Thomson coefficient for an ideal gas and inversion temperature. Ionic Equilibria-I: Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect.
4	Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations UNIT-II: Chemical Bonding and Molecular Structure. Ionic Bonding: Ionic bonding, lattice energy, Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications	4	UNIT-II: Ionic Equilibria: II and Chemical Equilibrium Ionic Equilibria-II: Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts –applications of solubility product principle. Chemical Equilibrium: Free energy change in a chemical reaction
5	Polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment,	5	Thermodynamic derivation of the law of chemical equilibrium (Van't Hoff reaction isotherm). Distinction between ΔG and

	dipole moment and percentage ionic character. Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements		ΔG , Le Chatelier's principle. Relationships between K_p , K_c and K_x for reactions involving ideal gases. Variation of equilibrium constants with temperatures.
6	MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO and NO+.	6	UNIT-III: Spectroscopy, Alkyl and Aryl Halides Spectroscopy: Introduction to conventional methods of elucidation of structure of organic compounds (chemical degradation) and comparison with spectroscopic methods, electromagnetic spectrum. UV spectroscopy: Principle, types of transitions, chromophores, concept of auxochromes and their effect on λ_{max}
7	Comparison of VB and MO approaches. UNIT-III: Fundamentals of Organic Chemistry and Alkenes. Fundamentals of Organic Chemistry: Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis	7	Bathochromic shift, hypsochromic shift, hypochromic and hyperchromic shift. Woodward and Fieser rules and illustration of calculation of λ_{max} taking myrcene and β -phelladrene as examples. Alkyl and Aryl Halides Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.
8	Unit Test I	8	Unit Test I
Week	Sem-I Activities	Week	Sem-II Activities
9	Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Hückel's rule	9	Alkyl Halides: Types of Nucleophilic Substitution (S_N1 , S_N2 and S_Ni) reactions. Preparation of alkyl halides from alkenes and alcohols. Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis. Aryl Halides: Preparation of aryl halides (Chloro, bromo and iodo-benzene) from phenol, Sandmeyer & Gattermann reactions. Reactions.
10	Alkenes: Methods of preparation of alkenes by (i) dehydration of alcohols (ii) dehydro halogenation. Saytzeff's elimination (Formation of highly substituted alkene, 2-butene), Hofmann orientation (Formation of least substituted alkene, 1-pentene). Chemical reactions of alkenes-Peroxide effect and its mechanism	10	Aromatic nucleophilic substitution (replacement by -OH group) and effect of nitro substituent. Benzyne Mechanism: KNH_2/NH_3 (or $NaNH_2/NH_3$). Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides. UNIT-IV: Aldehydes and ketones, Carboxylic Acids, Ethers and Epoxides
11	Hydroboration, oxidation, oxy-	11	Aldehydes and ketones (aliphatic and

	mercuration–reduction and mechanism, ozonolysis with respect to 2-butene and 2-methyl-2-butene, oxidation with KMnO_4 . Dienes: Classification, Nomenclature and Preparation of 1,3 butadiene; Reactions of 1,2 and 1,4 addition reactions (addition of halogens and halogen acids), Diel's-Alder reaction		aromatic): (Formaldehyde, acetaldehyde, acetone and benzaldehyde) Preparation: from acid chlorides and from nitriles. Reactions –Reaction with HCN , ROH , NaHSO_3 , NH_2 -G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction. Carboxylic Acids .
12	Unit Test II	12	Unit Test II
13	Polymerization of 1,3 butadiene. Alkynes: Acidity of Alkynes, reactions of acetylene –metal ammonia reduction, oxidation and polymerization UNIT-IV: Purification of organic compounds and Stereochemistry (15 Hours) Purification of organic compounds: Methods of purification of solids: Crystallization, fractional crystallization and sublimation. .	13	Nomenclature, structure and bonding, acid strengths of mono, di and trichloroacetic acids and nitro, chloro and hydroxy substituted benzoic acids, mechanism of esterification and hydrolysis of ester (Aac_2 and Bac_2). Reactions of carboxylic acids -i) Conversion into acid derivatives (acid chlorides, amides, esters and anhydrides), ii) Curtius rearrangement, iii) Reaction with organometallic compounds and iv) Hell-Volhard-Zelinsky reaction.
14	Method of purification of liquids: Distillation, fractional distillation, distillation under reduced pressure, steam distillation. Chromatography: General principles, types, brief outline of thin layer chromatography, paper chromatography and column chromatography	14	Ethers: Nomenclature of ethers and their methods of preparation, chemical reactions - Reaction with HI , hot and cold taking symmetric and unsymmetrical ethers. Crown ethers: Definition, examples, use of crown ethers as phase transfer catalysts. Epoxides:
15	Solvent extraction. Criteria of purity: Melting point and boiling point. Stereochemistry: Cycloalkanes: Baeyer's strain theory, calculation of angle strain, Sachse Mohr theory of strain less rings. Chair and boat forms of cyclohexane. Axial and equatorial bonds. Conformational isomerism: Basic concept of conformational analysis with reference to ethane and butane. Geometrical isomerism: definition, E and Z notation for 2-butene and butenedioic acid,	15	Synthesis of 1,2-epoxy ethane and 1,2-epoxycyclopentane, acid catalyzed ring opening of 1,2-epoxycyclopentane in aqueous solution Nomenclature of ethers and their methods of preparation, chemical reactions -Reaction with HI , hot and cold taking symmetric and unsymmetrical ethers. Crown ethers
16	rules for assigning notations. Determination of configuration of butenedioic acid by anhydride formation, dipole moment measurement, melting point and stability. Optical isomerism: Chirality, van't Hoff-Label	16	Definition, examples, use of crown ethers as phase transfer catalysts. Epoxides: Synthesis of 1,2-epoxy ethane and 1,2-epoxycyclopentane, acid catalyzed ring opening of 1,2-epoxycyclopentane in aqueous solution

	<p>hypothesis, optical activity, D and L configurations, R and S notations, sequence and priority rules, enantiomers, diastereoisomers, epimers, anomers, racemic and meso (with suitable examples like lactic and tartaric acids.), racemisation, resolution of racemic mixture by chemical method, asymmetric synthesis, Walden inversion.</p>		
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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,	6	Types of pollutants, sources and control measures- CO, CO ₂ , SO _x , NO _x , H ₂ S, Transition state theory.

	Claisen rearrangement, Elbs persulphate oxidation and Lederer-Manasse reaction,		
7	Types, properties of good solvents, non-aqueous solvents - Liquid NH ₃ 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 K _b and K _f by thermodynamic treatment,	13	Definitions and their determinations. 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 nucleophilic 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 efficiency, Carnot's theorem, entropy and its significance, entropy changes in reversible and irreversible process for ideal gases.	15	Mechanism of the following reactions a) Aldol condensation b) Cannizzaro'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, –NH ₂ , –Cl, –NO ₂ , –CH ₃ , and –COOH in halogenation and nitration reactions, Gibb's–Helmholtz equation, Clausius-Clapeyron equation and its applications, problems	16	Nomenclature, structure and bonding, acid strengths of mono, di and t richloroacetic acids and nitro, chloro and hydroxy substituted benzoic acids, mechanism of esterification and hydrolysis of ester, Ethers and Epoxides.
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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 K _p , K _c and K _x ,
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 K _p and K _c with temperature and pressure.
5	Conditions of precipitation, co precipitation 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), LiAlH ₄ (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, recycling of wastes, 12 principles of green chemistry.	9	DDQ(Benzylic oxidation of tetralin, aromatisation of tetralin), Lead Tetra Acetate(oxidation of 1,2-diols), 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	NB (allylic bromination), OsO ₄ (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 Hantzsch 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 pyridine(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 following class of dyes- Azo dyes-Congo red, Vat dyes-Indigo, Anthraquinone dyes-Alizarin
14	Acidity of α -hydrogens, synthesis of ethylacetoacetate(EAA) by Claisen condensation and its mechanism, Two-component systems-Bismuth-Cadmium system and KI – water system.Eutectic and freezing mixture.	14	Triphenylmethane dyes-Malachite green, Crystal violet Phthalein dyes-Fluorescein, Eosin; Synthesis of each dye
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 Freundlich 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. Catalysis-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
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1	Crystal field theory(CFT) with reference to octahedral, distorted octahedral (Jahn- Teller distortion), Introduction-dipole moment, induced dipole moment, measurement of dipole moment by temperature variation method and its applications.	1	Chromatography :Principle, types, stationary and mobile phases, physical factors of 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, Lambert's Law, Beer-Lambert'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(d_1 to d_{10} 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 $[Ti(H_2O)_6]^{3+}$ 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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