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UNIVERSITY OF MYSORE
Estd. 1916

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Crawford Hall, Mysuru- 570 005

No.AC2(S)/151/2020-21 Dated: 01.09.2023

Notification

Sub:- Syllabus and Scheme of Examinations of Chemistry (UG) (V & VI Semester) with effect from the Academic year 2023-24.

Ref:- 1.This office letter No: AC6/303/2022-23 dated: 28-07-2023.
2.Decision of BOS in Chemistry (UG) meeting held on 12-08-2023.

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The Board of Studies in Chemistry (UG) which met on 12-08-2023 has resolved to recommended and approved the syllabus and scheme of Examinations of Chemistry programme (V & VI Semester) with effect from the Academic year 2023-24.

Pending approval of the Faculty of Science & Technology and Academic Council meetings the above said syllabus and scheme of examinations are hereby notified.

The syllabus and scheme of Examinations contents may be downloaded from the University website i.e., www.uni-mysore.ac.in.

Registrar

Registrar
University of Mysore
Mysore

To:-

1. All the Principal of affiliated Colleges of University of Mysore, Mysore.
2. The Registrar (Evaluation), University of Mysore, Mysuru.
3. The Chairman, BOS/DOS, in Chemistry, Manasagangothri, Mysore.
4. The Director, Distance Education Programme, Moulya Bhavan, Manasagangotri, Mysuru.
5. The Director, PMEB, Manasagangothri, Mysore.
6. Director, College Development Council , Manasagangothri, Mysore.
7. The Deputy Registrar/Assistant Registrar/Superintendent, Administrative Branch and Examination Branch, University of Mysore, Mysuru.
8. The PA to Vice-Chancellor/ Registrar/ Registrar (Evaluation), University of Mysore, Mysuru.
9. Office Copy.

University of Mysore

B.Sc. Degree Programme in Chemistry

SYLLABI OF V and VI SEMESTERS

NATIONAL EDUCATION POLICY (NEP)-2020

Choice Based Credit System (CBCS) with Multiple Entry and Exit Options

2021-22 (Batch onwards)

V SEMESTER

CHDSC-5: Chemistry-V

(L:T:P = 4:0:0) Contact Hours: 60 Credits: 4 Workload: 4 Hours/Week

Unit-I: Inorganic Chemistry **15 Hrs.**

Coordination compounds: Ligands, classification of ligands, and chelation, physical methods in the study of complexes–change in conductance, color and pH. Nomenclature of co-ordination compounds, Inner metallic polynuclear and bridged complexes, Preparation of complexes-by simple addition reactions, substitution reactions and oxidation-reduction reactions. Geometries of complexes with coordination number 3 to 8. **05 Hrs.**

Metal-Ligand equilibria in solution: Stability of complexes- kinetic and thermodynamic stability of metal complexes, step-wise and overall formation constant and their relationship, trends in step-wise constant. Factors affecting the stability of metal complexes with reference to the nature of the metal ion and ligand, chelate effect, macrocyclic effect and their thermodynamic origin. Determination of formation constant by pH metric, and spectrophotometric methods. **06 Hrs.**

Isomerism in co-ordination complexes: Structural isomerism**-** Ionization, Hydrate, linkage, Ligand isomerism. Stereoisomerism – Geometrical and optical isomerism exhibited by co-ordination compounds of co-ordination number 4 and 6. **04 Hrs.**

Unit-II: Organic Chemistry **15 Hrs.**

Aromaticity, Homo-aromaticity of azulene, tropone, tropolone, annulenes, benzenoids, meso-ionic compounds. Alternant and non-alternant hydrocarbons, Energy levels in odd and even-alternant hydrocarbons. **02 Hrs.**

Stereochemistry: Chirality in allenes, alkylidene cycloalkanes and spiranes (with a stereogenic axis). Cram's and Prelog's rules. Conformational analysis of substituted cycloalkanes (Methyl, iso-propyl, tert-butyl, dialkyl, dihalo, diols), and cycloheptane. Nomenclature and conformations of fused rings and bridged ring systems. Prochirality: Enantiotopic and diastereotopic atoms, groups and faces. **06 Hrs**.

Vitamins: Definition, classification. Structure elucidation, synthesis and biological importance of Vitamin A, and Vitamin C. Structural formulae and biological importance of thiamine, pyridoxine, folic acid, pantothenic acid, riboflavin, α-tocopherol, biotin, vitamin K_1 and vitamin K_2. **07 Hrs**.

Unit-III: Physical Chemistry **15 Hrs.**

Photochemistry: Laws of photochemistry: Grothus-Draper's law, Stark-Einstein law of photochemical equivalence. Quantum efficiency: definition, reasons for low quantum yield and high quantum yield with examples (formation of HBr and formation of HCl). Actinometers: Uranyl oxalate actinometer, Potassium ferrioxalate actinometer (Qualitative study). (Numerical problems).

Photophysical processes: Jabolonski diagram, photosensitization (mercury as an example), photoinhibition, fluorescence and phosphorescence, chemiluminescence and bioluminescence (explanation with examples), mechanism (qualitative).

Radiation Chemistry: Definition, primary and secondary stages in radiochemical reactions, ionic yield, energy yield, comparison with photochemistry. Units of radiation-rad, gray, Roentgen. Dosimeters-Frick-dosimeter, ceric sulphate dosimeter (qualitative study)

theories of radiolysis – Lind's and EHT theories. Radiolysis of water (qualitative study) and acetic acid. **10 Hrs.**

Phase equilibria: Definition of the terms-phase, component and degree of freedom with examples. Statement of Gibb's phase rule and thermodynamic derivation. Applications: (a) one component system (water system); (b) reduced phase rule and reduced system, two component system (Silver-lead system, eutectic type), desilverization of lead and $FeCl_3$-H_2O system (congruent melting point). Freezing mixtures: Definition and examples, explanation based on KI-water system. **05 Hrs.**

Unit-IV: Molecular Spectroscopy **15 Hrs.**

Electromagnetic radiation: Regions of electromagnetic radiations (spectra), molecular energy levels, absorption and emission spectra, Born- Oppenheimer approximation.

Rotation spectroscopy: Selection rules, expression for rotational spectra of diatomic molecules for rigid rotator model, moment of inertia (expression to be derived) rotational energy rotational spectral lines, determination of bond lengths of diatomic molecules, isotopic substitution effect on rotational lines. **05 Hrs.**

Vibrational spectroscopy: Selection rules, classical equation of vibration, computation of force constant, expression for vibrational energy levels and potential energy of simple harmonic oscillator, zero-point energy, determination of force constant bond dissociation energies, fundamental frequencies, overtones. The number of degrees of freedom of vibrations polyatomic molecules, modes of vibration ($CO_2$and H_2O). **05 Hrs.**

Raman spectroscopy- Selection rules, origin of Raman spectrum, quantum mechanical theory, stokes and anti-stokes lines. Pure rotational Raman spectra of diatomic molecule(derivation), and vibrational rotational Raman spectra for diatomic molecule(explanation with equation) .

Electronic spectra: Concepts of potential energy curves for bonding and anti-bonding molecular orbitals, Franck-Condon principle. **05 Hrs.**

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CHDSCP-5: Chemistry-V Practical

(L:T:P = 0:0:2) Contact Hours: 60 Credits: 2 Workload: 4 Hours/Week

PART-A: Organic Preparations (Multistep synthesis):

1. Preparation of *p*-bromo aniline from acetanilide.
2. Preparation of anthranilic acid from phthalic acid.
3. Preparation of benzanilide from benzophenone.
4. Preparation of 2,4-dinitrophenylhydrazine from chlorobenzene.
5. Preparation of acridone from 2-chlorobenzoic acid.
6. Preparation of benzocaine from p-nitrobenzoic acid
7. Pechmann Reaction: Preparation of coumarin from resorcinol and ethyl acetoacetate.
8. Sandmeyer reaction: Preparation of 4-chlorotoluene from 4-toluidine.

PART-B: Organic Estimations:

1. Estimation of glucose by colorimetric method.
2. Estimation of aspirin by colorimetric method.
3. Estimation of ascorbic acid by iodometric method.
4. Estimation of amino acids by formylation method.
5. Estimation of carboxylic acid.
6. Estimation of amino group.
7. Determination of saponification value of oil.

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CHDSC-6: Chemistry-VI

(L:T:P = 4:0:0) Contact Hours: 60 Credits: 4 Workload: 4 Hours/Week

Unit-I: Inorganic Chemistry **15 Hrs.**

Modern concept of acids and bases: Lux-Flood and Usanovich concepts, solvent system and leveling effect. Hard-Soft Acids and Bases, Classification and Theoretical backgrounds.

Non-aqueous solvents: Classification of solvents, Properties of solvents (dielectric constant, donor and acceptor properties) protic solvents (anhydrous H_2SO_4, HF and glacial acetic acid) aprotic solvents (liquid SO_2, BrF_3 and N_2O_4). Solutions of metals in liquid ammonia, hydrated electron. Super acids and super bases. **07 Hrs.**

Chemistry of main group elements: Structure and bonding in boranes (B_2H_6, B_4H_{10}, B_5H_9), carboranes ($C_2B_{10}H_{12}$, $C_2B_9H_{13}$, $C_2B_6H_{12}$), Wades rules, borazines, phosphazines, S, N-compounds.

M-M bond and metal atom clusters: Halide clusters, bonding in $[ReCl_8]^{2-}$. Metal carbonyl clusters- LNCC's and HNCC's. Electron counting in carbonyl clusters, Wades-Mingos and Lauher rule. **08 Hrs.**

Unit-II: Organic Chemistry **15 Hrs.**

Carbohydrates: Introduction. Monosaccharides-Open and ring structure of glucose, mutarotation, epimerization. Interconversion reactions (aldose to ketose, ketose to aldose, chain elongation-Killiani-Fischer method, and chain degradation-Ruff's method), Determination ring size of glucose (methylation). Determination of configuration and conformational analysis of monosaccharides (glucose, galactose). Amino sugars: Structural formulae and conformations of α- and β- (glucosamine, galactosamine). Disaccharides-Structure elucidation of sucrose. Polysaccharides-partial structural formulae of starch and cellulose. Application of starch in titrimetric analysis. **08 Hrs.**

Heterocyclic compounds: Definition, classification and nomenclature.

Furan-synthesis (from pentasan), reactions (nitration, acylation). Thiophene-synthesis (from sodium succinate), reactions (sulphonation, chlorination). Pyrrole-synthesis (from furan), reactions (diazotization, Riemer-Tiemann). Pyridine-synthesis (from acetylene), reactions (bromination, with $NaNH_2$). Aromaticity and basicity of pyrrole and pyrimidine. Indole: Synthesis (Fischer), reactions (Br_2/HOAc, $CHCl_3$/NaOH). Quinoline: Synthesis (Skraup), reactions (nitration, with $NaNH_2$, with $KMnO_4$/NaOH). Pyrazole: Synthesis (From acetyl acetone and hydrazine), reactions (nitration, bromination). **07 Hrs.**

Unit-III: Physical Chemistry **15 Hrs.**

Quantum Mechanics: Introduction, black body radiation, plank radiation law, photo electric effect, Compton effect, de Broglie concept and uncertainty principle.

Concepts of Operators: Laplacian, Hamiltonian, Linear and Hermitian operators. Commutative and non-commutative of operators. Eigen function and eigen values. Postulates of quantum mechanics. Solutions of Schrödinger wave equation for a free particle, particle in a one-dimensional box. **05 Hrs.**

Colligative properties: Definition and examples.

Lowering of vapour pressure: Raoult's law (to be derived), relationship between relative lowering of vapour pressure and molar mass (to be derived). Experimental determination of molar mass of the solute by Dynamic method (Numerical problems).

Elevation in boiling point: Definition, its relation to lowering of vapour pressure and molar mass (to be derived). Ebullioscopic constant of the solvent and its relation to the boiling point (only equation). Experimental determination of molar mass of the solute by

Walker–Lumsden method (Numerical problems).

Depression in freezing point: Definition, its relation to lowering of vapour pressure and molar mass (to be derived). Cryoscopic constant and its relation to melting point (only equation), Determination of molar mass of non-volatile solute by Rast method (Numerical problems).

Semipermeable membrane: Definition, types with examples. Preparation of artificial semipermeable membrane (copper ferrocyanide) by Morse-Frazer method.

Osmotic pressure: Definition of osmosis, reverse osmosis and osmotic pressure. Determination of osmotic pressure by Berkely-Hartley's method (Numerical problems). Applications of osmotic pressure (mention only).

Osmotic laws and analogy with gas laws: Relationship between molar mass and osmotic pressure (to be derived). Isotonic solutions, plasmolysis and haemolysis. Abnormal molecular mass, causes, vant Hoff's factor (Numerical problems). **10 Hrs.**

Unit-IV: UV-Visible Spectroscopy **15 Hrs.**

Introduction, measurement of absorption intensities, absorption maxima (λmax), instrumentation, types of electronic transitions, concept of chromophores and auxochromes. Absorption and intensity shifts (bathochromic, hypsochromic, hyperchromic and hypochromic). Types of absorption bands (K, R, B and E-bands). The effect of solvents temperature and conjugation on absorption. **05 Hrs.**

Woodward-Fieser rules for calculation of absorption maxima for: Conjugated dienes (aliphatic, alicyclic, exocyclic, homoannular, heteroannular, with and/or without extended conjugation, and polyenes), α,β-Unsaturated carbonyl compounds (aldehydes, ketones, carboxylic acids, esters with and/or without extended conjugation) and Acyl benzene derivatives. Absorption in compounds with N-O bonds, quinones, α-diketones, α-keto aldehydes, benzene and its derivatives. Absorption spectra of heterocyclic and condensed ring systems (cata-condensed and peri-condensed). Effect of steric hindrance and coplanarity (cis, trans isomers) on absorption. The electronic transitions in charge transfer complexes, and keto-enol tautomers. **10 Hrs.**

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CHDSCP-6: Chemistry-VI Practical

(L:T:P = 0:0:2) **Contact Hours: 60** **Credits: 2** **Workload: 4 Hours/Week**

PART-A:

1. Conductometric titration of weak acid (CH_3COOH/HCOOH) versus weak base (Ammonium hydroxide).
2. Conductometric titration of a mixture of HCl and CH_3COOH versus NaOH.
3. Conductometric titration of strong acid (HCl) with salt ($CuSO_4$) versus NaOH.
4. Potentiometric titration of FAS versus $K_2Cr_2O_7$.
5. Potentiometric method of determination of dissociation constant of Formic acid.
6. Potentiometric titration of weak acid CH_3COOH against a strong base NaOH using quinhydrone electrode and calculation of pKa and Ka of the weak acid.
7. Colorimetric estimation of Fe^{2+} ions concentration in the given solution by titration of FAS versus $KMnO_4$.
8. Colorimetric estimation of Fe^{2+} ions concentration using 1,10- phenanthroline.

PART-B:

1. Determination of the isoelectric point of an amino acid by pH metry.
2. Determination of pH of acetic acid with sodium acetate buffer by pH metry
3. Potentiometric determination of pH of a buffer by using quinhydrone electrode and comparison of the pH values obtained with glass electrode.
4. Colorimetric determination of dissociation constant of a given indicator.
5. Potentiometric titration of $AgNO_3$ versus KCl (demonstration).
6. Conductometric titration of weak acid (CH_3COOH) with salt ($CuSO_4$) versus NaOH.
7. Determination of pKa value of phosphoric acid by pH meter.

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VI SEMESTER

CHDSC-7: Chemistry-VII

(L:T:P = 4:0:0) Contact Hours: 60 Credits: 4 Workload: 4 Hours/Week

Unit-I: Inorganic Chemistry **15 Hrs.**

Metal-ligand bonding: Valence bond theory: Salient features, formation and magnetic properties of octahedral complexes $[Fe(CN)_6]^{4-}$, $[Fe(CN_6)]^{3-}$, $[Co(CN)_6]^{3-}$, $[CoF_6]^{3-}$ $[Cr(H_2O)_6]^{3+}$ and $[Fe(H_2O)_6]^{2+}$. Formation and magnetic properties of tetrahedral and square planar complexes $[Ni(CO)4]$, $[Cu(NH_3)_4]^{2+}$, $[Ni(CN)_4]^{2-}$ and $[Pt(Cl_4)]^{2-}$, limitations of VBT. **04 Hrs.**

Crystal field theory: Salient features, splitting of d-orbitals in octahedral, tetrahedral, and square planar geometry. Applications - colors of transition metal complexes, magnetic properties of octahedral complex, CFSE and their uses. Factors affecting CFSE: Geometry of complexes, nature of the central metal ion, nature of ligand, and spectrochemical series. Limitations of CFT. Experimental evidence for metal-ligand covalent bonding in complexes, nephelauxetic effect. MO theory: tetrahedral and octahedral complexes (including p-bonding). **08 Hrs.**

Magnetic properties of coordination compounds: Introduction, magnetic susceptibility and its determination- Gouy and Faraday method, the effects of temperature on μeff, ferromagnetism, anti-ferromagnetism and ferrimagnetism. **03 Hrs.**

Unit-II: Organic Chemistry **15 Hrs.**

Aromatic Electrophilic Substitution Reactions: Quantitative treatment of reactivity in substrates and electrophiles. Amination, sulfonylation, diazonium coupling, Vilsmeier-Haack reaction, Gatterman reaction, Gatterman-Koch reaction and Hoesch reaction.

Aromatic Nucleophilic substitution reactions: The Goldberg reaction, Bucherer reaction, Schiemann reaction, von Richter reaction, and Sommelet-Hauser reactions. **07 Hrs.**

Addition Reactions: Addition reactions of cyclopropane ring. Addition reactions of carbon-heteroatom multiple bonds: Mechanism of metal hydride reduction (NaH, LiH, $LiAlH_4$, $NaBH_4$), Grignard reagent (CH_3MgBr) and organolithium (CH_3Li) of saturated and unsaturated carbonyl compounds. Hydrolysis of nitriles with mechanism. Wittig, Mannich and Stobbe reactions.

Elimination Reactions: Effects of substrate structure, attacking base, the leaving group and the medium on elimination reactions. Chugaev reaction. **08 Hrs.**

Unit-III: Physical Chemistry **15 Hrs.**

Ionic equilibria: Ionic equilibria in aqueous solutions, strong and weak electrolytes-definition and examples. Ostwald's dilution law (to be derived) and its limitations. Debye-Huckel theory of strong electrolytes (relaxation time, electrophoretic effect and viscous effect). Activity and activity coefficient–definition and their relation. Hydrolysis of salts-Derivation of hydrolysis constant and degree of hydrolysis of the salt of weak acid and weak base (ammonium acetate as an example), effect of temperature on degree of hydrolysis. (Numerical problems). **05 Hrs**.

Electrochemistry-II: Electrolytic and Electro chemical cells (galvanic cells)-Daniel cell (construction, working and cell reaction). Reversible and irreversible cells, rules for representation of a cell, single electrode potential, Standard electrode potential, sign convention for electrode potential, Nernst equation for single electrode potential (Derivation).

Reference electrodes: Calomel electrode, Ag-AgCl electrode**.** Weston standard cell

(Construction, working, reaction and standard emf). Equilibrium constant and free energy of a cell reaction, Concentration cell with transport (example) concentration cell without transport, EMF of concentration cell (derivation). Liquid junction potential. Salt bridge. Application of concentration cell: Valency of ions and solubility product of sparingly soluble salt.

Applications of EMF measurements in (a) Determination of pH of a solution using - (i) quinhydrone electrode, (ii) glass electrode. (b) Potentiometric titration-principle and location of end point in (i) Oxidation - reduction reaction, (ii) Precipitation reaction, iii) acid-base reaction. **10 Hrs**.

Unit-IV: Infrared Spectroscopy **15 Hrs.**

Introduction, principle, modes of vibrations, vibrational frequency. Factors influencing vibration frequencies (coupled vibration, electronic effects, and bond angles). Finger print region and its significance. Effects of H-bonding, conjugation, resonance, and ring size on IR absorptions. **04 Hrs.**

IR absorption frequency positions in; Hydrocarbons (alkanes, alkenes, alkynes, cycloalkanes, aromatic), halogen compounds, alcohols and phenols, ethers, aldehydes and ketones (aliphatic, alicyclic, and aromatic), esters and lactones, carboxylic acids, acid halides, acid anhydrides, amides, lactams, amines, amino acids, nitro compounds, anilides, nitriles, thiols, thiophenols, sulphonic acids, sulphonamides, and hetero aromatic compounds. **07 Hrs.**

Coordination compounds: Changes in infrared spectra of donor molecules upon coordination (*N,N*-dimethylacetamide, urea, DMSO, pyridine N-oxide, ammine, cyano, cyanato and thiocyanato complexes), mono and multinuclear carbonyl complexes, nitrosyls, and phosphine complexes. **04 Hrs.**

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CHDSCP-7: Chemistry-VII Practical

(L:T:P = 0:0:2) Contact Hours: 60 Credits: 2 Workload: 4 Hours/Week

PART-A: Gravimetric and Volumetric Analysis

1. Gravimetric determination of Fe in iron ore as Fe_2O_3.
2. Gravimetric estimation of calcium as calcium oxide.
3. Gravimetric estimation of aluminum as aluminum oxide.
4. Gravimetric estimation of magnesium as magnesium 8-hydroxy oxinate.
5. Gravimetric estimation of lead as lead chromate.
6. Gravimetric determination of Ni using DMG in Cu and Ni solution.
7. Gravimetric determination of Fe using NH_4OH in Fe and Cr solution.
8. Gravimetric estimation of Cu using NH_4SCN in Cu and Zn solution.
9. Volumetric estimation of Ca and Mg in dolomite solution.
10. Volumetric estimation of Fe in Cu and Fe solution.
11. Volumetric estimation of Zn in Cu and Zn solution.
12. Volumetric estimation of Ni in Ni and Zn solution.

PART-B: Preparation of co-ordination complexes

1. Preparation of hexamminenickel(III) chloride.
2. Preparation of chloropentaminecobalt(III)chloride.
3. Preparation of tris(oxalato)ferrate(III) and estimate the iron.
4. Preparation of hexamminecobalt(III)chloride(demonstration).
5. Preparation of mercury tetrathiocyantocobaltate(II) (demonstration).

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CHDSC-8: Chemistry-VIII

(L:T:P = 4:0:0) Contact Hours: 60 Credits: 4 Workload: 4Hours/Week

Unit-I: Inorganic Chemistry **15 Hrs.**

Paints: Constituents and their functions, manufacture of lithopone and titanium dioxide.

Propellants: Definition, characteristics, classification and applications.

Abrasives: Definition, classification with examples, hardness, manufacture and applicationsof carborundum, alundum and tungsten carbide.

Refractories: Definition, properties, classification with examples. Different steps involved in the manufacture of refractories. Applications of refractories. **05 Hrs.**

Ceramics: Introduction, types, manufacturing process, applications.

Explosives: Origin of explosive and classification. preparation and explosive properties of leadazide, PETN, cyclonite (RDX).

Fertilizers: Economic importance and synthesis of nitrogenous fertilizers- CAN, ammonium sulfate, ammonium nitrate and urea. Phosphate fertilizers- calcium dihydrogen phosphate, super phosphate. **05 Hrs.**

Silicates: Structure, classification - silicates with discrete anions, silicates containing chainanion, silicates with layer structure, silicones with three dimensional net-work and applications. **02 Hrs.**

Nanotechnology: Definition, uses and nature of nanotechnology. Nanomaterials: Definition, properties and applications. Carbon nanotubes: Definition, types, methods of preparation (mention), properties and industrial applications of carbon nanotubes, Nanowires: Definition, types, production of crystalline nanowires by vapour-liquid-solid synthesis method, application of nanowires. **03 Hrs.**

Unit-II: Organic Chemistry **15 Hrs.**

Rearrangements: Reaction and mechanism of Wagner-Meerwein, Fries, Beckmann, Hofmann, Benzil-benzilic acid, Favorskii, Dienone-phenol, and Benzidine rearrangement. Baeyer-Villiger oxidation, Arndt-Eistert reaction. **07 Hrs.**

Amino acids and Peptides: Amino acids: Synthesis (from α-halogen acids, Gabriel phthalimide, malonic ester), reactions (alkyl halides, nitrous acid, acid halide, NH_3, $LiAlH_4$). Classification and nomenclature of peptides. Sanger and Edman methods of sequencing. Cleavage of peptide bond by chemical and enzymatic methods. Peptide synthesis- Protection of amino group (Boc-) and carboxyl group as alkyl esters. Use of DCC, and HOBt in peptide bond formation reactions. Deprotection and racemization in peptide synthesis. Solution and solid phase techniques. Synthesis of oxytocin. Introduction to peptidomimetics. **08 Hrs.**

Unit-III: Physical Chemistry **15 Hrs.**

Chemical Dynamics: Arrhenius equation-characteristics, Significance of energy of activation, Temperature coefficient and its evaluation. Thermodynamical formulation of reaction rates (Thermodynamic parameters).

Reaction between ions in solutions - Influence of ionic strength on reaction rates - primary and secondary salt effects, Effect of dielectric constant (single sphere model).

Complex reactions: Kinetics of parallel reactions, consecutive reaction, reversible reactions (qualitative treatment). **07 Hrs.**

Kinetics of homogeneous catalysis- kinetics of acid-base catalyzed reactions-specific acid and specific base catalysis, general acid base catalysis. Enzyme catalyzed reactions, Mechanism (Lock and Key theory), Kinetics of enzyme catalyzed reactions - Henri-Michaelis- Menten mechanism, Significance of Michaelis-Menten constant, Lineweaver-

Burk plot. Effects of enzyme concentration, pH, Temperature, catalysts and Inhibitors on enzyme activity.

Kinetics of fast reactions: Introduction, Study of reactions by relaxation method (Temperature and pressure jump), flow method (continuous flow method and stopped flow method), Flash photolysis and Shock tube method. **08 Hrs.**

Unit-IV: Nuclear Magnetic Resonance Spectroscopy **15 Hrs.**

^{1}H NMR spectroscopy: Introduction (including magnetic properties of nuclei, spin population), relaxation process (spin-spin, spin-lattice, quadrupole), number of signals. Instrumentation, chemical shifts, internal standards, shielding and deshielding effects. Factors affecting chemical shift (inductive, Van der Waals, anisotropic, H-bonding). Solvents used. Peak area and proton counting, splitting of the signals, spin-spin coupling, equivalent and non-equivalent protons. Chemical exchange (proton exchange reactions). Calculation of atoms ratio from the height of signals. coupling constant (geminal, vicinal, long-range coupling). Restricted rotation. Double resonance (spin decoupling), nuclear overhauser effect. **09 Hrs.**

Structure determinations/interpretation of spectra of; ethane, propane, 1-bromopropane, 2-bromopropane, ethylene, propene, acetylene, propionamide, methylamine, dimethylamine, trimethylamine, ethyl acetate, methyl cyanide, ethylbenzene, o-cresol, p-cresol, benzoic acid, anisole, benzaldehyde, acetaldehyde, benzophenone, acetophenone, thiophenol. **06 Hrs.**

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CHDSCP-8: Chemistry-VIII Practical

(L:T:P = 0:0:2) Contact Hours: 60 Credits: 2 Workload: 4 Hours/Week

PART-A:

1. Hydrolysis of methyl acetate in presence of two different concentrations of HCl and determination of the relative strength.
2. Determination of energy of activation for the reaction between $K_2S_2O_8$ versus KI (first order) in two different temperatures.
3. Determination of rate constant for the reaction between chloramine-T and indigocaramine dye in pH 10 buffer medium spectrophotometrically.
4. Conductometric determination of strength of HCl, CH_3COOH and $CuSO_4$ versus NaOH.
5. Conductometric titration of sodium sulphate versus $BaCl_2$.
6. Conductometric determination second order rate constant for the saponification of ethyl acetate.
7. Determination of partial molar volume of NaCl-H_2O system by apparent molar volume method.
8. Potentiometric titration of acid mixture (CH_3COOH and $ClCH_2COOH$) versus NaOH.

PART-B: Organic Preparations:

1. Cannizarro reaction of benzaldehyde.
2. Friedel-Crafts reaction of benzene and acetyl chloride.
3. Oxidation of cyclohexanol.
4. Preparation of p-iodonitrobenzene
5. Preparation of *N*-phenyl-2,4-dinitroaniline.
6. Preparation of 2,4,6-tribromoaniline.
7. Preparation of 2,4-dichlorophenoxyacetic acid.

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Recommended Books/References:

1. Basic Inorganic Chemistry, F. A. Cotton, G. Wilkinson, P. L. Gaus; John Wiley, 6th Ed. (1999).
2. Advanced Inorganic Chemistry, F. A. Cotton, G. Wilkinson, 6th Ed.
3. Inorganic Chemistry, J. E. Huheey, E. A. Keiter and R. L. Keiter, Addison; Wesley, 4th Ed. (1993).
4. Inorganic Chemistry, D. F. Shriver, P. W. Atkins, C. H. Langford, Oxford University Press, 2nd Ed. 1994.,
5. Concise Inorganic Chemistry, J. D. Lee, 5th Ed. (1996).
6. Essentials of nuclear chemistry, H. J. Arniker, NAIL publishers, 4th Ed. (1995).
7. Vogel's Qualitative Chemical Analysis, J. Bassett, G. H. Jeffery and J. Mendham, ELBS (1986).
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9. Advanced Organic Chemistry, F A Carey and R J Sundberg, Plenum, (1990).
10. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice-Hall, (1998).
11. Stereochemistry of Organic Compounds, D Nasipuri, New-Age International, (1999).
12. Stereochemistry of Carbon Compounds, E L Eliel, S H Wilen and L N Mander, John Wiley, (1994).
13. Stereochemistry, Potapov, MIR, Moscow, 1984.
14. Organic Chemistry, Vol. I and II, I L Finar, Longman, (1999).
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22. Physical Chemistry: A Molecular Approach, McQuarie and Simon, Viva, New Delhi, (2001).
23. Introduction to Quantum Chemistry, A. K. Chandra, Tata McGraw Hill, (1988).
24. Quantum Chemistry, R. K. Prasad, New Age International, 2nd Ed. (2000).
25. Chemical Kinetics, K. J. Laidler, McGraw Hill. Inc. New York (1988).
26. Principles of Chemical Kinetics, House J. E. Wm C Brown Publisher, Boston, (1997).
27. Kinetics and Mechanism, A. A. Frost and R. G. Pearson, John-Wiley, New York, (1961).
28. Chemical Kinetic Methods, C. Kalidas, New Age International Publisher, New Delhi (1995)
29. Physical Chemistry, P. Atkins and J. D. Paula, 9th Ed., Oxford University Press (2010).
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Annexure-II

Scheme of Examination for CHDSC-5, CHDSC-6, CHDSC-7, and CHDSC-8
(V and VI Semesters) Credits (4:0:0)

Formative/Continuous Internal Assessment (Max. Marks: 40)	Marks		
	Assignment	Test	Total
C1	10	10	20
C2	10	10	20
Semester End Examination: C3			60
		Total	100

Question Paper pattern for CHDSC-5, CHDSC-6, CHDSC-7, and CHDSC-8 (V and VI Semesters)

Duration: 02 Hours		**Max. Marks: 60**
Part-A	Answer any six out of eight questions (Two questions from each unit)	6 x 2 =12
Part-B (Inorganic Chemistry)	Answer any two out of three questions	2 x 6 = 12
Part-C (Organic Chemistry)	Answer any two out of three questions	2 x 6 = 12
Part-D (Physical Chemistry)	Answer any two out of three questions	2 x 6 = 12
Part-E (Spectroscopy)	Answer any two out of three questions	2 x 6 = 12
Questions Pattern: (3 + 3) or (6)		

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Scheme of Examination for CHDSCP-5, CHDSCP-6, CHDSCP-7, and CHDSCP-8 practical
(V and VI Semesters) Credits (0:0:2)

Formative/Continuous Internal Assessment (Max. Marks: 25)	Marks			
	Test	Continuous Assessment/ Attendance	Record	Total
C1	10	--		10
C2	--	10	05	15
Semester End Examination: C3				25
			Total	50

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Annexure-III

Scheme of Evaluation: Practical

V Semester

CHDSCP-5: Chemistry-V Practical

Duration: 03 Hours **Max. Marks: 25**

DISTRIBUTION OF MARKS

- Procedure writing: 05 Marks
  (Note: If experiments from Part-A were given, procedure writing be from Part-B experiments, and vice-versa).
- Experimental: (Experiments be given from Part-A or Part-B) 20 Marks

Part-A: Organic Preparations

Skill	04 Marks
Reaction and mechanism	04 Marks
Yield	03 + 03 Marks
Recrystallisation products	02 + 02 Marks
Physical constants	01 + 01 Marks

Part-B: Organic estimations

Colorimetric estimation of glucose and aspirin		
Preparation of standard solution		05 Marks
Discrepancy	100 µg	10 Marks
	200 µg	08 Marks
	300 µg	06 Marks
	Any other value	04 Marks
Graph		05 Marks

Estimation of ascorbic acid		
Preparation of standard $K_2Cr_2O_7$ solution and calculation of its normality		03 Marks
Standardization of $Na_2S_2O_3$ solution and calculation of its normality		03 Marks
Discrepancy	10 mg	12 Marks
	15 mg	10 Marks
	20 mg	08 Marks
	Any other value	05 Marks
Calculation		02 Marks

Estimation of amino acid/carboxylic acid/amino group		
Preparation of standard potassium hydrogen phthalate solution and calculation of its normality		03 Marks
Standardization of NaOH solution and calculation of its normality		03 Marks
Discrepancy	± 0.2 cm^3	12 Marks
	± 0.3 cm^3	10 Marks
	± 0.4 cm^3	08 Marks
	Any other value	05 Marks
Calculation		02 Marks

Saponification value of an oil		
Preparation of standard Na_2CO_3 solution and calculation of normality		03 Marks
Standardization of HCl solution and calculation of its normality		03 Marks
Discrepancy	± 10%	12 Marks
	± 15%	10 Marks
	± 20%	08 Marks
	Any other value	05 Marks
Calculation		02 Marks

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Scheme of Evaluation

V Semester

CHDSCP-6: Chemistry-VI Practical

Duration: 03 Hours **Max. Marks: 25**

DISTRIBUTION OF MARKS

- Procedure writing: 05 Marks
  (Any one of the experiments from Part-B):
- Experimental: (Experiments be given from Part-A) 20 Marks

Colorimetric Determinations/Estimations		
Preparation of solutions		04 Marks
Determination of λmax		02 Marks
Accuracy	± 4%	09 Marks
	± 6%	07 Marks
	± 8%	05 Marks
	Any other value	03 Marks
Graph, Calculation		05 Marks

Conductometric titrations		
Accuracy	± 0.2 cm^3	12 Marks
	± 0.3 cm^3	10 Marks
	± 0.4 cm^3	08 Marks
	Any other value	05 Marks
Graph		05 Marks
Calculation of Normality, weight/dm^3		03 Marks

Potentiometric/pH metric/colorimetric titrations		
Accuracy	± 0.2 cm^3	12 Marks
	± 0.3 cm^3	10 Marks
	± 0.4 cm^3	08 Marks
	Any other value	05 Marks
Graph		05 Marks
Calculation of Normality, weight/dm^3		03 Marks

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Scheme of Evaluation

VI Semester

CHDSCP-7: Chemistry-VII Practical

Duration: 03 Hours **Max. Marks: 25**

DISTRIBUTION OF MARKS

- Procedure writing: 05 Marks
  (Any one of the experiments from Part-B):
- Experimental: (Experiments be given from Part-A) 20 Marks

Gravimetric Determination		
Skill		05 Marks
Accuracy	± 3%	12 Marks
	± 5%	10 Marks
	± 8%	08 Marks
	Any other value	05 Marks
Calculation		03 Marks

Volumetric Estimations		
Preparation of standard solution and calculation of normality		01 + 01 Marks
Deviation	Standardization	Estimation
± 0.3 cm^3	05 Marks	07 Marks
± 0.4 cm^3	04 Marks	06 Marks
± 0.5 cm^3	03 Marks	05 Marks
Any other value	02 Marks	04 Marks
Calculation of normality of link solution		02 Marks
Calculation of normality of test solution and wight/dm^3		02 + 02 Marks

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Scheme of Evaluation

VI Semester

CHDSCP-8: Chemistry-VIII Practical

Duration: 03 Hours **Max. Marks: 25**

DISTRIBUTION OF MARKS

- Procedure writing: 05 Marks
  (Any one of the experiments from Part-B):
- Experimental: (Experiments be given from Part-A) 20 Marks

Conductometric titrations		
Accuracy	± 0.2 cm^3	12 Marks
	± 0.3 cm^3	10 Marks
	± 0.4 cm^3	08 Marks
	Any other value	05 Marks
Graph		05 Marks
Calculation of normality, weight/dm^3		03 Marks

Kinetics Expts: Determination rate constant(k)	
6 constant values of k	12 Marks
5 constant values of k	10 Marks
4 constant values of k	08 Marks
Any other values of k	06 Marks
Graph	03 Marks
k from graph	02 Marks
Calculation and unit	03 Marks

Note: For experiments i) Hydrolysis of methyl acetate in presence of two different concentrations of HCl and determination of the relative strength, and ii) Determination of energy of activation for the reaction between $K_2S_2O_8$ versus KI (first order) in two different temperatures; only determination of rate constant for one concentration of acid and one temperature.

Determination of partial molar volume		
Accuracy	± 4%	12 Marks
	± 6%	10 Marks
	± 8%	08 Marks
	Any other value	06 Marks
Graph		05 Marks
Calculation		03 Marks

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