ANDHRA LOYOLA COLLEGE, VIJAYAWADA

ANDHRA LOYOLA COLLEGE, VIJAYAWADA

CHEMISTRY CURRICULUM

FIRST YEAR B.Sc

SEMESTER I

Course I (General, Physical & Inorganic Chemistry) CHE111IPC

Course outcomes:

At the end of the course, the student will be able to;

1. Understand the basic concepts of p-block& d-block elements
2. Explain the difference between solid, liquid and gases in terms of intermolecular interactions.
3. Understand the concept of orbitals & energy levels
4. shape of covalent molecules, identify types of intermolecular forces and predict those that are important for a given molecule,
5. relate the chemical and physical properties of substances to molecular structure, chemical bonding, and intermolecular interactions

Learning outcomes:

1. At the completion of this course, the learning outcome could be:
2. Solve quantitative chemistry problems and demonstrate reasoning clearly and completely. Integrate multiple ideas in the problem solving process---Critical thinking
3. Describe, explain and model chemical and physical processes at the molecular level in order to explain macroscopic properties----Communication& Information Literacy
4. Classify matter by its state and bonding behavior---- Information Literacy&Numbers / Data
5. Apply important theories such as the Kinetic Molecular Theory of Gases or the Quantum Mechanical Theory of the Atom to the solution of general chemistry problems---Understanding
6. Perform Volumetric laboratory experiments using standard chemistry glassware and equipment and demonstrate appropriate safety procedures ----Skill
7. Record, graph, chart and interpret data obtained from experimentation and use that information to correctly identify/analyze assigned unknown substances----Experimentation & Knowledge

PART- A

Unit I

Atomic Structure and Chemical bonding – 14 h

Atomic Structure: 8h

Definitions of Eigen function, Eigen Value, Operator with 2 examples - Postulates of Quantummechanics, Particle in 1-D box. Expression for Energy of particle in 1-D box. Relationship between Energy and Box length. De-Broglie concept of matter waves - Deriving expression for wavelength of de-Broglie matter waves - Application of de-Bbroglie concept to Bohr's model. Node & Nodal plane definitions - Drawing the radial probability distribution curves for 1s, 2s, 3s, 2p &3d orbitals

Chemical bonding:**6h**

Valence bond theory, hybridization, VB theory as applied to ClF_3& BrF_5 molecular orbital theory -LCAO method, construction of M.O. diagrams for homo-nuclear and hetero-nuclear diatomic molecules (N_2, O_2, CO and NO).

Unit II

Solid state 10 h

Definition of lattice point, space lattice, unit cell. Bravais lattices and crystal systems. Law of constancy of interfacial angles, the law of rationality of indices, the law of symmetry. Miller indices, Symmetry in crystals, density of crystals,

Efficiency of packing in SC. Types of layer pattern in HCP & FCC. Bragg's equation. Defects in crystals. Stoichiometric and non-stoichiometric defects.

UNIT-III

Gaseous state, Liquid state & Surface Chemistry 16h

Gaseous state 6h

Deviationfromidealbehaviour,explanationofbehaviourofagasbyVanderWaal'sequation(no need of derivation). Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. Relationship between critical constants and Vander Waal's constants, Lawof corresponding states (elementary treatment only). Joule-Thomson effect. Inversiontemperature.

PART-B

Liquid state 4h

Liquid crystals, mesomorphic state. Differences between liquid crystal and solid/liquid. Classification of liquid crystals into Smectic and Nematic. Application of liquid crystals as LCD devices.

Surface chemistry 6h

Colloids- Introduction, classification, Preparation of colloids by peptization and Bredig's arc method, Optical and mechanical properties, Coagulation of colloids- Hardy-Schulze rule. Protection of Colloids, Gold number. Adsorption-Physical and chemical adsorption, Langmuir adsorption isotherm, applications of adsorption.

UNIT IV

Chemistry of P-block elements 12h

Group 13: Preparation & structure of Diborane, Borazine Group 14:

Preparation, classification and uses of silicones

Group 15: Preparation & structures of Phosphonitrilic halides $\{(PNCl_2)_n$ where n=3, 4

Group 16: Oxides and Oxo acids of Sulphur (structures only)

Group 17: Pseudo halogens, Structures of Inter halogen compounds.

Group 18: Structures of Xenon compounds.

UNIT V

Chemistry of d& f-block elements 8h

Chemistry of d-block elements 4h

Characteristics of d-block elements with special reference to electronic configuration, variable valence, magnetic properties, catalytic properties and ability to form complexes and stability of various oxidation states.

Chemistry of f-block elements 4h

Chemistry of lanthanides - electronic structure, oxidation states, lanthanide contraction, consequences of lanthanide contraction, magnetic properties. Chemistry of actinides - electronic configuration, oxidationstates.

Books:

(1) Inorganic Chemistry, Shriver and Atkins', Fifth Edition,This edition has been authorized by Oxford University Press-1986

(2) Modern inorganic chemistry,c.Chambers,A.k. Holliday, University Press-2008

(3) O.P Agarwal unified volume I

(4) Principles of physical chemistry by Prutton andMarron

(5) Solid State Chemistry and its applications by Anthony R.West

(6) Text book of physical chemistry by K LKapoor

(7) Text book of physical chemistry by SGlasstone

(8) Advanced physical chemistry by Bahl andTuli

(9) Inorganic Chemistry byJ.E.Huheey

(10) Basic Inorganic Chemistry by Cotton andWilkinson

Web Learning Resources:

https://chem.libretexts.org/Textbook_Maps/General_Chemistry

https://www.beautifulchemistry.net/atomic-structure/

https://nptel.ac.in/courses/104103071/

https://swayam.gov.in/dashboard

Animations/simulations websites list (Open Access)

http://www.openculture.com/chemistry-free-courses

https://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm

LABORATORYCOURSE(2 h /w)
Course I (Volumetric Analysis)

Course outcomes:

At the end of the course, the student will be able to:

1. Understand the basic concepts of Quantitative analysis
2. Perform the techniques involved in Volumetric Analysis
3. Understand the concepts and role of the indicators used
4. Acquire an idea about the significant figures and accuracy of reporting
5. Estimate the unknown solute present in the given solution by suitable methods.

Learning outcomes:

At the completion of this course, the learning outcome could be:

1. Record, chart and interpret data obtained from experimentation and use that information to correctly identify/analyze assigned unknown substances----Experimentation & Knowledge

2. Solve quantitative chemistry problems and demonstrate reasoning clearly and completely. Integrate multiple ideas in the problem solving process---Critical thinking

CHEMISTRY-
CourseII CHE122OPC
(Organic & Physical Chemistry)

At the end of the course, the student will be able to;

1. Understandandexplainthedifferentialbehaviorof organiccompoundsbasedonfundamentalconceptslearnt.
2. Formulate the mechanism of organic reactions by recalling and correlating the fundamental properties of the reactants involved.
3. Learn and identify many organic reaction mechanisms including Free Radical Substitution, Electrophilic addition and Electrophilic AromaticSubstitution.
4. Correlate and describe the stereo chemical properties of organic compounds andreactions.

Learning outcomes:
At the completion of this course, the learning outcome could be:

The student will demonstrate knowledge of the classification, composition and behavior of families of carbon compounds ---Critical thinking & Information Literacy
The student will demonstrate knowledge of using the International Union of Pure and Applied Chemistry (IUPAC) rules for nomenclature --- Numbers / Data& Information Literacy
will demonstrate knowledge of the spatial arrangement, properties andreactivity ofstereoisomers

--- Understanding
demonstrate knowledge of the types of reactions that classes of organiccompounds undergo along with mechanisms---Knowledge, Understanding &Information Literacy

PART A

UNIT I

Alkanes and Cycloalkanes 12h

General methods of preparation of alkanes- Wurtz and Wurtz-Fitting reaction, Corey House synthesis,physicalandchemicalpropertiesofalkanes,Isomerismanditseffectonproperties, Free radical substitutions; Halogenation, concept of relative reactivity v/s selectivity. Conformational analysisofalkanes(Conformations,relativestabilityandenergydiagramsofEthane,Propaneand butane). General molecular formulae of cycloalkanes and relative stability, Baeyer strain theory, Cyclohexane conformations with energy diagram, Conformations of monosubstitutedcyclohexane.

UNIT II

Alkenes and alkynes 12h

Preparation: Dehydration of alcohols and dehydrohalogenation of alkyl halides– Mechanism of E^1, E^2, E^1cb reactions, Saytzeff rule; Chemical properties – electrophilic addition reactions–syn and anti-additions; addition of H_2 and X2; mechanisms of (Markownikoff's/Anti-Markownikoff'saddition)additionofHydrogenhalides, water:Oxymercuration-demercurationandhydroboration- oxidation; ozonolysis, hydroxylation (cis and trans), Diels-Alder reaction, 1,2- and 1,4- addition reactions in conjugated dienes. Reactions of alkynes–acidity, electrophilic and nucleophilic additions, hydration to form carbonyl compounds, Alkylation of terminalalkynes.

UNIT III

Benzene and its reactivity 10h

Concept of aromaticity, Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non Benzenoid compounds (Cyclopropenyl cation, cyclopentadienyl anion and tropylium cation) Reactions - General mechanism of electrophilic aromatic substitution, mechanism of nitration, Friedel-Craft'salkylationandacylation.

PART B

Orientationofaromaticsubstitution-ortho,paraandmeta directing groups Orientation of (i) Amino, methoxy and methyl groups (ii) Carboxy, nitro,nitrile, carbonyl and sulphonic acid groups (iii) Halogens (Explanation by taking minimum of one example from each type)

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- UNIT IV

Structural theory and Stereo Chemistry 14h

- Structural theory in Organic Chemistry6h

- Typesofbondfissionandorganicreagents,bondpolarization,Inductiveeffectanditsapplications to basicity of amines, acidity of carboxylic acids, stability of carbocations; Resonance and its application to acidity of phenols and carboxylic acids; Hyper conjugation and its application to stability of carbocations, Free radicals and alkenes.

- Stereo Chemistry8h

- Molecular representations- Wedge, Fischer, Newman and Saw-Horse formulae. Optical isomerism: Optical activity- wave nature of light, plane polarized light, optical rotation and specific rotation. Chiral molecules- definition and criteria (Symmetry elements)- Definition of enantiomers and diastereomers – Explanation of optical isomerism with examples- Glyceraldehyde, Lactic acid, Alanine, Tartaric acid, 2,3-dibromopentane. D,L, R,S and E,Z- configuration with examples. Definition of Racemic mixture – Resolution of racemic mixtures (any 2 techniques)

UNIT V

Solutions and theory of dilute solutions

12h Solutions

Thermodynamics of ideal solutions: Ideal solutions and Raoult’slaw,deviations from Raoult’s law–non-ideal solutions. Vapourpressure-composition and temperature composition curves of ideal and non-ideal solutions. Azeotropes-HCl-H2Osystem and ethanol-water system, Partial miscibility of liquids:Phenol – Water system, Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids - Principle of steam distillation. Nernst distribution law and its applications,

Dilute solutions

Colligative properties- RLVP, Osmotic pressure, Elevation in boilingng point and depression in freezingpoint.Experimentalmethodsforthe determination ofmolarmassofanon-volatilesolute using osmotic pressure, Elevation in boiling point and depression in freezing point. Abnormal colligative properties. Van't Hofffactor.

(1) Stereochemistry, E Vogtle, E. Weber, Oxford UniversityPress-2002

(2) Organic Chemistry, Paula yurkanisBruice, Fifthedition-2015

(3) Organic Chemistry - Morrison andBoyd

(4) Barrow, G.M. PhysicalChemistry

(5) Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

(6) Advanced physical chemistry by BahlandTuli

(7) Eliel, E. L. &Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London,1994.

(8) Kalsi, P. S. Stereochemistry Conformation and Mechanism; New Age International,2005.

(9) Principles of physical chemistry by Prutton andMarron

AdditionalResources:

Solomons,T. W. G.; Fryhle, C.B. &Snyder, S. A. Organic Chemistry, 12th Edition, Wiley.

Bruice, P. Y. Organic Chemistry, Eighth Edition, Pearson.

Clayden, J.; Greeves, N.&Warren, S. Organic Chemistry, Oxford.

Nasipuri, D. Stereochemistry of Organic Compounds: Principles and Applications,ThirdEdition,NewAge International.

Gunstone, F. D. Guidebook to Stereochemistry, Prentice Hall Press, 1975.

LABORATORYCOURSE–II **30**hrs (2 h /w)

Qualitative inorganic analysis**50MCHE122MA(P)**

(Minimum of Six Mixtures Should BeAnalyzed)

Course outcomes:

At the end of the course, the student will be able to;

1. Understand the basic concepts of qualitative analysis ofinorganic mixture
2. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
3. Apply the concepts of common ion effect, solubility product and concepts related to qualitative analysis

ANALYSISOFSALTMIXTURE 50M

Analysis of mixture salt containing two anions and two cations (From two different groups) from the following:

Anions: Carbonate, Sulphate, Chloride, Bromide, Acetate, Nitrate, Borate, Phosphate. **Cations:** Lead, Copper, Iron, Aluminium, Zinc, Nickel, Manganese, Calcium, Strontium, Barium, Potassium and Ammonium.

B.Sc Chemistry SYLLABUS UNDER CBCS (PROPOSED)
[2020-21 Batch onwards]

Course III (ORGANIC AND PHYSICAL CHEMISTRY)

4h / w 60 Hrs/Sem No. of Credits-4

Course outcomes: At the end of the course, the student will be able to;

1. Understand the concept of SN^1 and SN^2 and SN^imechanisms.
2. Understand reactivity of alkyl halides towards nucleophilic substitution reactions.
3. Execute the skills to propose various mechanisms
4. Derive integrated rate expressions for zero order, first order and second order reactions
5. Recognize the significance of phase diagrams.
6. Appreciate the concept of quantum efficiency and mechanisms of photochemical reactions.

Unit I 12 Hrs
(Halogen compounds & Hydroxy compounds)

Alkyl halides: Preparation of alkyl halides by from alcohols with PCl_5, PCl_3, $SOCl_2$, $HX/ZnCl_2$. Properties-nucleophilic substitution reactions–SN^1 and SN^2 and SN^imechanisms with energy profile diagrams, stereo chemical aspects and effect of solvent. Nucleophilic substitution verses elimination reactions, Williamson's synthesis. **Aryl halides:** Preparation from i) from phenols ii) Sandmeyer's reaction, nucleophilic aromatic substitution (Benzyne mechanism); relative reactivity of alkyl, allyl, vinyl and benzyl, aryl halides towards nucleophilic substitution reactions.

Alcohols: Preparation of 1^0, 2^0, 3^0 alcohols from Grignard's reagent, Bouveault–Blanc Reduction; Chemical properties - replacement of -OH by X using PCl_5, PCl_3, PBr_3, $SOCl_2$ and with $HX/ZnCl_2$, Oxidation of alcohols with PCC, PDC; Oxidation of diols by HIO_4 and $Pb(OAc)_4$, Pinacol Pinacolone arrangement with mechanism, relative reactivity of 1°, 2°, 3° alcohols. **Phenols:** Preparation from diazonium salt and Cumene; Reactions–Reimer–Tiemann and Kolbe's–Schmidt reactions with mechanism, Fries and Claisen rearrangements.

Unit II 12 Hrs
(Carbonyl compounds)

Preparation from Acid chlorides, 1,3-dithiane and nitriles; Structure and reactivity of carbonyl group, Nucleophilic addition reactions with HCN, $NaHSO_3$ and alcohols. addition-elimination reactions with hydroxylamine, hydrazine, phenyl hydrazine, 2,4 DNP, semi carbazide. Mechanisms of Aldol condensation, Cannizzaro reaction, Claisen-Schmidt reaction, Perkin reaction, Benzoin condensation, Wittig reaction, Beckmann rearrangement. Haloform reaction and Baeyer Villiger oxidation, α-substitution reactions, oxidations and reductions (Clemmensen's, Wolf–Kishner's, with $LiAlH_4$&$NaBH_4$). Addition reactions of α, β-unsaturated carbonyl compounds: Michael addition.

Unit III 12 Hrs
(Carboxylic acid and Active methylene compounds)

Carboxylic Acids: Preparation from GR and hydrolysis of nitriles, typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids, Reactions of monocarboxylic acids- Reactions involving -H, -OH and -COOH groups, formation of salts, anhydrides, acid chlorides, amides and esters with mechanism of esterification. Degradation of carboxylic acids by Huns-Diecker's reaction, decarboxylation by Schmidt reaction, Arndt-Eistert synthesis, halogenation by Hell- Volhard- Zelinsky reaction. Preparation and reactions of acid chlorides,

anhydrides, esters and amides; Comparative study of nucleophilic substitution at acyl group-, Curtius rearrangement. Mechanisms of acidic and alkaline hydrolysis of esters, Reformatsky reactions.

Active methylene compounds: Keto enol tautomerism, preparation of AAE by Claisen condensation with mechanism, preparation of Malonic ester from acetic acid, synthetic applications of AAE and Malonic ester in the preparation of monocarboxylic acids, di carboxylic acids, α,β-unsaturated acids, keto acids and hetero cyclic compounds

Unit IV 12 Hrs

(Chemical Kinetics and Enzyme catalysis)

Chemical Kinetics: The concept of reaction rates, order and molecularity of a reaction, derivation of integrated rate equations for zero, first and second order reactions (for equal concentrations of reactants), Half–life of various orders, determination of order of a reaction – differential method, half-life method, Effect of temperature on rate of reaction-Arrhenius equation/, concept of activation energy, Steady state approximation-Lindemann theory of unimolecular reaction (for a general reaction), Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions, qualitative comparison of the two theories.

Enzyme catalysis - Characteristics, factors affecting enzyme catalysis, derivation of Michaels- Menten equation, significance of Michaelis-Menten constant.

Unit V 12 Hrs

(Phase rule and Photo Chemistry)

Phase rule: Concept of phase, components, degree of freedom, Phase equilibria of one component Water system, two-component simple eutectic diagram of Pb-Ag system, desilverisation of lead, system with congruent melting point: Mg–Zn system and incongruent melting point: NaCl–Water system. Freezing mixtures.

Photochemistry: Difference between thermal and photochemical processes, Laws of photochemistry – Grothus Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield and Photochemical reaction mechanism of H_2–Cl_2 and H_2–Br_2 reactions. Beer-Lambert's law, Qualitative description of fluorescence, phosphorescence, Jablonski diagram- energy transfer processes, Chemiluminescence.

Reference books

1. G. M. Barrow: Physical Chemistry Tata McGraw-Hill (2007).
2. G. W. Castellan: Physical Chemistry 4th Ed. Narosa (2004
3. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
5. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education)
6. Graham Solomons, T.W. Organic Chemistry, John Wiley & Sons, Inc
7. Atkins, P.W & Paula, J.D. Physical Chemistry, 9th Ed., Oxford University Press (2011).
8. Castellan, G. W. Physical Chemistry 4th Ed., Narosa (2004).
9. Mortimer, R. G. Physical Chemistry 3rd Ed., Elsevier: NOIDA, UP (2009).
10. Barrow, G. M., Physical Chemistry 5th Ed., Tata McGraw Hill: New Delhi (2006).
11. Engel, T. & Reid, P. Physical Chemistry 3rd Ed., Prentice-Hall (2012)

B.Sc CHEMISTRY SYLLABUS UNDER CBCS

[2020-21 Batch onwards]

Course III

(ORGANIC QUALITATIVE ANALYSIS)

2h / w **30 Hrs/Sem** **No. of Credits-2** **50 M**

Course outcomes: At the end of the course, the student will be able to;

1. Understand the basic concepts of qualitative analysis of organic compound
2. Analyze various organic compounds using documented procedures
3. Classify organic compounds based on functional groups
4. Identify organic compound by determination of melting point

Analysis of an organic compound using systematic qualitative procedure for functional group identification and determination of melting point and boiling pointof Organic compounds containing functional groups **Alcohols, Phenols, Aldehydes, Ketones, Acids, amines, Carbohydrates, Amides and Nitro compounds.** (At least ***Six functional groups*** *to be analysed*)

Reference Books

1. Textbook of Practical Organic Chemistry, A.I. Vogel , Prentice Hall, 5th edition.
2. Practical Organic Chemistry, F. G. Mann. & B. C. Saunders, Orient Longman, 196
3. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
4. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)
5. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).
6. Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000).

B.Sc Chemistry SYLLABUS UNDER CBCS

[2020-21 Batch onwards]

Course IV (OrganicChemistry& Spectroscopy of Organic compounds)

4h / w **60 Hrs/Sem** **No. of Credits-4**

Course outcomes: At the end of the course, the student will be able to;

1.Understand nitrogen containing functional groups with respect to their reactivity

2. Comprehend the chemistry of amino acids and Proteins
3. Gain knowledge about the structural elucidation of various mono and disaccharides.
4. Understand and analyse the spectra of organic molecules
5. Comprehend the synthesis and reactivity of various Heterocyclic compounds

Unit I 12 Hrs

(Nitrogen containing functional groups)

Nitro alkanes: Preparation of nitroalkanes, Tautomerism in nitroalkanes, Reactivity – with HNO_2, Nef reaction and Mannich reaction leading to Michael addition and reduction. **Amines:** Chirality in amines (pyramidal inversion), preparations– Gabriel synthesis and Hoffman's bromamide reaction (with mechanisms), reduction of amides and Schmidt reaction. reaction of primary, secondary and tertiary amines with nitrous acid and Heinsberg's reagent, Carbylamine reaction, Mannich reaction, Hoffmann and Cope eliminations. Aromatic amines: Preparation and Bromination and Nitration and oxidation of Aniline. Diazonium Salts: Preparation and its synthetic applications in the preparation of arenes, haloarenes, phenols, cyano and nitro compounds. Coupling reactions of diazonium salts.

Unit II 12 Hrs

(Amino acids & Heterocyclic compounds)

Amino acids–Definition and classification of Amino acids, Methods of synthesis: synthesis from halogenated carboxylic acid, Gabriel Phthalimide and Strecker's synthesis. Physical properties: Zwitter ion structure and isoelectric point. Chemical reactions due to amino and carboxyl groups – formation of lactams from gamma and delta amino acids, peptide bond, nomenclature and synthesis of dipeptides. Overview of structure of proteins, determination of primary structure of peptides by Edman degradation (N-terminal) and C–terminal (thiohydantoin and with carboxypeptidase enzyme). **Heterocyclic compounds–**Introduction, Synthesis of Pyrrole, Furan and Thiophene by Paul-Knorr method, resonance and aromaticity in them. Properties: electrophilic substitution at 2 or 5 position, Pyrrole-Acidic character of pyrrole, Halogenation, Nitration and Sulphonation, Diels Alder reaction in furan and reduction of thiophene with raney Nickel. Pyridine–Synthesis, aromaticity and its basic nature comparison with pyrrole- properties -Chichibabin's reaction.

Unit III 12 Hrs

(Carbohydrates)

Carbohydrates–Definition and classification of carbohydrates, Mono saccharides: Constitution (structure elucidation) of Glucose and Fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani-Fischer synthesis and Ruff degradation; Disaccharides–treatment of maltose, lactose and sucrose with respect to hydrolysis, reducing nature and structures, poly saccharides – starch and cellulose,

Unit IV 12 Hrs

(Molecular, UV-Visible and IR Spectroscopy)

Molecular Spectroscopy: Interaction of electromagnetic radiation with molecules and various types of spectra; Rotational spectroscopy–Selection rules, determination of bond lengths of diatomic molecules, isotopic substitution. **UV-Visible:** Electronic transitions in molecules, Concept of chromophore and auxochrome, effect of conjugation. Woodward rules for calculating λmax of conjugated dienes and α, β–unsaturated compounds.

Vibrational/IR spectroscopy–Classical equation of vibration, computation of force constant, Harmonic oscillator, Morse potential curve, vibrational degrees of freedom for polyatomic molecules, modes of vibration, selection rules for vibrational transitions, Fundamental frequencies, overtones and combination bands. Principle of Infrared spectroscopy, fingerprint region. IR spectra of alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions).

Unit V **12 Hrs**

(H-NMR and Mass Spectroscopy)

Proton magnetic resonance spectroscopy (^{1}H-NMR)–Principle of nuclear magnetic resonance – shielding and de-shielding - equivalent and non-equivalent protons, Chemical shift and splitting of signals – spin-spin coupling, Applications of NMR with suitable examples –Propanol and iso-propanol, Propanal and Acetone, 1,1-dibromo ethane and 1,2-dibromoethane, ethyl acetate and Acetic acid.

Mass spectrometry–Principle of mass spectrometry, molecular ion and fragment ions, Isotopic peaks and their importance in the determination of nature of hetero atoms in the molecule, Mass spectral fragmentation in aldehydes, ketones, carboxylic acids and alcohols with an example each.

Reference books

1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education)
4. Graham Solomons, T.W. Organic Chemistry, John Wiley & Sons, Inc
5. Spectroscopy of organic compounds by William Kemp
6. Spectroscopy by Pavia
7. Organic Spectroscopy by J. R. Dyer 8. Elementary organic spectroscopy by Y.R. Sharma
9. Spectroscopy of organic compounds by P.S.Kalsi
10. Spectrometric Identification of Organic Compounds by Robert M Silverstein, Francis X Webster

[2020-21 Batch onwards]

Course IV (Preparation of Organic compounds and Spectral Analysis of Organic compounds)

2h / w **30 Hrs/Sem** **No. of Credits-2** **50 M**

Course outcomes: At the end of the course, the student will be able to;

1. Understand the preparation of various organic compounds
2. interconvert various functional groups
3. Examine the spectra of various functional groups
4. Appreciate the methods of preparation of some drugs and dyes.

I. Any five of the following organic preparations.

1. Green method of Identification of extra elements in organic compounds
2. Preparation of Benzoic acid from Toluene.
3. Preparation of m-dinitro benzene.
4. Preparation of Acetanilide by Green method approach.
5. Preparation of Aspirin and Paracetamol.
6. Preparation of various Dyes

II. Combined spectral (UV-Vis, IR, NMR and Mass) analysis of functional groups.

1. Alcohol – Butanol
2. Aldehyde – Butanaldehyde
3. Ketone – Acetophenone
4. Carboxylic acid – Butanoic acid
5. Amine – Butyl amine

Reference Books

1. Textbook of Practical Organic Chemistry, A.I. Vogel , Prentice Hall, 5th edition.
2. Practical Organic Chemistry, F. G. Mann. & B. C. Saunders, Orient Longman, 196
3. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
4. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)
5. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).
6. Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000).

B.Sc. Chemistry SYLLABUS UNDER CBCS

[2020-21 Batch onwards]

Course V (IN-ORGANIC AND PHYSICAL CHEMISTRY)

4h / w **60 Hrs/Sem** **No. of Credits-4**

Course outcomes: At the end of the course, the student will be able to;
1. Apply IUPAC nomenclature rules to name different complex compounds
2. Recognize structural and stereoisomerism in complex compounds
2. Understand the concept of metal ligandbondingincomplex compounds
3. Know the role of metal ions and other inorganic elements in biological systems.
4. Know the importance of EMF measurements and its applications.
5. Discuss and apply laws of Chemical Thermodynamics
6.Understand the working of Carnot cycle and its efficiency.

Unit I 12 Hrs
(Co-ordination compounds-I)

Complex compounds I: Basic terminology, IUPAC nomenclature of complex compounds, structural and stereoisomerism (Geometrical and Optical) in complexes with coordination numbers Four and Six, **Valence Bond theory** - discussion of structure and magnetic properties of complexes eg., $[NiCl_4]^{2-}$, $[Ni(CO)_4]$, $[Ni(CN)_4]^{2-}$, $[Cu(NH_3)_4]^{+2}$, $[Co(NH_3)_6]^{3+}$, $[Fe(CN)_6]^{-3}$, $[Fe(CN)_6]^{-4}$,$[CoF_6]^{3-}$ and $Fe(CO)_5$ using VBT, limitations of VBT. **Crystal fieldtheory:** splitting of d-orbitals in Octahedral, tetrahedral and square planar field, calculation of CFSE and factors affecting of CFSE, classification into spinels and inverse spinels, spectrochemical series, Tetragonal distortion of octahedral geometry – Jahn-Teller distortion.Selection rules for electronic spectroscopy, electronic absorption spectrum of $[Ti(H_2O)_6]^{3+}$ ion.

Unit II 12 Hrs
(Co-ordination compounds-II &Organo metallics)

Complex compounds II: Reaction mechanism: Labile and inert complexes, ligand substitution reactions of complexes in octahedral field – S_N^1 and S_N^2, square planar field – Trans-effect and its application in the synthesis of (Cis-$[PtCl_2(NH_3)_2]$ from $[PtCl_4]^{-2}$, Cis and trans $[PtCl_2(NH_3)_2]$ from $[Pt(NH_3)_4]$, $[PtClBr(C_2H_4)(Py)]$ from $[PtCl_4]^{2-}$, Kurnakov's test; Stability of metal complexes - factors affecting the stability of metal complexes, determination of composition of complex by Job's method.

Organo metallic compounds: Definition and classification of organo metallic compounds on the basis of nature of bond, concept of hapticity, Metal carbonyls: 18 electron rule, electron count of mononuclear, polynuclear metal carbonyls of 3d series, methods of preparation of mono and binuclear carbonyls of Ni, Co, Fe and Cr by direct Combination, Reductive carbonylation and preparation of binuclear carbonyls from mononuclear carbonyls, π-acceptor behaviour of CO (MO diagram of CO to be discussed), synergic effect and use of IR data to explain extent of back bonding.

Unit III 12 Hrs
(Bio-Inorganic and HSAB theory)

Metal ions present in biological systems - classification of elements into essential and non-essential and according to their action in biological system, Sodium/Potassium pump, Carbonic anhydrase and Carboxypeptidase, Excess and deficiency of some trace metals (Cu, Zn, Mn). Toxicity of Hg, Pb, Cd and As, use of chelating agents in

medicine, cis-Platin as an anti-cancer drug. Iron and its application in bio-systems, Haemoglobin, Myoglobin. Storage and transfer of iron. **HSABtheory:** Pearson's concept, principle of HSAB theory & its applications.

Unit IV 12 Hrs

(Chemical Thermodynamics)

Introduction to terminology, **First law of thermodynamics**-statement, definition of internal energy and enthalpy, Heat capacities and their relationship, Joule-Thomson effect-coefficient, calculation of work for the expansion of ideal gas under isothermal and adiabatic conditions for reversible processes, Temperature dependence of enthalpy of formation- Kirchhoff s equation. **Second law of thermodynamics**–different statements, Carnot cycle and its efficiency, Carnot theorem, concept of entropy, Entropy as a state function, Entropy changes in reversible, irreversible and equilibrium processes. **Third law of thermodynamics**, Nernst heat theorem, **Helmholtz and Gibbs Energies**-Gibbs-Helmholtz's equation, criteria for spontaneity, variation of G with P, V and T.

Unit V 12 Hrs

(Electro Chemistry & Electro chemical cells)

Electro chemistry: Definition of Specific, equivalent, molar conductance and effect of dilution on them, Kohlrausch's law and its applications (calculation of equivalent conductance of weak electrolyte at infinite dilution, degree of ionization (α) of weak electrolyte, determination of dissociation constant (K_a) of an acid, and determination of solubility product of sparingly soluble salt), transport number definition and abnormal transport number, determination of transport number by Hittorf's method, elementary idea of Debye-Huckel-Onsager's equation for strong electrolytes, conductometric titrations.

Electrochemical cells: concept of EMF of a cell, measurement of EMF of a cell, Nernst equation and its importance, Types of electrodes – the gas electrode, metal-metal ion, metal-insoluble salt and redox electrodes. Standard electrode potential. Electrochemical series. Calculation of thermodynamic properties (ΔG, ΔH and ΔS), equilibrium constant and solubility product from EMF data, Concentration cells without transference, role of salt bridge in cells. P^H determination using hydrogen electrode. Fuel cells- Basic concepts, examples and applications. Potentiometric titrations (acid-base and oxidation-reduction).

Reference books

1. Shriver, D.D. & P. Atkins, Inorganic Chemistry 2nd Ed., Oxford University Press, 1994
2. Purcell, K.F &Kotz, J.C. Inorganic Chemistry W.B. Saunders Co, 1977.
3. Huheey, J.E., Inorganic Chemistry, Prentice Hall, 1993.
4. Lippard, S.J. & Berg, J.M. Principles of Bioinorganic Chemistry Panima Publishing Company 1994.
5. Cotton, F.A. & Wilkinson, G, Advanced Inorganic Chemistry. Wiley-VCH, 1999
6. Basolo, F, and Pearson, R.C., Mechanisms of Inorganic Chemistry, John Wiley & Sons, NY, 1967.
7. Atkins, P.W & Paula, J.D. Physical Chemistry, 9th Ed., Oxford University Press (2011).
8. Castellan, G. W. Physical Chemistry 4th Ed., Narosa (2004).
9. Mortimer, R. G. Physical Chemistry 3rd Ed., Elsevier: NOIDA, UP (2009).
10. Barrow, G. M., Physical Chemistry 5th Ed., Tata McGraw Hill: New Delhi (2006).
11. Engel, T. & Reid, P. Physical Chemistry 3rd Ed., Prentice-Hall (2012).
12. Rogers, D. W. Concise Physical Chemistry Wiley (2010).

B.Sc CHEMISTRY SYLLABUS UNDER CBCS

[2020-21 Batch onwards]

Course V

(PHYSICAL AND INSTRUMENTAL METHODS ANALYSIS)

2h / w **30 Hrs/Sem** **No. of Credits-2** **50 M**

Course outcomes: At the end of the course, the student will be able to;

1. Connect concepts of conductometric titrations, reaction kinetics covered in lectures with experimental measurements and calculations performed in this lab course.
2. Integrate chemical concepts with skills learned in laboratories to formulate, perform experiments, collect data, compile and interpret results and draw logical conclusions.

List of Practicals to be performed in Physical and instrumental methods of analysis.

1. Titration of Strong acid with Strong base by measuring P^H
2. Titration of Weak acid with Strong base by measuring P^H
3. Titration of Strong acid with Strong base by measuring conductance.
4. Titration of Weak acid with Strong base by measuring conductance.
5. Potentiometric titration of Mohr's salt with potassium dichromate
6. Verification of Beer-Lambert's law by Spectro photometry.
7. Effect of electrolyte on the CST of Phenol-Water system
8. Study of kinetics of decomposition of H_2O_2
9. Determination of composition of the mixture by viscosity measurements.

Reference books

1. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011). 25
2. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.; McGraw-Hill: New York (2003).
3. Halpern, A. M. &McBane, G. C. Experimental Physical Chemistry 3rd Ed.; W.H. Freeman & Co.: New York (2003)

B.Sc CHEMISTRY SYLLABUS UNDER CBCS

[2020-21 Batch onwards]

Course IV (Preparation of Organic compounds and Spectral Analysis of Organic compounds)

2h/w 30Hrs/Sem No.ofCredits-2 50M

Course outcomes: At the end of the course, the student will be able to;

1. Understand the preparation of various organiccompounds
2. interconvert various functional groups
3. Examine the spectra of various functional groups
4. Appreciate the methods of preparation of some drugs and dyes.

I. Any five of the following organicpreparations.

1. Green method of Identification of extra elements in organiccompounds
2. Preparation of Benzoic acid fromToluene.
3. Preparation of m-dinitro benzene.
4. Preparation of Acetanilide by Green methodapproach.
5. Preparation of Aspirin andParacetamol.
6. Preparation of various Dyes

II. Combined spectral (UV-Vis, IR, NMR and Mass) analysis of functionalgroups.

1. Alcohol – Butanol
2. Aldehyde – Butanaldehyde
3. Ketone –Acetophenone
4. Carboxylic acid – Butanoic acid
5. Amine – Butyl amine

Reference Books

1. Textbook of Practical Organic Chemistry, A.I. Vogel , Prentice Hall, 5thedition.
2. Practical Organic Chemistry, F. G. Mann. & B. C. Saunders, Orient Longman,196
3. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education(2009)
4. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical OrganicChemistry, 5th Ed., Pearson (2012)
5. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry:Preparation and Quantitative Analysis, University Press(2000).
6. Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000).

B.Sc. Chemistry SYLLABUS UNDER CBCS

[2020-21 Batch onwards]

Course V (IN-ORGANIC AND PHYSICAL CHEMISTRY)

4h/w 60Hrs/Sem No. ofCredits-4

Course outcomes: At the end of the course, the student will be ableto;

1. Apply IUPAC nomenclature rules to name different complexcompounds
2. Recognize structural and stereoisomerism in complex compounds
2. Understand the concept of metal ligandbondingin complex compounds
3. Know the role of metal ions and other inorganic elements in biologicalsystems.
4. Know the importance of EMF measurements and its applications.
5. Discuss and apply laws of Chemical Thermodynamics 6.Understand the working of Carnot cycle and itsefficiency.

UnitI 12Hrs

(Coordination compounds-I)

Complex compounds I: Basic terminology, IUPAC nomenclature of complex compounds, structural and stereoisomerism (Geometrical and Optical) in complexes with coordination numbers Four and Six, **ValenceBond theory** - discussion of structure and magnetic properties of complexes eg., $[NiCl_4]^{2-}$, $[Ni(CO)_4]$, $[Ni(CN)_4]^{2-}$, $[Cu(NH_3)_4]^{+2}$, $[Co(NH_3)_6]^{3+}$, $[Fe(CN)_6]^{-3}$, $[Fe(CN)_6]^{-4}$,$[CoF_6]^{3-}$ and $Fe(CO)_5$ using VBT, limitations of VBT. **Crystal fieldtheory:** splitting of d-orbitals in Octahedral, tetrahedral and square planar field, calculation of CFSE and factors affecting of CFSE, classification into spinels and inverse spinels, spectrochemical series, Tetragonal distortion of octahedral geometry – Jahn-Teller distortion.Selection rules for electronic spectroscopy, electronic absorption spectrum of $[Ti(H_2O)_6]^{3+}$ ion.

Unit II 12 Hrs

(Coordination compounds-II Organometallics)

Complex compounds II: Reaction mechanism: Labile and inert complexes, ligand substitution reactions of complexes in octahedral field – S_N^1 and S_N^2, square planar field –Trans-effect and its application in the synthesis of (Cis-$[PtCl_2(NH_3)_2]$ from $[PtCl_4]^{-2}$, Cis and trans $[PtCl_2(NH_3)_2]$ from $[Pt(NH_3)_4]$, $[PtClBr(C_2H_4)(Py)]$ from $[PtCl_4]^{2-}$, Kurnakov'stest; Stability of metal complexes - factors affecting the stability of metal complexes, determination of composition of complex by Job's method.

Organo metallic compounds: Definition and classification of organo metallic compounds on the basis of nature of bond, concept of hapticity, Metal carbonyls: 18 electron rule, electron count of mononuclear, polynuclear metal carbonyls of 3d series, methods of preparation of mono and binuclear carbonyls of Ni, Co, Fe and Cr by direct Combination, Reductive carbonylation and preparation of binuclear carbonyls from mononuclear carbonyls,

π-acceptor behaviour of CO (MO diagram of CO to be discussed), synergic effect and use of IR data to explain extent of back bonding.

Unit III **12 Hrs**

(Bio-Inorganic and HSAB theory)

Metal ions present in biological systems - classification of elements into essential and non-essential and according to their action in biological system, Sodium/Potassium pump, Carbonic anhydrase and Carboxypeptidase, Excess and deficiency of some trace metals (Cu,Zn, Mn). Toxicity of Hg, Pb, Cd and As, use of chelating agents in medicine, cis-Platin as an anti-cancer drug. Iron and its application in bio-systems, Haemoglobin, Myoglobin. Storage and transfer of iron. **HSABtheory:** Pearson's concept, principle of HSAB theory & its applications.

Unit IV **12 Hrs**

(Chemical Thermodynamics)

Introduction to terminology, **First law of thermodynamics**-statement, definition of internal energy and enthalpy, Heat capacities and their relationship, Joule-Thomson effect-coefficient, calculation of work for the expansion of ideal gas under isothermal and adiabatic conditions for reversible processes, Temperature dependence of enthalpy of formation- Kirchhoff s equation. **Second law of thermodynamics**–different statements, Carnot cycle and its efficiency, Carnot theorem, concept of entropy, Entropy as a state function, Entropy changes in reversible, irreversible and equilibrium processes. **Third law of thermodynamics**, Nernst heat theorem, **Helmholtz and Gibbs Energies**-Gibbs-Helmholtz's equation, criteria for spontaneity, variation of G with P, V and T.

UnitV **12 Hrs**

(Electro Chemistry & Electro chemical cells)

Electro chemistry: Definition of Specific, equivalent, molar conductance and effect of dilution on them, Kohlrausch's law and its applications (calculation of equivalent conductance of weak electrolyte at infinite dilution, degree of ionization (α) of weakelectrolyte, determination of dissociation constant (K_a) of an acid, and determination of solubility product of sparingly soluble salt), transport number definition and abnormal transport number, determination of transport number by Hittorf's method, elementary idea of Debye-Huckel-Onsager's equation for strong electrolytes, conductometrictitrations.

Electrochemical cells: concept of EMF of a cell, measurement of EMF of a cell, Nernst equation and its importance, Typesof electrodes – the gas electrode, metal-metal ion, metal-insoluble salt and redox electrodes. Standard electrode potential. Electrochemical series. Calculation of thermodynamic properties (ΔG, ΔH and ΔS), equilibrium constant and solubility product from EMF data, Concentration cells without transference, role of salt bridge in cells. P^H determination using hydrogen electrode. Fuel cells- Basic concepts, examples and applications. Potentiometric titrations (acid-base and oxidation-reduction).

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1967.
7. Atkins, P.W & Paula, J.D. Physical Chemistry, 9th Ed., Oxford University Press(2011).
8. Castellan, G. W. Physical Chemistry 4th Ed., Narosa(2004).
9. Mortimer, R. G. Physical Chemistry 3rd Ed., Elsevier: NOIDA, UP(2009).
10. Barrow, G. M., Physical Chemistry 5th Ed., Tata McGraw Hill: New Delhi(2006).
11. Engel, T. & Reid, P. Physical Chemistry 3rd Ed., Prentice-Hall(2012).
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B.Sc CHEMISTRY SYLLABUS UNDER CBCS

[2020-21 Batch onwards]

Course V

(PHYSICAL AND INSTRUMENTAL METHODS ANALYSIS)

2h/w 30Hrs/Sem No.ofCredits-2 50M

Course outcomes: At the end of the course, the student will be able to;

1. Connect concepts of conductometric titrations, reaction kinetics covered in lectures with experimental measurements and calculations performed in this lab course.
2. Integrate chemical concepts with skills learned in laboratories to formulate, perform experiments, collect data, compile and interpret results and draw logicalconclusions.

List of Practicals to be performed in Physical and instrumental methods of analysis.

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3. Titration of Strong acid with Strong base by measuringconductance.
4. Titration of Weak acid with Strong base by measuringconductance.
5. Potentiometric titration of Mohr's salt with potassiumdichromate
6. Verification of Beer-Lambert's law by Spectrophotometry.
7. Effect of electrolyte on the CST of Phenol-Watersystem
8. Study of kinetics of decomposition of H_2O_2
9. Determination of composition of the mixture by viscosity measurements.

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2. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.; McGraw-Hill: New York(2003).
3. Halpern, A. M. &McBane, G. C. Experimental Physical Chemistry 3rd Ed.; W.H. Freeman & Co.: New York(2003)

Andhra Loyola College (Autonomous):: Vijayawada-8

ProposedIIIB.ScChemistrySyllabusforPaperVIAandVIIA **PaperVIA**

I. LearningOutcomes:

Students after successful completion of the course will be able to:

1. Identify the importance of reagents used in the synthesis of organiccompounds.
2. Learn the fundamental ideas behind the many forms of pericyclicreactions.
4. Understand the importance of retro synthesis in organicchemistry.
5. Comprehend the applications of different reactions in synthetic organicchemistry.

Synthetic Organic Chemistry Unit: I

Pericyclic reactions

Definition and features of Pericyclic reactions, Types of Pericyclic reactions – Electro cyclic, Cyclo addition and Sigmatropic reactions with definition &suitable examples, Woodward-Hoffmann selection rules of pericyclic reactions, sigmatropic reactions – migration of –H, –C, Cope and Claisen rearrangement.

Molecular orbital diagrams for ethylene, 1,3-butadiene and 1,3,5-hexatriene, definition of HOMO and LUMO, Mechanism of electro cyclic and cyclo addition reactions by Frontier Molecular Orbital (FMO) theoryunder thermal and photochemical conditions,

Unit: II

Organic Photochemistry

(Recapitulation of Laws of Photochemistry and Quantum yield) * Jablonski diagram – Singlet and Triplet states, Photochemistry of carbonyl compounds – Photo reduction, Norrish type-I and Norrish type-II reactions,

Photo-addition–Paterno-Buchi Reaction; Photo chemistry of Olefine – Cis-trans isomerisation, Photo rearrangements – The Di-π-Methane rearrangement

Unit: III

Reactions of synthetic importance

Formation of "C-C" bonds – mechanism of Intra molecular aldol condensation leading to the formation of rings and Dieckmann condensation, McMurry reaction and Wittig reaction,

Stork-Enamine reaction;Robinson ring annulation, Mechanisms of Bailys-Hillman reaction, Heck reaction, Suzuki coupling.

Unit: IV

Reagents and Retrosynthesis

1,3-dithane in the synthesis of aldehydes and ketones, Diazomethane–with Phenol, acetic acid and cyclohexanone, Sodamide – conversion of lower alkynes to higher alkynes, with quinoline and Isoquinoline, NBS – allylic bromination alkenes and with cyclohexanone, Gilman reagent – preparation and its reactions with acid chloride, α,β-unsaturated ketones, epoxides and alkyl halides i.e., Corey-House synthesis

Important terms in Retro synthesis with examples–Disconnection, Target molecule, FGI, Synthon, Retro synthetic analysis, Retro synthetic analysis of some compounds:

Unit: V

Reduction and Oxidation

Reduction by dissolving metals – Reduction of alkynes with Metal/liq. NH_3; Aromatic rings (Birch reduction) having electron releasing and with drawing groups, Catalytic reduction of Butyne-2 and acid chloride (Rosenmund reduction), Reduction by Hydride transfer reagents – $LiAlH_4$ with mechanism, $NaBH_4$, Reduction by metal alkoxides – MPV reduction.

Oxidation of olefinic double bonds to glycols by OsO_4 and mCPBA, Woodward and Prevost hydroxylation, Oxidation of aromatic side chain by Cr^{+6}reagents and Etard's reaction, Oxidation of alcohols with PCC and PDC, Hydroboration-oxidation, Oxymercuration and demercuration of alkene and alkynes; Oxidation of ketones by SeO_2 and allylic alcohols by MnO_2.

Books Recommended:

1. Peri cyclic reactions by Ian Fleming, Second edition, Oxford University press.
2. Reaction Mechanism in Organic Chemistry by S.M. Mukherji and S.P.Singh
3. Pericyclic reactions-AMechanistic study by S.M. Mukherji, Macmillan, India.
4. Organic synthesis: The disconnection approach by Stuart Warren, John Wiley &Sons.
5. Organic chemistry by Jonathan Clayden, Nick Greeves and Stuart Warren, Secondedition, Oxford university press.
6.Reactions, Reagents and Rearrangements by S.N. Sanyal, Bharati Bhawan Publishers
7. Organic Reactions and their mechanisms by PS Kalsi, Second Edition, New Age Publishers

Paper VIA
Laboratory Course: Organic Preparations

1. Preparation of Acetanilide Greenmethod
2. Benzil-Benzilic acid rearrangement
3. Preparation of m-dinitro benzene
4. Preparation of Picric acid
5. Preparation of Phenyl azoβ-naphthol
6. Preparation of Paracetamol orAspirin
7. Preparation of Methyl Orange or Phenolphthalein
8. Preparation of Benzoic acid fromToluene
9. Photo reduction of Benzophenone to Benzo Pinacol in the presence of sunlight.

Books Recommended:

1. Vogel A. I. Practical Organic Chemistry, Longman GroupLtd.
2. Bansal R.K. Laboratory Manual of Organic Chemistry,Wiley-Eastern.
3. Ahluwalia V. K. and Aggarwal R. Comprehensive Practical Organic Chemistry, University press.
4. Mann F. G and Saunders B.C, Practical Organic Chemistry, PearsonEducation.

Paper VIIA

Separation techniques and Analysis of organic compounds

I.Learning Outcomes:

Students after successful completion of the course will be able to:
1. Describe the role of mass spectrometry in revealing the structural details of organicmolecules.
2. Learn about the structural analysis of organicmolecules.
3Appraise the volumetric and gravimetric methods in analytical chemistry.
4. Understandvariouschromatographymethodsintheseparationandidentificationoforganic compounds.
5. Use knowledge of solvent extraction to separate organicmolecules.

Unit: I

Part A

Basic principle, Instrumentation of Mass spectrometer, distinction of isomeric pairs by Mass **spectrometry – Butanal and 2-methyl Propanal, Butanoic acid and 2-methyl propanoic acid and** Pentanone-2 and Pentanone-3.

Part B

Elucidation of structure of molecules from their combined spectral data – 2-methyl Butanal, Acetophenone, 2-methyl butanoic acid, Pentanone-2, para-nitroaniline and Phenyl acetylene. ***(Data of UV-Visible, IR, NMR and Mass data of the above molecules must be supplied in the question paper)***

Part A **Unit: IIQuantitativeAnal**

y s i s A brief introduction to analytical methods in chemistry, Principles of volumetric analysis, concentration terms, preparing solutions- Standard solution, primary standards, itscharacteristics, secondary standards, examples.-choice of indicators for titrationsTheories of acid-base, redox, precipitation titrations and complexometrictitrations.

Part **B**

Principles of gravimetric analysis: precipitation, coagulation, peptization, co precipitation, post precipitation, digestion, filtration, and washing of precipitate, drying and ignition.

Unit: III
Treatment of Analytical data

Part A

Types of errors- Relative and absolute, significant figures and its importance, accuracy - methods of expressing accuracy, errors- Determinate and indeterminate and minimization of errors,

Part B

Precision-methods of expressing precision-mean, median, average deviation, standarddeviation,relative standard deviationand confidence interval.

Unit: IV
Separation Techniques – I

Part A

Solvent extraction–Principle and theory, the process of extraction technique, single step, and multistep extraction.Efficiency of extraction, batch extraction techniqueApplication of batch extraction in the separation of organic compounds from mixture- acid & neutral, base &neutral; Application-Determinationof Iron (III).

Part B

Chromatography–Principle and theory, classification, Adsorbents, characteristics of good adsorbents, eluents, $R_f$values and factors affecting it,

Paper chromatography–Principle, experimental procedure, choice of paper and solvents, various modes of development-ascending, descending, radial. One dimensional andtwo-dimensional chromatography, applications

Unit: V
Separation Techniques – II

Part A

Thin layer chromatography–principle, experimental procedure, preparation of plates, adsorbents and solvents, development of chromatogram, detection of spots, applications, and advantages.

Part B

Column chromatography–Principle, classification, experimental procedure, stationary and mobile phases, development of the Chromatogram, applications; GC and HPLC–Principle, block diagram and applications.

Books Recommended:

1. Organic Spectroscopy by William Kemp, Third Edition, PalgraveUSA.
2. Organic Spectroscopy: Principles and Applications by Jag Mohan, Second edition,Alpha Science.
3. Spectroscopy of Organic Compounds by P.S. Kalsi, Seventh edition, New Age International.
4. Spectroscopic Methods in Organic Chemistry by Ian Fleming and Dudley Williams, Seventh edition,Springer.
5. Fundamentals of Analytical Chemistry by F. James Holler, Stanley R Crouch, M. Westland Douglas A. Skoog, Ninth edition, Cengage.
6. Quantitative analysis by R.A. Day Jr. and A.L. Underwood, Sixth edition,Pearson.
7. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition,Pearson
8. Chemistry of Natural products, Volume-1 by O.PAgarwal

Paper VIIA
Laboratory
Course:
Separation and identification of organic mixture and Chromatography

1. Separation and Identification of mixture of organic compounds -1
2. Separation and Identification of mixture of organic compounds -2
3. Separation and Identification of mixture of organic compounds -3
4. Separation of mixture of amino acids by paperchromatography.
5. Separation of a dye mixture (methyl orange and methylene blue) usingTLC
6. Separation of mixture of methyl range and methyl enable by column chromatography
7. Separation of triglycerides usingTLC

Books Recommended:

1. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition,Pearson.
2. Vogel A. I. Practical Organic Chemistry, Longman GroupLtd.
3.Bansal R.K. Laboratory Manual of Organic Chemistry,Wiley-Eastern