6. SEMESTER WISE SYLLABUS

SEMESTER – I

Course I (Inorganic &Physical Chemistry)

Course outcomes:

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

1. Understand the basic concepts of p-block elements
2. Explain the difference between solid, liquid and gasesinterms of intermolecular interactions.
3. Applytheconceptsofgasequations,pHandelectrolyteswhilestudyin gotherchemistrycourses.

INORGANIC HEMISTRY

UNIT –I

Chemistry of p-block elements

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 Oxoacids of Sulphur (structures only) **Group 17**:

Pseudohalogens, Structures of Interhalogen compounds.

UNIT-II

1. Chemistry of d-block elements:

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

2. Chemistry of f-block elements:

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

3. Theories of bonding in metals:

Valence bond theory andFree electron theory, explanation of thermal and electrical conductivity of metals based on these theories, explanation of conductors,

semiconductors and insulators.

PHYSICAL CHEMISTRY

UNIT-III

Solidstate

Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. The law of symmetry. Miller indices, Definition of lattice point, space lattice, unit cell. Bravais lattices and crystal systems. X-ray diffraction and crystal structure. Bragg's law. Powder method. Defects in crystals. Stoichiometric and non-stoichiometric defects.

UNIT-IV

1. Gaseous state

van der Waal's equation of state. Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. Relationship between critical constants and vander Waal's constants. Lawof corresponding states. Joule-Thomson effect. Inversion temperature.

2.Liquid state

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

UNIT-V

Solutions, Ionic equilibrium& dilute solutions

1. Solutions

Azeotropes-HCl-H_2O system and ethanol-water system. Partially miscible liquids-phenol- water system. Critical solution temperature (CST), Effect of impurity on consulate temperature. Immiscible liquids and steam distillation.Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

2. Ionic equilibrium

Ionic product, common ion effect, solubility and solubility product. Calculations based on solubility product.

3. Dilute solutions

Colligative properties- RLVP, Osmotic pressure, Elevation in boing point and depression in freezing point. Abnormal colligative properties. Van't

Hoff factor.

Co-curricular activities and Assessment Methods

1. Continuous Evaluation: Monitoring the progress of student's learning
2. Class Tests, Worksheets and Quizzes
3. Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality
4. Semester- end Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

LABORATORY COURSE -I

Practical-I Analysis of SALT MIXTURE(At the end of Semester-I)

Qualitative inorganic analysis (Minimum of Six mixtures should be analysed)

Course outcomes:

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

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

ANALYSIS OF SALT MIXTURE

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.

SEMESTER – II

Course II – (Organic & General Chemistry)

Course outcomes:

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

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

1. Understand and explain the differential behavior of organic compounds based on fundamental concepts learnt.
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 Aromatic Substitution.
4. Correlate and describe the stereochemical properties of organic compounds and reactions.

ORGANIC CHEMISTRY
UNIT-I

Recapitulation of Basics of Organic Chemistry

Carbon-Carbon sigma bonds (Alkanes and Cycloalkanes)

General methods of preparation of alkanes- Wurtz and WurtzFittig reaction, Corey House synthesis, physical and chemical properties of alkanes, Isomerism and its effect on properties, Free radical substitutions; Halogenation, concept of relative reactivity v/s selectivity.Conformational analysis of alkanes (Conformations, relative stability and energy diagrams of Ethane, Propane and butane).General molecular formulae of cycloalkanes and relative stability, Baeyer strain theory, Cyclohexane conformations with energy diagram, Conformations of monosubstituted cyclohexane.

UNIT-II
Carbon-Carbon pi Bonds (Alkenes and Alkynes)

General methods of preparation, physicaland chemical properties. Mechanismof E1, E2, E1cb reactions, Saytzeff and Hoffmann eliminations, Electrophilic Additions, mechanism (Markownikoff /Antimarkownikoff addition) with suitable examples, *syn* and *anti*-addition; addition of H_2, X_2, HX. Oxy mercuration demercuration, hydro boration-oxidation, ozonolysis, hydroxylation, Diels Alderreaction,1,2- and1,4-addition reactions in conjugated dienes.

Reactions of alkynes; acidity, electrophilic and nucleophilic additions, hydration to

form carbonyl compounds, Alkylation of terminal alkynes.

UNIT-III

Benzene and its reactivity

Concept of aromaticity, Huckel's rule - application to Benzenoid (Benzene, Naphthalene) andNon - Benzenoid compounds (cyclopropenylcation, cyclopentadienyl anion and tropyliumcation)

Reactions - General mechanism of electrophilic aromatic substitution, mechanism of nitration, Friedel- Craft's alkylation and acylation. Orientation of aromatic substitution - ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like NO_2 and Phenolic). 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)

GENERAL CHEMISTRY

UNIT-IV

1. Surface chemistry and chemical bonding

Surface chemistry

Colloids- Coagulation of colloids- Hardy-Schulze rule. Stability of colloids,Protection of Colloids, Gold number.

Adsorption-Physical and chemical adsorption, Langmuir adsorption isotherm, applicationsof adsorption.

2. Chemical Bonding

Valence bond theory, hybridization, VB theory as applied to ClF_3**,**$Ni(CO)_4$**,** 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).

3. HSAB

Pearson’s concept, HSAB principle & its importance, bonding in Hard-Hard and Soft-Soft combinations.

UNIT-V

Stereochemistry of carbon compounds

Molecular representations- Wedge, Fischer, Newman and Saw-Horse formulae.

Optical isomerism: Optical activity- wave nature of light, plane polarised 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 3 techniques)

Co-curricular activities and Assessment Methods

Continuous Evaluation: Monitoring the progress of student's learning

Class Tests, Work sheets and Quizzes

Presentations, Projects and Assignments and Group Discussions:

Enhances critical thinking skills and personality

Semester-end Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

LABORATORY COURSE-II

Practical-II Volumetric Analysis

(At the end of Semester-II)

Course outcomes:

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

1. Use glassware, equipment and chemicals and follow experimental procedures in thelaboratory
2. Understandandexplainthevolumetric analysisbasedonfundamental conceptslearnt in ionic equilibria
3. Learnandidentifythe concepts of a standard solutions, primary and secondary standards
4. Facilitate the learner to make solutions of various molar concentrations. This may include: The concept of the mole; Converting moles to grams; Converting grams tomoles; Defining concentration; Dilution of Solutions; Making different molar concentrations.

Volumetric analysis

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Determination of Fe (II) using $KMnO_4$ with oxalic acid as primary standard.
3. Determination of Cu (II) using $Na_2S_2O_3$ with $K_2Cr_2O_7$ as primary standard.

SEMESTER - III

Course III (ORGANICCHEMISTRY&SPECTROSCOPY)

Course outcomes:

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

1. Understand preparation, properties and reactions of haloalkanes, haloarenes and oxygen containing functional groups.
2. Use the synthetic chemistry learnt in this course to do functional group transformations.
3. To propose plausible mechanisms for any relevant reaction

ORGANIC CHEMISTRY

UNIT – I

1. Chemistry of Halogenated Hydrocarbons:6h Alkylhalides: Methods of preparation and properties, nucleophilic substitution reactions– SN1,SN2 and SNi mechanisms with stereochemical aspects and effect of solvent etc.; nucleophilic substitution vs.elimination, Williamson's synthesis. Arylhalides: Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution; SNAr, Benzyne mechanism.

2. Alcohols &Phenols

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouvaelt Blanc Reduction; Oxidation of diols by periodic acid and lead tetra acetate, Pinacol- Pinacolone rearrangement;

Phenols: Preparation and properties; Acidity and factors effecting it, Ring substitution reactions, Reimer–Tiemann and Kolbe's–Schmidt Reactions, Fries and Claisen rearrangements with mechanism;

UNIT-II

CarbonylCompounds

Structure, reactivity, preparation and properties; Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives

Mechanisms of Aldol and Benzoin condensation,Claisan-Schmidt, Perkin,Cannizzaro with $LiAlH_4$ and Wittig reaction, Beckmann haloform reaction andBaeyerVilliger oxidation,α-Substitution reactions, oxidations and reductions (Clemmensen, wolf – kishner,&$NaBH_4$).

Addition reactions of α,β-unsaturated carbonyl compounds: Michael addition.

Activemethylene compounds: Keto-

Enol tautomerism. Preparation and synthetic applications of diethyl

Malonate and ethyl acetoacetate.

UNIT-III

CarboxylicAcidsand their Derivatives

General methods of preparation, physical properties and reactions of monocarboxylic acids, effect of Substituents on acidic strength.Typical reactions of dicarboxylic acids, hydroxyl acids and unsaturat edacids.

Comparative study of nucleophilic substitution at acyl group-Mechanism of acidic and alkaline hydrolysis of esters, Claisen condensation, Reformatsky reactions and Curtius rearrangement

Reactions involving H, OH and COOH groups- salt formation, anhydride formation, acid chloride formation, amide formation and esterification (mechanism). Degradation of carboxylic acids by Huns-Diecker reaction, decarboxylation by Schimdt reaction, Arndt- Eistert synthesis, halogenation by Hell- Volhard- Zelinsky reaction.

SPECTROSCOPY

UNIT-IV

MolecularSpectroscopy:

Interactionofelectromagneticradiationwithmoleculesandvarioustypesof spectra;

Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

Vibrational spectroscopy: Classical equation of vibration, computation offorceconstant, vibrational degrees offreedom for polyatomic molecules, modes of vibration. Selection rules for vibrational transitions, Fundamental frequencies, overtones and hotbands.

Electronic spectroscopy: Energy levels of molecular orbitals (σ, π, n). Selection

rules for electronic spectra. Types of electronic transitions in molecules, effect of conjugation. Concept of chromophore. bathochromic and hypsochromic shifts.Beer-Lambert's law and its limitations.

Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals - spin-spin coupling, coupling constants. Applications of NMR with suitable examples - ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate, toluene and acetophenone.

UNIT-V **8h**

Application of Spectroscopy to Simple Organic Molecules

Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Application of electronic spectroscopy and Woodward rules for calculating λ_{max} of conjugated dienes and α,β – unsaturated compounds.

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions).

Co-curricular activities and Assessment Methods

ContinuousEvaluation:Monitoringtheprogressof student'slearning ClassTests,WorksheetsandQuizzes Presentations,ProjectsandAssignmentsandGroupDiscussions:Enhancescriti calthinkingskillsand personality

Semester-endExamination:criticalindicatorofstudent'slearningandteachingmethodsadoptedby teachersthroughoutthesemester.

LABORATORY COURSE -III

Practical Course-III Organic preparations and IR Spectral Analysis

(At the end of Semester- III)

Course outcomes:

On the completion of the course, the student will be able to do the following**:**

1. how to use glassware, equipment and chemicals and follow experimental proceduresin the laboratory
2. how to calculate limiting reagent, theoretical yield, and percent yield
3. how to engage in safe laboratory practices by handling laboratory glassware,equipment, and chemical reagents appropriately
4. how to dispose of chemicals in a safe and responsible manner
5. how to perform common laboratory techniques including reflux, distillation, recrystallization, vacuum filtration.
6. how to create and carry out work up and separation procedures
7. how to critically evaluate data collected to determine the identity, purity, and percentyield of products and to summarize findings in writing in a clear and concise manner

Organic preparations:

i. Acetylation of one of the following compounds:

amines (aniline, o-, m-, ptoluidines and o-, m-, p-anisidine) and phenols (β-naphthol,vanillin, salicylic acid) by any one method:

a. Using conventional method.

b. Using green approach

ii. Benzolyation of one of the following amines

(aniline, o-, m-, p- toluidines and o-, m-, p-anisidine)

iii. Nitration of any one of the following:

a. Acetanilide/nitrobenzene by conventional method

b. Salicylic acid by green approach (using ceric ammonium nitrate).

IR Spectral Analysis

IR Spectral Analysis of the following functional groups with examples

a) Hydroxyl groups

b) Carbonyl groups

c) Amino groups

d) Aromatic groups

SEMESTER - IV

Course IV (INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY)

Course outcomes:

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

1. Tolearnaboutthelawsofabsorptionoflightenergybymoleculesandthesubsequentphotochemical reactions.
2. Tounderstandtheconceptofquantumefficiencyandmechanismsofphotochemicalreactions.

UNIT - I

OrganometallicCompounds

Definition and classification oforganometallic Compounds on the basis of bond type, Concept of hapticity of organic ligands. Metal carbonyls:18electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation of mono and bi nuclear carbonyls of 3d series.P-acceptor behaviour of carbon monoxide. Synergic effects (VB approach) - (MO diagram of CO can be referred to for synergic effect to IR frequencies).

UNIT – II

Carbohydrates

Occurrence, classification and their biological importance, Mono saccharides: Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Inter conversions of aldoses and ketoses; Killiani Fischer synthesis and Ruff degradation; Disaccharides–Elementary treatment of maltose, lactose and sucrose.Poly saccharides–Elementary treatment of starch.

UNIT- III

Amino acids and proteins

Introduction: Definition of Amino acids, classification of Amino acids into alpha, beta, and gamma amino acids. Natural and essential amino acids - definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples - Glycine, Alanine, valine and leucine) by following methods: a) from halogenated carboxylic acid b) Gabriel Phthalimide synthesis c) strecker's synthesis.

Physical properties: Zwitter ion structure - salt like character - solubility, melting points, amphoteric character, definition of isoelectric point.

Chemical properties: General reactions due to amino and carboxyl groups - lactams from gamma and delta amino acids by heating- peptide bond (amide linkage). Structure andnomenclature of peptides and proteins.

Heterocyclic Compounds

Introduction and definition: Simple five membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole - Aromatic character – Preparation from 1, 4, -dicarbonyl compounds, Paul-Knorr synthesis.

Properties: Acidic character of pyrrole - electrophillic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions - Diels Alder reaction in furan.

Pyridine – Structure - Basicity - Aromaticity- Comparison with pyrrole- one method of preparation and properties - Reactivity towards Nucleophilic substitution reaction.

UNIT- IV

Nitrogen Containing Functional Groups

Preparation, properties and important reactions of nitro compounds, amines and diazonium salts.

1. Nitro hydrocarbons

Nomenclature and classification-nitro hydrocarbons, structure - Tautomerism of nitroalkanes leading to aci and keto form, Preparation of Nitroalkanes, reactivity -halogenation, reaction with HONO (Nitrous acid), Nef reaction and Mannich reaction leading to Micheal addition and

reduction.

2.Amines:

Introduction, classification, chiralityin amines (pyramidal inversion),importanceandgeneralmethodsofpreparation.

Properties : Physical properties, Basicity of amines: Effect of substituent, solvent and steric effects. DistinctionbetweenPrimary,

Secondary and tertiary amines using Hinsberg's method and nitrous acid. Discussion of thefollowing reactions with emphasis on the mechanistic pathway: Gabriel Phthalimide synthesis, Hoffmann-Bromamide reaction,Carbylamine reaction,Mannich reaction,Hoffmann'sexhaustive methylation,Hofmann-elimination reaction and Cope elimination.

UNIT- V

Photochemistry

Difference between thermal and photochemical processes, Laws of photochemistry- Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield- Photochemical reaction mechanism- hydrogen- chlorine and hydrogen- bromine reaction. Qualitative description of fluorescence, phosphorescence, Jablonski diagram, Photosensitized reactions- energy transfer processes (simple example).

Thermodynamics

The 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 perfect gas under isothermal and adiabatic conditions for reversible processes, State function. Temperature dependence of enthalpy of formation- Kirchoff s equation, Second law of thermodynamics Different Statements of the law, Carnot cycle and its efficiency, Carnot theorem, Concept of entropy, entropy as a state function, entropy changes in reversible and irreversible processes. Entropy changes in spontaneous and equilibrium processes.

Co-curricular activities and Assessment Methods

Continuous Evaluation:Monitoring the progress of student'slearning

Class Tests, Worksheets and Quizzes

Presentations,Projects and Assignments and Group Discussions:

Enhances critical thinking skills and personality

Semester-end Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

LABORATORY COURSE -IV 30hrs(2 h / w)

Practical Course-IV Organic Qualitative analysis (At the end of Semester- IV)

Course outcomes:

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

1. Use glassware, equipment and chemicals and follow experimental procedures in thelaboratory
2. Determine melting and boiling points of organic compounds
3. Understandtheapplication of concepts of different organic reactions studied in theory partof organic chemistry

Organic Qualitative analysis

Analysis of an organic compound through systematic qualitative procedure for functional group identification including the determination of melting point and boiling point with suitable derivatives.

Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids, Aromatic primary amines, amides and simple sugars

A.P. State Council of Higher Education

Semester-wise Revised Syllabus under CBCS, 2020-21

Four-year B.Sc.(Hons) Course Code:

Domain Subject: **CHEMISTRY**

IV Year B.Sc.(Hons) –Semester-V

Max Marks: 100+50

***Course6-A*: Synthetic Organic Chemistry**

(Skill Enhancement Course (Elective), Credits: 05)

I. Learning Outcomes:

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

1. Identify the importance of reagents used in the synthesis of organic compounds.
2. Acquire knowledge on basic concepts indifferent types of pericyclic reactions.
4. Understand the importance of retro synthesis in organic chemistry.
5. Comprehend the applications of different reactions in synthetic organic chemistry.

II.* Syllabus :(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-1: Per cyclic reactions **12 hours**

1. A brief introduction to synthetic organic chemistry
2. Features and classification of per cyclic reactions: Phases, nodes and symmetry properties of molecular orbital's in ethylene, 1, 3-butadiene, 1, 3, 5-hexatriene, alkylation and ally radical. Thermal and photochemical reactions.
3. Electro cyclic reactions: Definition and examples, definitions of con and dis rotation, Woodward- Hoffmann selection rules.(Correlation diagrams are not required)
4. Cyclo addition reactions: Definition and examples, definitions of supra facial and an tar facial addition, Woodward- Hoffmann selection rules. (Correlation diagrams are not required)

Unit-2: Organic photochemistry **8hours**

1. Jablonski diagram-singlet and triplettates
2. Photochemistry of Carbonylcompounds-$n-\pi$ and $\pi-\pi^*$ transitions,Norrishtype-Iandtype-2 reactions
3. Paterno – Buchi reaction.

Unit-3: Retro synthesis **12 hours**

1. Important terms in Retro synthesis with examples-Disconnection, Target molecule, FGI, Synthon, Retro synthetic analysis, chemo selectivity, region selectivity
2. Importance of Order of events in organic synthesis
3. Retro synthetic analysis of the compounds: a. cyclohexene, b.4-Nitro toluene, c. Paracetamol.

8/7/22

Unit-4: Synthetic Reactions

8hours

Shapiro reaction, Stork - enamine reaction (only alkylation), Wittig reaction, Robinson annulation, Bailys-Hillman reaction, Heck reaction, Suzuki coupling. Synthesis of aldehydes and ketones using1, 3-Dithiane.

Unit-5: Reagents in Organic Chemistry

10 hours

Oxidizing agents: PCC, PDC, SeO_2 (Riley oxidation), NBS.
Reducing agents: $LiAlH_4$ (with mechanism), LTBA, Metal-solvent reduction (Birch reduction), Catalytic reduction.

III. References

1. Peri cyclic reactions by Ian Fleming, Second edition, Oxford University press.
2. Peri cyclic Reactions-A Text book: Reactions, Applications and Theory by S.Sankararaman, WILEY-VCH.
3. Reaction Mechanismin Organic Chemistry by S.M. Mukherji and S.P.Singh, Revised edition, Trinity Press.
4. Pericyclic reactions-AMechanistic study by S.M.Mukherji, Macmill an India.
5. Organic synthesis: The disconnection approach by Stuart Warren, John Wiley & Sons.
6. Organic chemistry by Jonathan Clayden, Nick Greeves and Stuart Warren, Second edition, Oxford university press.
7. Reactions, Reagents and Rearrangements by S.N. Sanyal, Bharati Bhawan Publishers & Distributors.

8/2/22

Course6-A: Synthetic Organic Chemistry-PRACTICAL SYLLABUS

IV. Learning Outcomes:

On successful completion of this practical course, student shall be able to:

1. Perform the organic qualitative analysis for the detection of N, S and halogens using the green procedure.
2. Learn the procedure for the separation of mixture famine acids using paper Chromatography.
3. Prepare the TLC plates for TLC chromatography.
4. Acquire skills in conducting column chromatography for the separation of dyes in the given mixture.

V. Practical (Laboratory) Syllabus :(30hrs) (Max.50 Marks)

1. Green procedure for organic qualitative analysis: Detection of N, S and halogens
2. Separation of given mixture of amino acids (glycine and phenyl alanine) using ascending paper chromatography.
3. Separation of a given dye mixture (methyl orange and methylene blue) using TLC (using alumina as adsorbent).
4. Separation of mixture of methyl range and methyl enable by column chromatography
5. Separation of food dyes using Column Chromatography
6. Separation of triglycerides using TLC

VI. Lab References:

1. Vogel A. I. Practical Organic Chemistry, Longman Group Ltd.
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, Pearson Education.

VII. Co-Curricular Activities

a) **Mandatory:***(Lab field training of students by teacher:lab: 10 ; field:05)*:

1. **For Teacher**: Training of students by the teacher in laboratory and field for not less than15 hours on the field techniques/skills of detection of N, Sand halogens using the green procedure, preparation of TLC plates, detection of organic compounds using R_f values in TLC/ paper chromatography, loading of column, selection of solvent systemforcolumnchromatography,separationofaminoacidsanddyemixtureusingchromatographictechniques.
2. **For Students**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observes the synthetic reactions. Write their observations and submit a hand written fieldwork/project work report notexceeding10 pages in the given format to the teacher.
3. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements*

4. Unit tests (IE).

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A.P. State Council of Higher Education

Semester-wise Revised Syllabus under CBCS, 2020-21

Course Code:

Four-year B.Sc. (Hons)

Domain Subject: **CHEMISTRY**

IV Year B.Sc.(Hons) –Semester–V

Max Marks: 100+50

***Course7-A*: Analysis of Organic Compounds**

(Skill Enhancement Course (Elective). Credits: 05)

I. Learning Outcomes:

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

1. Identify the importance of mass spectrometry in the structural elucidation of organic compounds.
2. Acquire the knowledge eon structural elucidation of organic compounds.
3. Understand various chromatography methods in the separation and identification of organic compounds.
4. Demonstrate the knowledge gained in solvent extraction for the separate the organic compounds.

***II.* Syllabus :** *(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-1: Mass Spectrometry **10 hours**

A brief introduction to analysis of organic compounds

Basic principles. Instrumentation - Mass spectrometer. electron Ionization (Electron Impact ionization, EI). Molecular ions, metastable ions, Isotope abundance. Basic fragmentation types. Fragmentation patterns in Toluene, 2-Butanol, But aldehyde, Propionic acid.

Unit-2: Structural elucidation of organic compounds using IR, NMR, mass spectral data- **8hours**

2, 2, 3, 3-Tetra methyl butane, Butane-2, 3-dione, Prop ionic acid and methyl propionate.

Unit-3: Structural elucidation of organic compounds using IR, NMR, Mass spectral data- **8 hours**

Phenyl acetylene, ace to phenomenon amici acid and p-nitro aniline.

Unit-4: Separation techniques-1 **12 hours**

1. Solvent extraction-Principle and theory, Batch extraction technique, application of batch extraction in the separation of organic compounds from mixture- acid & neutral, base &neutral.
2. Chromatography- Principle and theory, classification, types of adsorbents, eluents, $R_f$values and factors affecting $R_f$values.
3. Thin layer chromatography-principle, experimental procedure, advantages and applications.

16
12
10
12
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Unit-5: Separation techniques-2 **12 hours**

1. Paper chromatography- Principle, experimental procedure, ascending, descending, radial and two dimensional, applications.
2. Column chromatography-Principle, classification, experimental procedure, applications.
3. HPLC-Principle, Instrumentation-block diagram and applications.

III. References

1. Organic Spectroscopy by William Kemp, Third Edition, Palgrave USA.
2. Introduction to Spectroscopy by Pavia, Lamp man, Kriza nd Vyvyan, Fifth edition, Cen gage.
3. Organic Spectroscopy: Principles and Applications by Jag Mohan, Second edition, Alpha Science.
4. Spector's copy of Organic Compounds by P.S.Kalsi, Seventh edition, New Age International.
5. Spectroscopic Methods in Organic Chemistry by Ian Fleming and Dudley Williams, Seventh edition, Springer.
6. Fundamentals of Analytical Chemistry by F.James Holler, Stanley R Crouch, Donald M.Westand Douglas A.Skoog, Ninth edition, Cen gage.
7. Analytical Chemistry by Gary D.Christian, Purnendu K.Dasgupta and Kevin A.Schug, Seventh edition, Wiley:
8. Quantitative analysis by R.A.Day Jr. and A.L.Underwood, Sixth edition, Pearson.
9. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.

8/7/22

Course7-A: Analysis of Organic Compounds - PRACTICAL SYLLABUS

IV. Learning Outcomes:

On successful completion of this practical course, student shall be able to:

1. Prepare acetanilide using the green synthesis.
2. Demonstrate the preparation of anazodye.
3. Acquire skills in the separation of organic compounds in the given mixture using solvent extraction

V. Practical (Laboratory) Syllabus:(30hrs) (Max.50 Marks)

1. Identification of various equipment in the laboratory.
2. Acetylating of 1^0 amine by green method: Preparation of acetanilide
3. Rearrangement reaction in green conditions: Benzil - Benzilic acid rearrangement
4. Radical coupling reaction: Preparation of 1,1-bis -2-naphthol
5. Green oxidation reaction: Synthesis of adipic acid
6. Preparation and characterization of biodiesel from: vegetable oil/ waste cooking oil
7. Photo reduction of Benzophenone to Benzopinacol in the presence of sunlight
8. Separation of organic compounds in a mixture (acidic compound + neutral compound) using solvent extraction.
9. Separation of organic compounds in a mixture (basic compound +neutral compound) using solvent extraction.

VI. Lab References:

1. Vogel A. I. Practical Organic Chemistry, Longman Group Ltd.
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, Pearson Education.

IV. Co-Curricular Activities:

***a)* Mandatory:** *(Lab/field training of students by teacher (lab:10 field:05):*

5. **For Teacher:** Training of students by teacher in laboratory and field for not less than15 hours on the field techniques/skills of preparation of acetanilide, preparation of azodye, use of separating funnel for solvent extraction, separation of organic compounds in a mixture.
6. **For Student:** Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for the separation of organic compounds. Write their observations and submit a handwritten fieldwork/project work report not exceeding10 pages in the given format to the teacher.
7. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
5. Unit tests (IE).

***b)* Suggested Co-Curricular Activities**

1. Training of students' by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics), collection of videos and other material.
3. Visits of facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field industrial experts

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