ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS)
VISAKHAPATNAM

III SEMESTER CHEMISTRY
Time:4Hrs/Week

CH 3202(3) ORGANIC CHEMISTRY& SPECTROSCOPY
Max.Marks:100

20-21 admitted batch-"20AH" SYLLABUS 60hrs (4 h / w)

COURSE OBJECTIVES: To enable the students to

- Understand and apply the principles of Stereochemistry, the knowledge of which is essential for establishing the structure and understanding organic reactions mechanism.
- Use the synthetic chemistry learnt in this course to do functional group transformations
- propose plausible mechanisms for any relevant reaction .
- Describe and explain the functionality of Organic Compounds by molecular spectroscopic studies, UV, IR, NMR along with conceptual knowledge which is incorporated in the industrial manufacturing as the starting raw materials

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

- Understand and apply the principles of Stereochemistry, the knowledge of which is essential for establishing the structure and understanding organic reactions mechanism.
- Use the synthetic chemistry learnt in this course to do functional group transformations propose plausible mechanisms for any relevant reaction .
- Describe and explain the functionality of Organic Compounds by molecular spectroscopic studies, UV, IR, NMR and conceptual knowledge which is essential in the industrial manufacturing sector.

COURSE:

UNIT – I Stereochemistry of carbon compounds 10h

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)

2.Alcohols &Phenols **6h**

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouvaelt Blanc Reduction; Oxidation of diols by periodic acid and lead tetracetate, 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 **10h**

Structure, reactivity, preparation and properties; Nucleophilic additions, Nucleophilic addition elimination reactions with ammonia derivatives Mechanisms of Aldol and Benzoin condensation, Claisan-Schmidt, Perkin,

Cannizzaro and Wittig reaction, Beckmann haloform reaction and Baeyer Villiger oxidation, α- substitution reactions, oxidations and reductions (Clemmensen, wolf –kishner, with $LiAlH_4$ &$NaBH_4$).

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

Active methylene compounds: Enol tautomerism. Preparation and synthetic Keto-applications of diethyl malonate and ethyl acetoacetate.

UNIT-III

Carboxylic Acids and their Derivatives **12h**

General methods of preparation, physical properties and reactions of monocarboxylic acids, effect of

Substituents on acidic strength. Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids.

Preparation and reactions of acid chlorides, anhydrides, esters and amides; Comparative study of nucleophilic substitution at acyl group-Mechanism of acidic and alkaline hydrolysis of esters,

Claisen condensation, Reform at sky 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 **26 h**

UNIT-IV

Molecular Spectroscopy: **18h**

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 of force constant, Harmonic and anharmonic oscillator, Morsepotential curve, vibrational degrees offered for polyatomic molecules, modesofvibration. Selection rules for vibrational transitions, Fundamental frequencies, overtones and hot bands.

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 hypsochromicshifts.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 $\lambda_{max}$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 :

Continuous Evaluation: Monitoring the progress of student'slearning Class Tests, Work sheets and Quizzes Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills an d personality Semester-end Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

List of Reference Books

1. A Text Book of Organic Chemistry by Bahl and Arunbahl
2. A Text Book of Organic chemistry by I L FinarVol I
3. Organic chemistry by Bruice
4. Organic chemistry by Clayden
5. Spectroscopy by William Kemp
6. Spectroscopy by Pavia
7. Organic Spectroscopy by J. R. Dyer
8. Elementary organic spectroscopy by Y.R. Sharma
9. Spectroscopy by P.S.Kalsi
10. Spectrometric Identification of Organic Compounds by Robert M Silverstein, Francis X Webster
11. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
12. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. &Tatchell, A.R. Practical Organic Chemistry, 5th Ed. Pearson (2012)
13. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM
III SEMESTER CHEMISTRY TIME:3Hrs/Week
CH 3253 (2) VOLUMETRIC ANALYSIS Max.Marks:50
19-20 admitted batch-"19AG" PRACTICAL SYLLABUS – II A

Practical Course-III Organic preparations and IR Spectral Analysis

COURSE OBJECTIVE: The objective of the course is

- To train students in varied techniques of organic synthesis and equip them with the skill of synthesizing organic compounds with focus on purity, yield and energy efficiency.
- To train students in IR spectral analysis involving identification of functional groups in organic compounds

COURSE OUTCOMES:

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

- use glassware, equipment and chemicals and follow experimental procedures in the laboratory
- calculate limiting reagent, theoretical yield, and percent yield
- engage in safe laboratory practices by handling laboratory glassware, equipment, and chemical reagents appropriately
- dispose of chemicals in a safe and responsible manner
- perform common laboratory techniques including reflux, distillation, recrystallization, vacuum filtration.
- create and carry out work up and separation procedures
- Analyse IR spectra and characterize organic compounds by identifying functional groups
- critically evaluate data collected to determine the identity, purity, and percent yield of products and to summarize findings in writing in a clear and concise manner

COURSE:

Organic preparations: **40M**

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 **10M**

IR Spectral Analysis of the following functional groups with examples

a) Hydroxyl groups
b) Carbonyl groups
c) Amino groups
d) Aromatic groups