PITHAPUR RAJAH'S GOVERNMENT COLLEGE(AUTONOMOUS)
KAKINADA - 533 001, EAST GODAVARI, A.P.

Affiliated to Adikavi Nannaya University

NAAC Accredited with "A" Grade (3.17 CGPA)

BOARD OF STUDIES OF CHEMISTRY

B.Sc. Chemistry Under CBCS

Meeting Minutes/Resolutions

Convened on 03 November 2022

DEPARTMENT OF CHEMISTRY
P. R. GOVT. COLLEGE (Autonomous)
Opp. Mc Laurin High School, Raja Ram Mohan Roy Road, Kakinada

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	P R Govt College(A), Kakinada	Program&Semester			
Course Code **CHE-III**	TITLE OF THE COURSE **ORGANIC CHEMISTRY & SPECTROSCOPY**	II B.Sc. (III Semester)			
Teaching	HoursAllocated:60 (**Theory**)	L	T	P	C
Pre-requisites	Types of Organic Reactions, Reaction Intermediates, Molecular Energy levels, Symmetry rules, Resonance.	60	10	30	4+1

Course Objectives:

1. Mechanism of Nucleophilic substitution reactions
2. Stereo chemical aspects of Nucleophilic Substitution reactions
3. Mechanisms of some important named reactions related to Alcohols, Phenols, Carbonyl compounds, Carboxylic Acids.
4. Preparations and synthetic applications of Active Methylene compounds.
5. UV, IR, Rotational & NMR spectroscopic techniques and their applications.

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Acquire knowledge on different preparation methods of alkyl and aryl halogen compounds & Understand the nucleophilic substitution reactions– S_N1, S_N2, S_NAr mechanisms with stereo chemical aspects
CO2	Comprehend the mechanism of different reactions of alcohols, phenols, Carbonyl compounds and Carboxylic acids in synthetic organic chemistry
CO3	Understand the Preparations and synthetic applications of Active methylene compounds.
CO4	Understand UV, IR, Rotational & NMR spectroscopic techniques and their applications.

Coursewithfocusonemployability/entrepreneurship/SkillDevelopment modules

SkillDevelopment		Employability		Entrepreneurship	

UNIT I:

1. **ChemistryofHalogenatedHydrocarbons:**

AlkylHalides: Methods of preparation and properties, nucleophilic substitution reactions– S_N1, SN^2 and mechanisms with stereo chemical aspects and effect of solvent etc.; nucleophilic substitution vs. elimination, Williamson's synthesis.

Aryl Halides: Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution; SN Ar, Benzyne mechanism. Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

AdditionalInput: Applications of Diazonium salts,

2. **Alcohols&PhenolsAlcohols:**

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouvet Blanc Reduction; Oxidation of Diols by Periodic Acid and lead Tetra acetate, Pinacol- Pinacolone Rearrangement;

Phenols: Preparation and Properties; Acidity and Factors Affecting It, Ring substitution reactions, Reimer–Tiemann and Kolbe's–Schmidt Reactions, Fries and Claisen Rearrangement with mechanism.

AdditionalInput: Distinguish methods of 1°, 2°, 3° alcohols.

UNITII:

CarbonylCompounds:

Structure, reactivity, preparation and properties; Nucleophilic Addition, Nucleophilic Addition-elimination reactions with ammonia derivatives Mechanisms of Aldol and Benzoin Condensation, Cannizzaro, Claisen-Schmidt, Perkin, and Wittig reaction, Beckmann rearrangement & Haloform Reaction oxidations and reductions (Baeyer Villiger oxidation, Clemmensen, wolf –kishner, with $LiAlH_4$&$NaBH_4$). Addition Reactions of α, βunsaturated carbonyl compounds: Michael Addition.

AdditionalInput: Crossed Aldol condensation, Selectivity of $LiAlH_4$ & $NaBH_4$

UNITIII:

1. **CarboxylicAcidsandtheirDerivatives:**

General methods of preparation, physical properties and reactions of monocarboxylic acids, effect of substituents on acidic strength. 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, Reformatsky reactions. 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.

2. **Active Methylene Compounds:**

Keto-enol tautomerism. Preparation and Synthetic Applications Diethyl malonate and ethyl acetoacetate.

SPECTROSCOPY30h(2h /w)

UNITIV:

Molecular Spectroscopy: Interaction of electromagnetic radiation with molecules and varioustypesofspectra.MorsePotential curve

Vibrational Spectroscopy: Classical Equation of Vibration, computation of force constant, Infrared radiation and types of molecular vibrations, functional group and fingerprint region.

Electronicspectroscopy: Energy levels of molecularorbitals (σ,π, n) .Selection rulesforelectronic spectra. Types of electronic transitions in molecules, effect of conjugation. Concept ofchromophore. 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,Factors effecting chemical shift, NMR splitting ofsignals - spin-spin coupling, coupling constants.

Additional Input: Fermi resonance, Fundamental Frequencies, overtones and hot bands. and coupling constant.

UNITV:

ApplicationofSpectroscopytoSimpleOrganicMolecules

Application of visible, ultraviolet and infrared spectroscopy in organic molecules. Application ofelectronic spectroscopy and Woodward rules for calculating λ_{max} of conjugated dienes and α, β –unsaturatedcompounds.

IRSpectral interpretation of alkanes, alkenes, Aromatic Hydrocarbons and simple alcohols

(inter and intramolecular hydrogen bonding),aldehydes,ketones andcarboxylic acids amines.

Applications of NMR with suitable examples –ethylbromide,ethanol,acetaldehyde,1,1,2-tribromoethane,ethylacetateand Acetophenone.

Textbooks:

1. Organic chemistry by Jonathan Clayden, Nick Greeves and Stuart Warren, Second edition, Oxford University press
2. Elementary organic spectroscopy by Y.R. Sharma
3. Spectroscopy by Jag Mohan

Reference books:

1. Reaction Mechanism in Organic Chemistry by S.M. Mukherjee and S.P. Singh, Revised edition, Trinity Press
2. A Text Book of Organic Chemistry by Bahland Arunbahl
3. A Text book of Organic chemistry by IL Finar Vol I
4. Organic chemistry by Bruice
5. Organic chemistry by Clayden
6. Spectroscopy by William Kemp
7. Spectroscopy by Pavia
8. Organic Spectroscopy by J.R.Dyer
9. Mann, F.G. &Saunders ,B.C. Practical Organic Chemistry, Pearson Education (2009)
10. Spectrometric Identification of Organic Compounds by Robert M Silverstein, Francis X Webster.
11. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. Practical Organic Chemistry, 5th Ed. Pearson (2012)
12. Ahluwalia, V.K. &Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis

Web links:

1. https://www.youtube.com/watch?v=JlxM1QsvdUU&list=PLBWC8FLcfD-Dama4OPQUcTfydQp09mXAL

LABORATORYCOURSE-III 30hrs(2h/w)

Practical Paper-III (At the end of Semester-III)

Organic Preparations and IR Spectral Analysis Lab: 50 Marks

Course Outcomes

1. How to use glassware, equipment and chemicals and follow experimental procedures in 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 carryout workup and separation procedures
7. How to 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

Organic preparations: 30M

i. Acetylationofoneofthefollowing compounds:

Amines (aniline) and phenols (β-naphthol, salicylicacid) by any one method:

a. Using conventional method.

b. Using green approach

ii. Benzoylation of amine (aniline)

a. Nitration of any one of the following: Acetanilide/nitrobenzene by conventional method

b. Salicylicacid by green approach (using Ceric Ammonium Nitrate).

IR Spectral Analysis: 10M

IR Spectral Analysis of the following functional groups with examples
a) Hydroxylgroups
b) Carbonylgroups
c) Aminogroups
d) Aromatic groups

SCHEME OF VALUATION

S.NO	DISCRIPTION	MARKS
1	**Organic Preparations**	**30**
	i. Reaction with Mechanism	10
	ii. Procedure	10
	iii. Recrystallization	05
	iv. Report	05
2	**Interpretation of IR Spectra of given Organic Compounds**	**10**
3	**Record**	**05**
4	**Viva**	**05**