

St.James' College of Pharmaceutical Sciences St.James' Medical Academy River Bank, Chalakudy			
Programme:	B.Pharm	Sem.:	4
Name of Course: (Subject)	PHARMACEUTICAL ORGANIC CHEMISTRY III	Course Code:	BP401T
Teaching faculty of the course	Dr.HAREESHBABU E		

### Summary of the Lecture Plan

Topic	Lectures	Hours
Stereoisomerism	Optical isomerism, enantiomerism, diastereomerism and Meso compounds	4
	Chirality, Elements of symmetry	2
	D&L configurations.	1
	Sequence rules and R&S configurations	2
	Racemic modifications and its resolutions	2
	Asymmetric synthesis- partial and absolute	2
Geometrical isomerism	Cis-Trans, E&Z and Syn-anti configurations	2
	Methods of determination of configuration of geometrical isomers.	1
	Conformational isomerism in Ethane, n-Butane and Cyclohexane	3
	Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity	2
	Stereospecific and stereoselective reactions	2
Heterocyclic compounds	Nomenclature and classification	2
	Synthesis, reactions and medicinal uses of Pyrrole, Furan, and Thiophene	2
	Relative aromaticity, reactivity and Basicity of pyrrole	1
	Synthesis, reactions and medicinal uses of Pyrazole, Imidazole, Oxazole and Thiazole.	4
	Synthesis, reactions and medicinal uses of Pyridine, Quinoline, Isoquinoline, Acridine and Indole	4
	Basicity of pyridine	1
	Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives	3
Reactions of synthetic importance	Metal hydride reduction (NaBH <sub>4</sub> and LiAlH <sub>4</sub> )	2
	Clemmensen reduction, Birch reduction, Wolff Kishner reduction	3

	Oppenauer-oxidation and Darkin reaction	2
	Beckmanns rearrangement and Schmidt rearrangement	2
	Claisen- Schmidt condensation	1

**Major issues or Core aspects to be addressed/ covered:**

<b>Stereoisomerism</b>
Definition and classification of stereoisomers
Molecular asymmetry, Optical activity, dextro and levo optical isomers
Enantiomers, diastereomers and meso compounds
Chiral carbon and elements of symmetry
Relative configurations -D & L configurations
Sequence rules
Absolute configurations – R & S configurations
Racemic mixture
Resolution techniques for racemic mixture
Definition of asymmetric synthesis.
Types of asymmetric synthesis- partial & absolute
<b>Geometrical isomerism</b>
Molecular symmetry
Configurations in symmetrically substituted alkenes – Cis-Trans
Configurations in asymmetrically substituted alkenes – E&Z
Configurations in oximes – Syn-anti
Different methods to determine configurations
Stereoisomerism due to carbon-carbon single bond free rotation - conformations
Conformations of ethane
Conformations of propane
Conformations of n-butane
Conformations of cyclohexane
Atropisomerism – Biphenyl compounds
Criteria for optical activity in biphenyls
Stereospecific and stereoselective reactions – SN <sub>2</sub> reaction
<b>Heterocyclic compounds</b>
Definition, classification and nomenclature of heterocyclic compounds
Any four method of preparations for pyrrole
Important chemical reactions of pyrrole
Medicinal compounds containing pyrrole nucleus
Any four method of preparations for furan
Important chemical reactions of furan

Medicinal compounds containing furan nucleus
Any four method of preparations for thiophene
Important chemical reactions of thiophene
Medicinal compounds containing thiophene nucleus
Comparison of aromaticity among pyrrole, furan and thiophene.
Comparison of reactivity among pyrrole, furan and thiophene.
Basicity of pyrrole comparing with furan and thiophene
Any four method of preparations for pyrazole
Important chemical reactions of pyrazole
Medicinal compounds containing pyrazole nucleus
Any four method of preparations for imidazole
Important chemical reactions of imidazole
Medicinal compounds containing imidazole nucleus
Any four method of preparations for oxazole
Important chemical reactions of oxazole
Medicinal compounds containing oxazole nucleus
Any four method of preparations for isoxazole
Important chemical reactions of isoxazole
Medicinal compounds containing isoxazole nucleus
Any four method of preparations for thiazole
Important chemical reactions of thiazole
Medicinal compounds containing thiazole nucleus
Any four method of preparations for pyridine
Important chemical reactions of pyridine
Medicinal compounds containing pyridine nucleus
Any four method of preparations for quinoline
Important chemical reactions of quinoline
Medicinal compounds containing quinoline nucleus
Any four method of preparations for isoquinoline
Important chemical reactions of isoquinoline
Medicinal compounds containing isoquinoline nucleus
Any four method of preparations for acridine
Important chemical reactions of acridine
Medicinal compounds containing acridine nucleus
Any four method of preparations for indole
Important chemical reactions of indole
Medicinal compounds containing indole nucleus

Basicity of pyridine.
Synthesis and medicinal use of pyridine, purine and azepine.
Reactions of synthetic importance
Different reduction reactions
Metal hydrides as reducing agents ( $\text{NaBH}_4$ and $\text{LiAlH}_4$ ), mechanism and applications
Clemmenson reduction for carbonyl compounds, mechanism and applications
Hydrazine derivatives as reducing agents (Wolff-Kishner reduction), mechanism and applications
Birch reduction, mechanism and applications
Different oxidizing agents
Oppenauer-oxidation, mechanism and applications
Darkin reaction, mechanism and applications
Rearrangement reactions, Beckmann and Schmidt rearrangement reactions with mechanism and applications
Claisen-Schmidt condensation reaction, mechanism and applications

### Sample Questions

Stereoisomerism
Define stereoisomerism, give its classification with examples.
Define enantiomerism and give example for enantiomers.
Define diastereomerism and give example for diastereomers.
What are meso compounds? Give example.
What are chiral compounds? Give its significance.
Narrate the lexicon of elements of symmetry.
Explain D&L configuration for stereoisomers.
How R&S system helps in the nomenclature of stereoisomers?
What are sequence rules? How it helps in the nomenclature of stereoisomers?
What is a racemic mixture? How a racemic mixture can be resolved?
Define and give significance of asymmetric synthesis.
Geometrical isomerism
Explain cis-trans configuration with suitable examples.
Explain E&Z configuration with suitable examples.
Explain Syn-Anti configuration with suitable examples.
Write any three methods to determine the configurations of geometrical isomers.
Draw the conformational isomers for ethane and explain the stability of each conformer.
Briefly write the conformational isomerism in n-butane.
Which are the different conformational isomers possible for cyclohexane? Write them in their stability sequence.

What are atropisomers? Give example and compare with rotamers.
Explain the stereochemistry of biphenyl compounds.
Define stereospecific and stereoselective reactions with examples.
<b>Heterocyclic compounds</b>
Define and give the classification of heterocyclic compounds with suitable examples.
Write any four method of preparations for pyrrole
Explain the important chemical reactions of pyrrole
Give examples for medicinal compounds containing pyrrole nucleus
Write any four method of preparations for furan.
Explain the important chemical reactions of furan.
Give examples for medicinal compounds containing furan nucleus
Write any four method of preparations for thiophene.
Explain the important chemical reactions of thiophene.
Give examples for medicinal compounds containing thiophene nucleus
Compare the aromatic nature of pyrrole, furan and thiophene.
Explain the basicity of pyrrole.
Write any two methods of preparation for pyrazole.
Explain the important chemical reactions of pyrazole.
Write any two methods of preparation for imidazole.
Explain the important chemical reactions of imidazole.
Write any two methods of preparation for oxazole.
Explain the important chemical reactions of oxazole.
Write any two methods of preparation for thiazole.
Explain the important chemical reactions of thiazole.
Write any two methods of preparation for pyridine.
Explain the important chemical reactions of pyridine.
Write any two methods of preparation for quinoline.
Explain the important chemical reactions of quinoline.
Write any two methods of preparation for isoquinoline
Explain the important chemical reactions of isoquinoline.
Write any two methods of preparation for acridine.
Explain the important chemical reactions of acridine.
Write any two methods of preparation for indole.
Explain the important chemical reactions of indole.
Explain the basicity of pyridine.
Give any two methods of preparation each for pyridine, purine and azepine.
<b>Reactions of synthetic importance</b>

Explain the reduction reactions for  $\text{NaBH}_4$  with example.

Explain the reduction reactions for  $\text{LiAlH}_4$  with example.

Explain clemmenson reduction with mechanism and give its synthetic application.

Explain birch reduction with mechanism and give its synthetic application.

Explain wolff-kishner reduction with mechanism and give its synthetic application.

Explain Oppenauer oxidation with mechanism and give its synthetic application.

Explain darkin reaction with mechanism and give its synthetic application.

Explain Beckmann rearrangement reaction with mechanism and give its synthetic application.

Explain Schmidt rearrangement reaction with mechanism and give its synthetic application.

Explain claisen-schmidt condensation reaction with mechanism and give its synthetic application.