

----- your Roll No.

DEPARTMENT OF CHEMISTRY
SCHOOL OF CHEMICAL & LIFE SCIENCES
SEMESTER-IV EXAMINATIONS-2025

M.Sc. CHEMISTRY

PAPER CODE: MCHCCO-403

PAPER TITLE: HETEROCYCLIC CHEMISTRY

(Write your Roll No. at the top immediately on receipt of this question paper)

Time: Three Hours

Maximum Marks: 60

Note: This paper has 3 sections, A, B, and C Attempt all three sections

Section A: Answer all the questions; Section B: Answer any 2 out of 4; Section C: Answer all the questions, each question has an internal choice

Abbreviations Used

CLO- Course Outcome, PLO- Program Outcome, BTL- Bloom Taxonomy Level: BT level 1-Remember; BT level 2-Understand; BT level 3-Apply; BT level 4-Analyse; BT level 5-Evaluate, BT level 6-Create

Section A

(1.5x10=15 Marks)

Q Very Short Type Questions (Attempt all)

		BTL	CLO	PLO
A 1.	Pyrrole undergoes electrophilic substitution reaction about 10^5 times faster than furan under similar conditions- explain	2/3	1/3	1/2
A 2.	Give the IUPAC name of 	3/4	3/4	2
A 3.	Mark the chemically different sets of proton(s) according to the proton NMR of Pyridine and arrange the sets according to their chemical shift with an explanation	3/4	2	3/4
A 4.	Draw the possible tautomeric structures of 2-pyridone and explain the major differences that are expected to be observed in the ^1H -NMR of the tautomers.	1/3	2	2
A 5.	Draw the structure of 4-Methyl-1,3-Thiazole, 1,2-oxazetidine, 7H-Thiopyrano[3,2-b]furan	1/2	2-4	2
A 6.	Discuss the electrophilic substitution at benzopyrrole and predict the preferred site of attack of the electrophile.	1/3	3-5	3/4
A 7.	What is the common name of 2-Aza naphthalene?	1/2	2/3	4
A 8.	What is the product obtained under vigorous bromination conditions of pyridine?	2/3	3/4	4
A 9.	What is the name given to the reaction involving the heating of an aldehyde or a ketone with arylhydrazine, followed by acid-catalysed rearrangement for the synthesis of indole?	2/3	3/4	5
A 10.	Which is the site of nucleophilic substitution in indole?	2/3	3/4	5

Section B

Long Type questions (Attempt any two out of four)

(2x10=20) Marks

- B 1. What are the factors that contribute to the empirical resonance energy of a heterocyclic aromatic compound? A heterocyclic compound exhibits a higher empirical resonance energy compared to its non-aromatic counterpart. What can be inferred about the compound's aromaticity? Arrange the following compounds, indicating the degree of aromaticity.
A) Pyridine B) Pyrrole C) Thiophene D) Furan

B 2. Propose different ways of synthesising indoles based on the following disconnection approach 4/5 3-4 4-7



B 3. 1,4-dicarbonyl systems and hydrazine act as starting materials for the synthesis of pyridazines, justify 4/5 1-2 4-7



B 4. Give the mechanistic details of Chichibabin pyridine synthesis 3/5 1-2 5-6

SECTION C

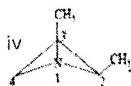
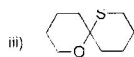
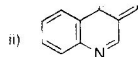
Attempt all questions, each question has an Internal choice

(5 x 5 = 25) Marks

C 1. What are the consequences of torsional strain in small ring heterocycles? 4/5 2-4 3-4

OR

Name the following compounds 4/5 1-3 2-4



C 2. Explain why the C3 position of pyridine is preferred for electrophilic substitution. Compare its relative reactivity to that of benzene. Which is more basic, pyrrole or pyridine, and why? 4/5 2-5 2-4

OR

Illustrate the synthetic significance of Pyridine N-Oxides, providing examples. 4/5 1-3 2-4

C 3. Cyclocondensation of 1,3-diketones with cyanoacetamide, catalysed by base, yields 3-cyanopyridones (Guareschi synthesis). Give mechanism 2/3 1-4 4-5

OR

How can 1,3-dicarbonyl compounds and aryl methyl ketones condense to give pyrilium salts 2/3 2-3 4-5

C 4. Discuss the different chemical behaviour of phosphorene and pyridine toward CH_3Li . 4/5 1-6 5-7

OR

Give a retrosynthetic analysis and suggest a suitable synthetic route for the following compound 4/5 1-6 5-7

C 5. Draw all the possible tautomeric forms of azepine and comment on the aromaticity property of 1H-azepine. Suggest a synthetic route for the synthesis of ethyl 1H-azepine-1-carboxylate starting from benzene. 4/5 3-4 3-4

OR

Propose a synthetic route for the 2-methyl oxepin. 4/5 3-4 3-4