NATIONAL OPEN UNIVERSITY OF NIGERIA PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI – ABUJA
FACULTY OF SCIENCES
DEPARTMENT OF CHEMISTRY
2025_1 EXAMINATION

COURSE CODE: CHM421
COURSE TITLE: HETEROCYCLIC CHEMISTRY
COURSE UNIT: 2 UNITS
TIME: 2 HOURS
INSTRUCTION*:* Answer Question 1 And Any Other 2 Questions

1(a). Discuss the various uses and emerging applications of chloroquine, highlighting its role in the treatment of malaria and other potential medical conditions. **(5 marks).**
(b). Explain the methods used for the isolation and synthesis of isoquinoline, focusing on the processes of fractional crystallization and selective extraction. **(6 marks)**
(c). Describe the Pomeranz-Fritsch and Pictet-Spengler methods for synthesizing isoquinoline derivatives, and discuss their applications. **(7 marks)**
(d). Discuss the relationship between isoquinolines and Parkinson's disease, focusing on the role of MPTP and tetrahydroisoquinoline derivatives as neurotoxins. **(6 Marks)**
(e). Discuss the general physical and chemical properties of indoles, focusing on their basicity, bonding, and behavior under acidic conditions. **(6 Marks)**

2(a). Describe the structure, occurrence, and uses of benzofuran and benzothiophene, highlighting their aromaticity and stability. **(5 Marks)**
(b). Describe the reactions of isoquinoline with electrophiles, including the conditions and products formed. **(5 marks)**
(c). Explain the reduction and nucleophilic reactions of isoquinoline, highlighting the reagents, conditions, and resulting products. **(5 marks)**
(d). Give the equation for the Reaction of Isoquinoline with Nucleophiles **(5 marks)**

3(a). Give the molecular structure of papaverine**.** **(2 marks)**
(b). Describe the therapeutic uses of papaverine and how it differs from other opium alkaloids. **(3 marks)**
(c). Describe the historical development and key characteristics of morphine as an analgesic**. (6 marks)**
(d). Discuss the clinical significance of morphine, including its risks. **(6 marks)**
(e). Explain what niacin (vitamin B3) is, including its chemical formula, structure, and its various forms. **(3 marks)**

4(a). Draw the structure of an anesthetics Isoquinoline "Dimethisoquine" **(3 marks)**
(ii). What is cromolyn and how does it function in a treatment? **(2 marks)**
(b). What is Bisbenzylisoquinolinium. **(2 marks)**
(c). Describe the chemical reactions of 3-substituted indoles, including the reagents and conditions used, and the products formed. **(5 marks)**
(d). Describe the Vilsmeier formylation of indole, including the reagents, conditions, and the final product**.** **(3 marks)**
(e). Describe the formation and reactivity of the indolyl anion, including the factors that influence N-1 versus C-3 substitution. **(5 marks)**

5(a). Name five methods for synthesizing benzopyrrole (indole). **(5 marks)**
(b). Discuss the characteristics and importance of tryptophan, including its stereoisomers, codon, and role in protein biosynthesis. **(5 marks)**
(c). Differentiate between benzofuran and benzothiophene in terms of their structure, source, and uses. **(5 marks)**
(d). Elucidate on the physical and chemical properties of benzofuran. **(5 marks)**