FACULTY OF NATURAL RESOURCES MANAGEMENT AND AGRICULTURE

DEPARTMENT OF ANIMAL PRODUCTION AND HEALTH

BACHELOR OF SCIENCE HONOURS DEGREE IN ANIMAL PRODUCTION AND HEALTH

Introduction to Genetics (NAP 1201)

Principles of Genetics (NHC 1204)

SEMESTER 2 EXAMINATION

June 2024

Time Allowed:	**3 hours**
Special Requirements:	**None**
Examiner's Name:	**K. Mafunga**

Instructions to Candidates:

1. *The paper consists of six questions, answer **ALL** questions in **Section A** and **ANY TWO** in **Section B**.*
2. *Marks for each question are shown in brackets. Where a question has subdivisions, the marks for each subdivision are given.*
3. *Illustrate your answer, where applicable, with large clearly labelled diagrams.*

MARK ALLOCATION

QUESTION	**MARKS**
SECTION A	**60**
SECTION B	**40**
TOTAL ATTAINABLE MARKS	**100**

This paper consists of three printed pages including this one.

SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

Question 1

a. Compare and contrast mitosis and meiosis. **[10 marks]**

b. Discuss how the processes in meiosis contribute to cellular reproduction and genetic diversity. **[12 marks]**

c. Discuss the significance of mitosis in multicellular organisms. **[6 marks]**

Question 2

a. How do chromosomal aberrations contribute to crop improvement in agriculture? **[4 marks]**

b. Outline the necessary conditions for the Hardy-Weinberg equilibrium. **[10 marks]**

Question 3

a. Provide two examples of gene interactions and explain how they affect phenotypic ratios in offspring. **[6 marks]**

b. Describe the following non-Mendelian inheritance patterns and explain how they deviate from Mendelian ratios:

i. Incomplete dominance **[4 marks]**

ii. Codominance **[4 marks]**

iii. Multiple alleles. **[4 marks]**

SECTION B: ANSWER ANY TWO QUESTIONS IN THIS SECTION

Question 4

a. State the Hardy-Weinberg equilibrium equation and describe what each component represents. **[4 marks]**

b. Explain the following processes and their impact on genetic diversity and population structure:

i. Gene flow **[4 marks]**

ii. Genetic drift **[4 marks]**

iii. Nonrandom mating **[4 marks]**

iv. Selection. **[4 marks]**

Question 5

Discuss the potential benefits and disadvantages associated with the adoption of Genetically Modified Organisms (GMOs) in agriculture. **[20 marks]**

Question 6

In shorthorn cattle, polledness (P) is dominant to the presence of horns (p), and red coat colour (R) is dominant to white coat colour (r). A true-breeding horned red bull is mated with a true-breeding polled white cow. The F_1 progeny are then allowed to mate with each other.

i. Use the forked-line method to calculate the probability of each possible F_2 genotype. **[18 marks]**

ii. If the F_1 cows are backcrossed to the true breeding horned red bull, what would be the genotypes of the offspring? **[2 marks]**

END OF QUESTION PAPER