

37



**UNIVERSITY OF ESWATINI  
FACULTY OF AGRICULTURE**

**1<sup>ST</sup> SEM. 2018/2019  
FINAL EXAMINATION PAPER**

**PROGRAMMES:**

BSc. ANIMAL SCIENCE II  
BSc. ANIMAL SCIENCE (DAIRY OPTION) II  
BSc. AGRONOMY II  
BSc. HORTICULTURE II  
BSc. AGRICULTURAL EDUCATION II  
BSc. AGRICULTURAL EXTENSION II

**COURSE CODE:**

ASC205

**TITLE OF PAPER:**

PRINCIPLES OF GENETICS

**TIME ALLOWED:**

TWO (2) HOURS

**INSTRUCTIONS:**

1. ANSWER QUESTION ONE IN SECTION A  
AND ANY OTHER TWO QUESTIONS IN SECTION B.
2. CANDIDATES MAY USE SCIENTIFIC CALCULATORS.

**DO NOT OPEN THIS PAPER UNTIL PERMISSION HAS BEEN GRANTED BY THE  
CHIEF INVIGILATOR**

38

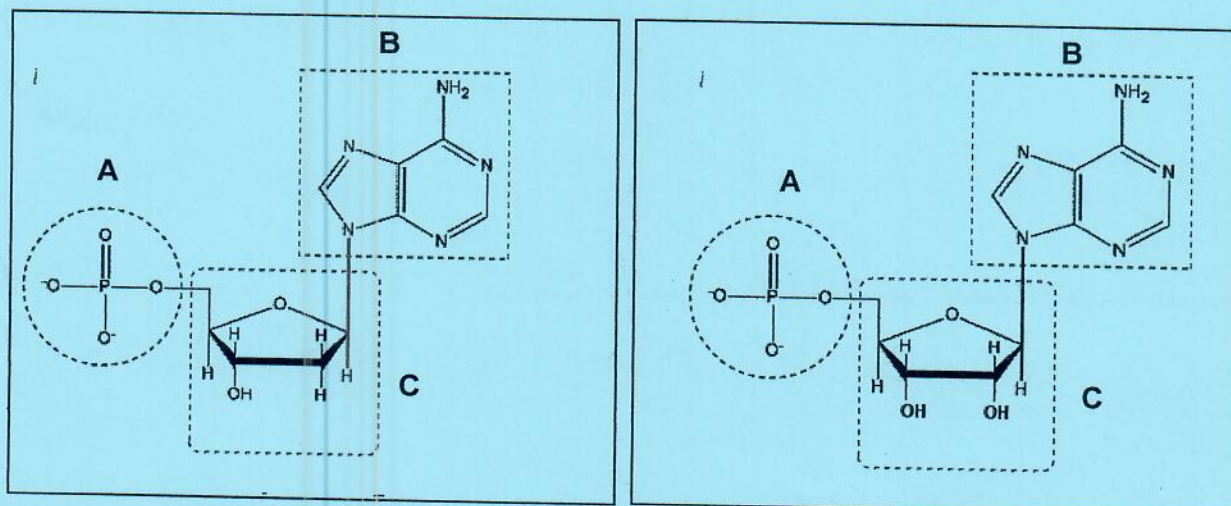
**Section A (Compulsory)**  
**Answer ALL questions in this section**

**Question 1**

(a) Study the structures shown below and answer the questions that follow.

Structure X

Structure Y



- (i) State the names of the three components **A**, **B**, and **C** on each structure. [3 marks]
- (ii) State the category which component **B** belongs to. [1 mark]
- (iii) State the name given to the structures **X** and **Y**. [1 mark]
- (iv) If component **A** is removed from structure **X** or **Y**, state the name that is given to the remaining part. [1 mark]
- (v) Name the bond that joins any two structures stated in (iii) above. [1 mark]
- (vi) Name the polymers formed by structures **X** and **Y**. [2 marks]
- (vii) State the difference between structures **X** and **Y**. [1 mark]
- (b) Write a sentence/ paragraph which connects the following: allele, phenotype, gene, dominant, genotype, recessive, homozygous, heterozygous, locus. [10 marks].
- (c) Assuming that genes assort independently, state the phenotypic ratios produced by the following crosses:
- (i) a selfed monohybrid [1 mark]
- (ii) a selfed dihybrid, [1 mark]
- (iii) a test-crossed dihybrid. [1 mark]
- (d) In rabbits, coat colour is a genetically determined characteristic. Some black females always produce black progeny, whereas other black females produce black progeny and white progeny. Explain these observations in genetic terms. [3 marks]
- (e). In sheep, lustrous fleece results from an allele that is dominant over an allele for normal fleece. A ewe (adult female) with lustrous fleece is mated with a ram (adult male) with normal fleece. The ewe then gave birth to a single lamb with normal fleece. From this single offspring, is it possible to determine the genotypes of the two parents? If so, what are their genotypes? If not, why not? [3 marks]

- (f) Holstein cattle are normally black and white. A superb black-and-white bull, Makhoya, was purchased by a farmer for E100,000. All the progeny sired by Makhoya were normal in appearance (black and white). However, certain pairs of his progeny, when interbred, produced red-and-white progeny at a frequency of about 25%. Makhoya was soon removed from the stud lists of the Holstein breeders. Explain these observations in precise genetic terms justifying why Makhoya was removed from the list of Holstein sires. [4 marks]
- (g) In house cats, black coat-color phenotype is dominant over orange. Male cats are either black or orange; females are black or orange, or calico (black/orange mosaic).  
(i) Given that these phenotypes are governed by an X-linked gene, explain these observations in genetic terms. [5 marks]
- (ii) Half the females produced by a certain kind of mating are calico, and half are black; half the males are orange, and half are black. State the phenotypes of the parental male and female used in this kind of mating and give the genotypes of the male and female progeny described here. [6 marks]
- (h) Explain 3 phenomena that cause genetic variation. [6 marks]

[Total marks = 50]

**Section B (Answer any two questions)****Question 2**

A recently married man and woman discover that each had an uncle with alkaptonuria, otherwise known as "black urine disease," a rare disease caused by an autosomal recessive allele of a single gene. They are about to have their first baby.

- (a) Draw a pedigree and genotype all people concerned. [10 marks]
- (b) Calculate the probability that their child will have alkaptonuria. [15 marks]
- [Total marks = 25]**

**Question 3**

Explain the following terms (giving examples):

- (a) Codominance, [3 marks]
- (b) Incomplete dominance, [3 marks]
- (c) Polygenic inheritance, [3 marks]
- (d) Pleiotropy, [3 marks]
- (e) Recessive lethal alleles, [3 marks]
- (f) Variable expressivity, [3 marks]
- (g) Incomplete penetrance, [3 marks]
- (h) Epigenetics, [3 marks]
- (i) Pure breeding. [1 mark]
- [Total marks = 25]**

**Question 4**

Discuss gene and chromosomal mutations.

[25 marks]  
**[Total marks = 25]**

**END OF EXAMINATION PAPER**