



**1<sup>st</sup> SEM. 2014/2015**

**UNIVERSITY OF SWAZILAND  
SUPPLEMENTARY EXAMINATION PAPER**

**PROGRAMMES: B.Sc. ANIMAL SCIENCE II**

B.Sc. ANIMAL SCIENCE (DAIRY OPTION) II

B.Sc. AGRONOMY II

B.Sc. HORTICULTURE II

B.Sc. AGRICULTURAL EDUCATION II

**COURSE CODE: AS 204**

**TITLE OF PAPER: PRINCIPLES OF GENETICS**

**TIME ALLOWED: TWO (2) HOURS**

**INSTRUCTIONS: ANSWER ANY FOUR QUESTIONS**

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

**QUESTION 1**

- a) Define the following terms:
- i). Homologous chromosomes. **(2 Marks)**
  - ii). A testcross parent. **(2 Marks)**
  - iii). Karyotype. **(2 Marks)**
  - iv). A carrier. **(2 Marks)**
- b) At what stage of mitosis do synapsed homologous chromosomes lie along the metaphase/equatorial plate? **(1 Mark)**
- c) The plant height trait in Mendel's studies is an example of complete dominance inheritance. What type of inheritance does the ABO blood group system exemplify? **(1 Mark)**
- d) If a genetic trait was inherited in a simple dominant-recessive fashion and furthermore, the inheritance of a dominant allele resulted in embryonic death, how many generations would it take to eliminate the lethal allele from the population? **(1 Mark)**
- e) Give the full name of the person referred to as "the father of modern genetics". **(1 Mark)**
- f) Name and state Mendel's first law. State a deviation/exception to this law. Name and briefly describe how two genetic diseases may arise due the deviation from Mendel's first law. **(13 Marks)**

**QUESTION 2**

- A). A woman who is afflicted with phenylketonuria (PKU) marries Jasper. The woman has normal colour vision but her father was colour blind. Jasper has normal colour vision but is a carrier of phenylketonuria. What fraction of their
- i) children are expected to be colour blind? **(2 Marks)**
  - ii) male children are expected to be colour blind? **(2 Marks)**
  - iii) female children are expected to be colour blind? **(2 Marks)**
  - iv) female children are expected to be carriers of the colour blind gene? **(2 Marks)**
  - v) female children are expected to be afflicted with PKU and are also colour blind? **(2 Marks)**
- B). A trait is controlled by two alleles Q3 and Q4 which exhibit incomplete dominance. Two individuals who are heterozygous at the locus controlling this trait are crossed to produce F2 progeny. If the gene is autosomal:
- i) How many phenotypic groups/classes are expected from this cross? **(2 Marks)**
  - ii) What F2 phenotypic ratio would you expect? **(2 Marks)**
  - iii) What F2 genotypic ratio would you expect? **(2 Marks)**
- C). Using sketches/diagrams show how chromosomes are classified based on the location of their centromere. **(9 Marks)**

**QUESTION 3**

- a) Explain how a phenotypic progeny ratio of 9:3:4 may arise from mating two Labrador dogs that are phenotypically black in colour. **(12 Marks)**
- b) When a male pig from a line of true breeding black, solid-hooved pigs was crossed with females from a true breeding red and cloven hoofed breed, all the F1 progeny were black with cloven hooves. When the F1 females were crossed with a true breeding red, solid hoofed male the F2 progeny were as follows: 110 Black and cloven hoofed; 113 black with solid hooves; 111 red with cloven hooves and 112 red and solid hooves.
- Which of the two colours is dominant and why? **(2 Marks)**
  - Which of the alleles controlling hoof phenotype is dominant and why? **(2 Marks)**
  - Does the F2 progeny ratio fit your expectations? Answer YES or NO **(4 Marks)**
  - Explain how you arrived at your choice of answer for question (iii) above. **(5 Marks)**

**QUESTION 4**

- a) The Rhesus positive ( $Rh^+$ ) allele is dominant to the Rhesus negative ( $Rh^-$ ) allele, while at another unlinked locus the A and B alleles exhibit codominance and are both dominant to the O allele. A woman who is phenotypically  $B^{Rh^+}$  has a baby who is phenotypically  $AB^{Rh^+}$ . Can a man who is  $AB^{Rh^-}$  possibly have fathered this child? Explain how you arrive at your answer. **(10 Marks)**
- b) Sugarcane (*Saccharum officinarum*) is grown from cuttings while pawpaws (*Carica papaya L.*) are grown from seed. If planting material for each season was to be obtained from the previous crop, which of these two plants would show greater genetic variation from one generation to the next? Briefly explain your answer. **(8 Marks)**
- c) Name and explain the consequences of a deviation from Mendel's second law. **(7 Marks)**

**QUESTION 5**

- a) Compare and contrast mitosis and meiosis (Use a tabular arrangement to present your answer). **(14 Marks)**
- b) List the functions of meiosis. **(4 Marks)**
- c) State two recessive genetic diseases caused by genes located on the X chromosome. **(4 Marks)**
- d) Name an organism whose cells are all haploid yet it is capable of producing fertile and fully functional sperms? Explain how this haploid organism produces fertile gametes. **(3 Marks)**