



SUPPLEMENTARY EXAMINATION 2011/2012

UNIVERSITY OF SWAZILAND

EXAMINATION PAPER

PROGRAMMES: BSc ANIMAL SCIENCE II
BSc. ANIMAL SCIENCE (DAIRY OPTION) II
BSc AGRONOMY II
BSc HORTICULTURE II

COURSE CODE: AS 204

TITLE OF PAPER: PRINCIPLES OF GENETICS

TIME ALLOWED: TWO (2) HOURS

INSTRUCTIONS: ANSWER ANY 4 QUESTIONS

**THIS PAPER MAY NOT BE OPENED UNTIL THE CHIEF INVIGILATOR HAS GRANTED
PERMISSION**

1. (a) List **two** functions of meiosis? (4)
(b) Compare mitosis and meiosis (present your answer in table form) (14)
(c) Male bees (drones) result from unfertilized eggs and as a result they are haploid. How do these males produce viable gametes when they are haploid? (2)
(d) In what stage of cell division would one observe a dyad? (3)
(e) A recessive gene call it "q" is Y linked. An afflicted man marries an unrelated normal woman. Their first born is an afflicted son, what is the probability that if their second child is a daughter it will be also afflicted? (2)

2. (a) Define the following genetic terms
 - i). Chiasmata (2)
 - ii). Genome (2)
 - iii). Dyad (4)
 - iv). Map distance (4)
 - v). Recessive epistasis (4)
(b) Briefly explain why most human societies do not tolerate consanguine marriages (4)
(c) You are presented with a brown female rabbit with long ears. You are informed that brown fur is dominant to white fur and long ears are dominant to short ears. Give a step by step explanation of how you would determine whether the female rabbit is true breeding for both coat colour and ear length. (5)

3. (a) Define the following genetic terms: (10)
 - i). Incomplete dominance
 - ii). Multiple allelism
 - iii). Chiasmata
 - iv). Sex linkage
 - v). Pedigree
(b) Why does mitosis not generate genetic variation? (3)
(c) Name the stage of mitosis when the following events occur: (12)
 - i). Chromosomes arrive at the spindle poles, the nuclear membrane reforms and the condensed chromosomes relax
 - ii). Chromosomes condense and mitotic spindle form
 - iii). Cytoplasm divides and cell wall formation in plants
 - iv). Chromosomes align on the spindle assembly
 - v). Sister chromatids separate, becoming individual chromosomes that migrate towards the poles
 - vi). Nuclear membrane disintegrates and spindle microtubules attach to the kinetochores

4. While examining a pedigree, how would you differentiate the presence of an autosomal recessive gene as opposed to presence of an X linked recessive gene? (8)
- (e) List **two** important characteristic patterns of a Y linked gene in a pedigree? (4)
- (f) If a condition is caused by an X linked dominant gene which sex (male or female) is expected to be more afflicted in a pedigree? (2)
- (g) List the **three** stages of the cell cycle which make up interphase. (6)
- (h) Which mode of reproduction, sexual or vegetative would produce more uniform plants? (2)
Explain why this should be the case (3)
5. In primrose (*Primula sp.*) the gene loci affecting three flower characteristics are linked. The table below describes each of the loci involved.

LOCUS	Dominant	Recessive
Stigma texture	Rough (R)	Smooth (r)
Flower colour	Pink (P)	White (p)
Stigma colour	Green (G)	Red (g)

A primrose plant that is heterozygous at all three loci is test crossed and the following progeny are obtained;

Phenotype	Numbers
RPG	2
rpG	70
RpG	21
rpg	4
RPg	82
rPg	21
rPG	13
Rpg	17

- a) Which gene locus is in the middle? (2)
- b) Which are the parental classes? (2)
- c) List all the products of single crossover events? (4)
- d) List all the products of double crossover events? (2)
- e) What is the genetic distance between the stigma texture and the stigma colour loci? (4)
- f) What is the genetic distance between the flower colour and stigma colour loci? (4)
- g) What is the theoretical probability of observing a double crossover progeny? (4)
- h) Are you most likely to observe more or less double crossovers than expected? Explain (3)