UNIVERSITY OF SWAZILAND
SUPPLEMENTARY EXAMINATION PAPER

PROGRAMME: DIPLOMA IN AGRICULTURE YEAR II,
DIPLOMA IN AGRICULTURE EDUCATION YEAR II
REMEDIAL YEAR IN AGRICULTURE AND
REMEDIAL YEAR IN AGRICULTURE EDUCATION

COURSE CODE: APH 202

TITLE OF PAPER: PRINCIPLES OF GENETICS

TIME ALLOWED: TWO (2) HOURS

INSTRUCTIONS:
1. ANSWER QUESTION 1 AND ANY OTHER THREE QUESTIONS.
2. EACH QUESTION CARRIES TWENTY FIVE (25) MARKS.)
3. ILLUSTRATE YOUR ANSWERS WITH LARGE AND CLEARLY LABELLED DIAGRAMS WHERE APPROPRIATE.
4. ALL WORKING MUST BE CLEARLY SHOWN.

SPECIAL REQUIREMENTS: a) CALCULATORS

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

QUESTION 1 THIS QUESTION IS COMPULSORY

a) Explain what is meant by the following terms:

i. A gene
ii. Allele
iii. Homozygous
iv. Heterozygous
v. Recessive **[10 Marks]**

b) Explain what is meant by the following:

i. Blending theory of inheritance
ii. Parallel behavior of genes and chromosomes
iii. X chromosome inactivation **[6 Marks]**

c) Give one example each of a dominant trait in cattle and in humans **[2 Marks]**
d) Give example each of a recessive trait in cattle and in humans **[2 Marks]**
e) Distinguish between sex linked and sex limited traits giving specific examples of each. **[5 Marks]**

[TOTAL 25 MARKS]

QUESTION 2

a) Explain what is meant by the chromosome theory of inheritance. **[4 Marks]**
b) Briefly explain what is meant by the parallel behavior of genes and chromosomes illustrating your answer with large, clearly labeled diagrams. **[6 Marks]**
c) State the main events that occur during these stages of cell division
   a. Mitotic Metaphase
   b. Mitotic Telophase
   c. Zygotene
   d. Diakinesis
   e. Metaphase I
   f. Anaphase I
   g. Anaphase II **[8 Marks]**
d) Compare and contrast between Mitosis and Meiosis. **[7 Marks]**

[TOTAL 25 MARKS]

QUESTION 3

a) In chickens, the shape of the comb is determined by two genes R and P as follows:

R- rose comb in the absence of P P- pea comb in the absence of R

When R and P are present together, a single comb arises. In chicken that are homozygous recessive for both genes a small comb referred to as walnut arises.

A Walnut comb hen is mated to a single comb male to produce an F_1 which is then allowed to intercross to produce an F_2.

i. State the genotype and phenotype of the F_1. **[2 Marks]**
ii. What phenotypes and in what proportions can be expected in the F_2 of this cross? **[6 Marks]**
iii. State the genotype associated with each phenotype. **[2 Marks]**

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b) State three types of genetic interaction known to you, citing specific examples where this occurs as well as an account of expected ratios. **[12 Marks]**
c) Distinguish between penetrance and expressivity. **[3 Marks]**

[TOTAL 25 MARKS]

QUESTION 4

a. Describe how sex is determined in each of the following organisms:

i. Sea worms
ii. Coral reef fish
iii. Bees
iv. Grasshoppers
v. Humans **[15 Marks]**

b. In humans, colour blindness is controlled by a recessive gene c located on the X chromosome. A woman who is heterozygous for this gene marries a normal man. Using accepted notation, explain what phenotypes and in what proportions are likely to occur among their children. **[5 Marks]**

c. If the woman was normal and her husband was colour blind, show what phenotypes and in what proportions could be expected among their children. **[5 Marks]**

[TOTAL 25 MARKS]

QUESTION 5

a) Distinguish between the following pairs of terms:

i. Metacentric and Telocentric

ii. Deletion and Duplication

iii. Euploidy and aneuploidy

iv. Autopolyploidy and Allopolyploidy **[8 Marks]**

b) Explain briefly, how monoploids might arise. **[5 Marks]**

c) Discuss the applications of polyploidy in agriculture using specific examples to illustrate your answer. **[12 Marks]**

[25 MARKS]