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UNIVERSITY OF ESWATINI
FACULTY OF AGRICULTURE

1ST SEM. 2018/2019
RE-SIT 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 <u>QUESTION ONE</u> IN SECTION A AND <u>ANY OTHER TWO</u> QUESTIONS IN SECTION B.

2. CANDIDATES MAY USE SCIENTIFIC CALCULATORS.

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

Section A (Compulsory)
Answer ALL questions in this section

Question 1

(a) Briefly explain how genetics has affected agriculture and modern biological research.
[6 marks]

(b) Explain the chromosome theory of inheritance
[6 marks]

(c) Explain how Mendel's 1st and 2nd laws are related to meiosis.
[6 marks]

(d) Briefly describe the molecular organisation of eukaryotic chromosomes.
[6 marks]

(e) Two black Guinea pigs were mated and over two seasons produced 29 black and 9 white offspring. Explain these results, giving the genotypes of parents and progeny.
[6 marks]

(f) A herd of pure breeding black polled (hornless) bulls was allowed to mate with a herd of pure breeding horned brown cows. All F1 calves were black and hornless. One F_1 bull and a fellow F_1 cow are now crossed to get an F_2 calf. Explain the genetic relationships between the two fur colour phenotypes as well as polled and horned phenotypes. Hence, calculate the probability that the F_2 calf will have either horns or brown fur.
[10 marks]

(g) A pure-breed albino Labrador is mated with a pure-bred black Labrador. All the F_1 are black. When the black F_1 progeny are crossed with each other, 89 black, 31 brown, and 42 albino dogs were obtained.
(i) Explain the observations described above.
[2 marks]

(b) Using letters of your own choice, indicate the genotypes of the two pure breeding parental dogs, the F_1, and the F_2 progeny.
[8 marks]

[Total marks = 50]

P.T.O

Section B (Answer any two questions)

Question 2

(a) State four traditional subdivisions of genetics and briefly state what each covers.

[9 marks]

(b) Explain the difference between the following:
(i) Epistasis and dominance,

[4 marks]

(ii) Recessive epistasis and dominant epistasis.

[4 marks]

(c) Explain the following genetic phenomena.
(i) In the absence of epistasis, a heterozygous progeny has a different phenotype from the two homozygous parents.

[4 marks]

(ii) Two heterozygous Manx cats (Mn) when crossed give progeny in the ratio of 2 Manx cats (Mn): 1 normal-tailed cat (mm) and not 3M-:1mm.

[4 marks]

[Total marks = 25]

Question 3

(a) Explain why tortoiseshell and calico cats are almost always female, highlighting why they have a patchy distribution of orange and black fur.

[10 marks]

(b) John and Martha are contemplating having children, but John's brother has galactosemia (an autosomal recessive disease) and Martha's great-grandmother also had galactosemia. Martha has a sister who has three children, none of whom have galactosemia. With the aid of a genotyped pedigree, determine the risk that John and Martha's first child will have galactosemia.

[15 marks]

[Total marks = 25]

Question 4

In *Drosophila*, curly wings (k), black body (b), and cinnabar eyes (c) result from recessive alleles that are all located on chromosome 2. A homozygous wild-type fly was mated with a curly, black, and cinnabar fly, and the resulting F1 females were test-crossed with curly, black and cinnabar males. The following F_2 progeny were produced from the test-cross:

Progeny genotype	Frequency
$k\,b^+\,c$	117
$k^+\,b^+\,c^+$	825
$k^+\,b\,c$	50
$k^+\,b^+\,c$	6
$k\,b\,c$	828
$k\,b^+\,c^+$	51
$k^+\,b\,c^+$	115
$k\,b\,c^+$	8
Total	**2000**

Use the data above to determine the order of genes on the chromosome, then compute coefficient of coincidence and gene interference during recombination.

[Total marks = 25]

END OF EXAMINATION PAPER