UNIVERSITY OF ESWATINI

1ST SEM. 2019/2020

FINAL EXAMINATION PAPER

PROGRAMMES: B. Sc. ANIMAL SCIENCE

B. Sc. ANIMAL SCIENCE (DAIRY OPTION)

B. Sc. AGRICULTURAL EDUCATION

B. Sc. AGRICULTURAL EXTENSION

B. Sc. AGRONOMY

B. Sc. HORTICULTURE

COURSE CODE: ASC 205

TITLE OF PAPER: PRINCIPLES OF GENETICS

TIME ALLOWED: TWO (2) HOURS

INSTRUCTIONS: ANSWER ANY FOUR (4) QUESTIONS

SPECIAL REQUIREMENTS: CALCULATORS

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

QUESTION 1

a. Outline three main differences between DNA and RNA. **(3 marks)**

b. Describe how genetic information, contained in DNA, gets expressed as heritable traits in an organism. **(5 marks)**

c. Describe four investigative approaches commonly used in the study of genetics. **(8 marks)**

d. Discuss any three applications of genetics in agriculture. **(9 marks)**

QUESTION 2

a. With the aid of labelled diagrams, describe how chromosomes are named on the basis of their centromere locations. **(16 marks)**

b. An organism has a diploid number of 16 in a primary oocyte.

i. How many tetrads are present in the first meiotic prophase? **(2 marks)**

ii. How many dyads are present in the second meiotic prophase? **(2 marks)**

iii. How many monads migrate to each pole during the second meiotic anaphase? **(2 marks)**

c. Explain why meiosis leads to significant genetic variation while mitosis does not. **(3 marks)**

QUESTION 3

a. Outline four features of the garden pea that made it a good choice as an experimental organism in Mendel's work? **(4 marks)**

b. In peas, round seeds are dominant to wrinkled seeds and yellow cotyledons are dominant to green cotyledons. If you were given a plant that has round seeds and yellow cotyledons, how would you determine its genotype? **(12 marks)**

c. Pigeons exhibit a checkered or plain feather pattern. In a series of controlled mating experiments, the following data were obtained:

P_1 cross	F_1 offspring	
	Checkered	Plain
(i) checkered × checkered	36	0
(ii) checkered × plain	38	0
(iii) plain × plain	0	35

i. Explain the mode of inheritance of the checkered and plain feather patterns. **(3 marks)**

ii. Predict the results of the $F_1 \times F_1$ mating from cross (ii). **(6 marks)**

QUESTION 4

a. Contrast incomplete dominance and codominance. Give examples. **(4 marks)**

b. In foxes, coat colour is controlled by a single gene, which has two alleles, ***P*** and ***p***. The ***PP*** genotype results in lethality, while ***Pp*** results in platinum coat colour, and ***pp*** results in silver coat colour.

i. What genotypic and phenotypic ratios of offspring are obtained when platinum foxes are interbred? **(4 marks)**

ii. Is the ***P*** allele behaving dominantly or recessively in causing lethality? **(2 marks)**

iii. Is the ***P*** allele behaving dominantly or recessively in causing platinum coat color? **(2 marks)**

c. In cattle, coats may be solid white, solid black, or black and white spotted. When true-breeding solid whites are mated with true-breeding solid blacks, the F_1 generation consists of all solid white individuals. Following many $F_1 \times F_1$ matings, the following ratio was observed in the F_2 generation:

12/16 solid white
3/16 black and white spotted
1/16 solid black

i. Explain the mode of inheritance governing coat colour and pattern by determining how many genes are involved and which genotypes yield which phenotypes. **(10 marks)**

ii. Is it possible to obtain a true-breeding strain of black and white spotted cattle? If so, what genotype would they have? If not, explain why not. **(3 marks)**

QUESTION 5

a. Contrast the following pairs of terms or phrases.

i. Aneuploidy and euploidy **(3 marks)**

ii. Monosomy and trisomy **(3 marks)**

iii. Autopolyploidy and allopolyploidy **(3 marks)**

iv. Paracentric inversion and pericentric inversion. **(3 marks)**

b. How does polyploidy arise in nature? **(3 marks)**

c. Discuss any four contributions of polyploidy (regardless of its origins, i.e. natural or artificial) to crop improvement. **(10 marks)**

QUESTION 6

a. Describe a method of nondisjunction in human female gametes that would give rise to Klinefelter and Turner syndrome offspring following fertilization by a normal male gamete. **(4 marks)**

b. Contrast the *Protenor* and *Lygaeus* modes of sex determination. **(4 marks)**

c. Cat breeders are aware that kittens expressing the X-linked calico coat pattern are almost invariably females. Explain this phenomenon. **(4 marks)**

d. Describe how temperature influences sex determination in reptiles. **(4 marks)**

e. Define the following terms and illustrate with examples.

   i. Monoecious **(2 marks)**

   ii. Heterogamy **(2 marks)**

   iii. Barr body **(2 marks)**

f. What is the expected number of Barr bodies in interphase cells of the following individuals: Klinefelter syndrome, Turner syndrome, and the karyotype 47, XXY? **(3 marks)**

THE END!