MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF PURE AND APPLIED SCIENCE

DEPARTMENT OF APPLIED SCIENCE

UNIVERSITY ORDINARY EXAMINATION

2017/2018 ACADEMIC YEAR

THIRD YEAR **SECOND** SEMESTER OF SEMESTER EXAMINATION FOR BACHELOR OF SCIENCE IN APPLIED STATISTICS WITH PROGRAMMING

AMS 316 – STATISTICAL GENETICS

DURATION: 2 HOURS

DATE: 27TH APRIL, 2018

TIME: 9.00 – 11.00 A.M.

Instructions to Candidates:

1. Answer **Question 1** and **Any Other Two** questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A – ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE

a) Differentiate between the following terms as used in statistical genetics

   i. Chromosomes and genes (2 marks)

   ii. Diploid and haploid cells (2 marks)

   iii. Genome and alleles (2 marks)

b) Explain the three types of phenotypic expression of a heterozygote with respect to a single locus (6 marks)

c) Given ABO blood system, the alleles A, B and O have the following properties A and B are dominant over, O but are co-dominants with respect to each. Get the genotype distribution and phenotype distribution (6 marks)

d) Given crosses AaBb x aabb, Find the gametes assuming independent assortment

e) In a hypothetical population of zebras, most of the individuals have dark, zebra-stripped shells (Aa or AA) however solid light colored shells (aa) occur in one of every 10,000 individuals. Calculate gene frequencies and numbers of dominant homozygotes AA and recessive homozygotes on a population of 10,000 zebras (6 marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO

a) Let A & B be two linked loci with A, a and B, b alleles respectively. Find the joint gamete distribution with respect to two linked loci and hence phenotype distribution of ABab cross (8 marks)

b) Describe cell division i.e. mitosis under the following steps

   i. Interphase

   ii. Prophase

   iii. Metaphase

   iv. Anaphase

   v. Telophase

   vi. Cyto kinesis (12 marks)

QUESTION THREE

a) Let A & a be dominant and recessive alleles respectively at locus A.

i. Since gametes combine independently into zygotes write down the genotypes and phenotypes distribution of heterozygotes (i.e Aa x Aa) (5 marks)

ii. Assume gamete a is less reliable than A with a ratio $a: A = \propto : 1$ where $0 < \propto < 1$ write the genotype and phenotype distribution of crosses $A\emptyset$ x Aa (5 marks)

b) List the four factors that regulate effective population size (8 marks)

c) State the Hardy-Weinberg law (2 marks)

QUESTION FOUR

a) Albinism is a rare genetically inherited trait that is only express in the phenotype of homozygous recessive individuals (aa). The most characteristic symptom is a marked deficiency on the skin and hair pigment melanin. The average human frequency of albinism is only about 1 in 20,000 individuals.

i. Calculate the probability of having an albino individual (3 marks)

ii. The probability of the recessive albinism allele (a) and the probability of the dominant albinism allele (A) (5 marks)

iii. Obtain the frequencies of the three genotypes for this trait in the population (6 marks)

iv. Comment on the prevalence of albinism in the population (2 marks)

b) Differentiate between mitosis and merosis (4 marks)