CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

SECOND YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE (AGRICULTURE)

ANSC 241: QUANTITATIVE GENETICS AND ANIMAL BREEDING

STREAMS: BSC (AGRIC) **TIME: 2 HOURS**

DAY/DATE: TUESDAY 05/12/2017 **11.30 A.M. – 1.30 P.M.**

INSTRUCTIONS:

- **This examination has TWO section; A and B**
- **Attempt ALL questions in section A and two questions in section B**
- **Mobile phones are NOT allowed in the examination room**

SECTION A: ATTEMPT ALL QUESTIONS – 30 MARKS

1. Differentiate between the following concepts
   (a) Minimum co-ancestry mating and inbreeding
   (b) Breeding value and additive genetic relationship
   (c) Selection differential and response to selection [12 marks]
2. In a population with 12,000 individuals the locus A has two alleles, A_1 and A_2. The frequency of allele A_1, denoted by p is 0.65.
   (a) Assuming hardy-Weinberg equilibrium, determine the number of individuals heterozygous for this locus. [2 marks]
   (b) A molecular assay indicated that the actual number of individuals heterozygous for the locus was 5,000. Determine if the population is in Hardy-Weinberg equilibrium. [6 marks]
3. Define the following terms
   (a) Co-dominance
   (b) Inbreeding depression
   (c) Selection limit
   (d) Natural selection
   (e) Marker assisted selection

SECTION B: ATTEMPT TWO QUESTION – 40 MARKS

4. A locus B has two alleles B_1 and B_2. The genotypic values for are B_2B_2, B_1B_2 and B_1B_1 are 200kg, 220 kg and 230 kg, respectively. The frequency of B_1 allele, p, is equal to 0.75.
   (a) Determine the average gene substitution effect for this locus [6 marks]
   (b) Estimate breeding values for B_1B_1, B_1B_2 and B_2B_2 genotypes. [9 marks]
   (c) Calculate the genotypic mean for this locus. [5 marks]

5. In a dairy cattle breeding program bulls are evaluated on progeny performance and dams on own performance records. The heritability for the trait is 0.30, additive genetic variance is 25,000 kg^2 and the population mean is 3,500 kg.
   (a) Determine the accuracy of the estimated breeding value for bull A with 20 progeny records. [5 marks]
   (b) Estimate the breeding for a cow with a performance record of 4,200 kg.[5 marks]
   (c) Determine the accuracy of estimated breeding values for cows. [3 marks]
   (d) If the intensity of selection in the sires is 0.467, determine the expected response per generation form sires. [7 marks]

6. Write short notes distinguishing between the following concepts
   (a) Selection differential and assortative mating
   (b) Individual Heterosis and maternal Heterosis
   (c) Response to selection and breeding value
   (d) Selection and mating
   (e) Crossbreeding and random mating
