CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

SECOND YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN ANIMAL SCIENCE

ANSC 241: QUANTITATIVE GENETICS AND ANIMAL BREEDING

STREAMS: BSC (ANSC, AGRI, AGED) **TIME: 2 HOURS**

DAY/DATE: WEDNESDAY 19/04/2023 **2.30 P.M. – 4.30 P.M.**

INSTRUCTIONS: Answer question ONE and any other TWO questions

1. A locus has two alleles, A_1 and A_2. The frequency of A_2 allele, q, in a population is 0.30.
   (a) Determine the expected genotype frequencies under Hardy-Weinberg equilibrium. [6 marks]
   (b) If the computed genotype frequencies were as follows: $\text{Freq}_{A_1A_1} = 0.45$ and $\text{Freq}_{A_1A_2} = 0.375$, determine if the population is in Hardy-Weinberg quilibrium. [4 marks]
2. In a population the mean body weight of 1 month old juveniles is 1.95 kg. σ_p and σ_A for this trait are 3.5 and 1.5, respectively.
   (a) Determine the heritability for this trait [2 marks]
   (b) Calculate the breeding value for a rabbit whose body weight at 1 month is 1.2 kg. [2 marks]
   (c) Determine the accuracy of the estimated breeding value for the rabbit in question 2b above. [2 marks]
   (d) If a male rabbit weighing 2.2 kg is mated to a female rabbit weighing 1.8 kg month, what is the expected weight of their offspring? [4 marks]

3. Use the pedigree provided below to answer the questions that follow

(a) Determine the additive genetic relationship between k and 1 [5 marks]

(b) Determine the coefficient of kinship, fxy, between k and Sire [3 marks]

(c) Define the term "dominance relationship. [2 marks]

SECTION B: ANSWER TWO QUESTIONS (40 MARKS)

4. Genetic relationships are important in Animal breeding

(a) Determine the additive genitive relationship between a sire and its offspring [5 marks]

(b) Determine the genetic covariance between a sire and its offspring [5 marks]

(c) Differences between pleiotropy and linkage disequilibrium [5 marks]

(d) Write short notes on heterosis [5 marks]

5. In a breeding program males are evaluated based on the performance records of 20 progenies and females are evaluated based on own performance and two halfsibs. The intensities of selection in males and females are 1.703 and 0.654, respectively. Heritability of the trait is 0.10. The phenotypic standard deviation for the trait is 10 g/day. Males are selected when 5 years and females at 3 years of age. Determine the response to selection for males and females per year.

6. (a) Prove that the heritability is the regression of the breeding value on the phenotype. [4 marks]

(b) Distinguish between marker assisted selection and genomic selection.

(c) Discuss two reasons for crossbreeding [4 marks]

(d) Discuss the following terms:

(i) Drift

(ii) Pleiotropy

(iii) Selection limit

(iv) Linkage disequilibrium [8 marks]
