JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF AGRICULTURAL AND FOOD SCIENCES

SECOND YEAR FIRST SEMESTER UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE ANIMAL SCIENCE

2018/2019 ACADEMIC YEAR

REGULAR

COURSE CODE: AAS 3217

COURSE TITLE: QUANTITATIVE GENETICS

EXAM VENUE: **STREAM: BSc (Animal Science)**

DATE: **EXAM SESSION:**

TIME: 2.00 HOURS

Instructions:

1. **Answer ALL question in Section A (compulsory) and ANY other TWO questions in Section B.**
2. **Candidates are advised NOT to write on the question paper.**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**

SECTION A [30 MARKS]

Answer ALL questions from this Section.

Question 1

Question 1 consists of 10 multiple choice questions. Only one of the four alternatives labelled (a), (b), (c) and (d) is correct. Write the letter corresponding to the correct answer in your booklet.

Q1.1 - 1.4 The data below are on egg weight in chickens. The values have been transformed to a base of 100.

1.1 Calculate heritability in the broad sense. (1 mark)

(a) 0.35

(b) 0.30

(c) 0.65

(d) 0.75

1.2 Calculate heritability in the narrow sense. (1 mark)

(a) 0.35

(b) 0.30

(c) 0.65

(d) 0.75

1.3 Calculate repeatability. (1 mark)

(a) 0.35

(b) 0.30

(c) 0.65

(d) 0.75

1.4 Calculate temporary environmental variance. (1 mark)

(a) 15

(b) 25

(c) 35

(d) 65

1.5 If additive genetic variance of a quantitative trait is zero, then (1 mark)

(a) heritability is at maximum value.

(b) dominance variance is zero.

(c) the trait is largely controlled by environment.

(d) none of the above.

1.6 Pleiotropy is a special situation in which (1 mark)

(a) many genes control a single trait.

(b) there is polygenic inheritance.

(c) there is no polygenic inheritance.

(d) same gene has different effects on different traits at the same time.

1.7 Additive genetic effects are the most important part of the phenotypic variation because

(1 mark)

(a) they are the stable and regularly transmitted from one generation to the next.

(b) the have the greatest effects on the phenotypic expression.

(c) they interact with the environment.

(d) none of the above.

1.8 Genotype x Environment interaction occurs (1 mark)

(a) when relative performance of genotypes defies the environment in which they are kept.

(b) in Bos indicus breeds only.

(c) when relative performance of genotypes changes with genotypes.

(d) when certain genotypes are exposed to good environment.

1.9 If there are records available on the performance of an animal, then the best estimate of its future performance is (1 mark)

(a) her first record.

(b) the mean of all her previous records.

(c) her breeding value estimate

(d) her Most Probable Producing Ability estimate.

1.10 Mass selection is suitable for genetic improvement of (1 mark)

(a) traits of high heritability.

(b) reproductive traits.

(c) sex limited traits.

(d) traits of low heritability.

Question 2

(a) Differentiate between the following. You may use illustrations and /or examples.

i. Mass selection and pedigree selection. (2 marks)

ii. Genotype x Environment interaction and Genotype – Environment correlation. (2 marks)

iii. Breeding value and Most Probable Producing Ability. (2 marks)

iv. Pure breeding and crossbreeding. (2 marks)

v. Heritability in the broad sense and repeatability. (2 marks)

(b) Explain the following terms, giving examples where necessary.

i. Pleiotropy. (2 marks)

ii. Selection differential. (2 marks)

iii. Correlated characters. (2 marks)

iv. Heterosis. (2 marks)

v. Inbreeding depression. (2 marks)

Question 3

Assume that selection is carried out separately for males and females in a herd of Boran cattle in which the average daily gain was 0.22 kg. If the means of the selected males and females were 1.80 and 1.50 kg/g/day, respectively.

(a) Compute the average selection differential when both males and females are selected. (3 marks)

(b) Repeat (a) above when only males are selected. (3 marks)

(c) By how much has the potential genetic gain changed by selecting only the males. (2 marks)

(d) Explain the implication for the change in (c) above. (2 marks)

SECTION B [40 MARKS]

Answer ANY TWO questions from this Section.

Question 4

What is family selection in the context of quantitative genetics? (3 marks)

State the two main family lines and explain how ech of them can arise. (6 marks)

Briefly discuss the limitations of whole family selection and within family selection. (8 marks)

Indicate and explain the conditions under which family selection can be recommended. (3 marks)

Question 5

Write short notes on the following:

(a) Maternal effects. (5 marks)

(b) Correlated traits. (5 marks)

(c) Indirect selection. (5 marks)

(d) Backcrossing. (5 marks)

Question 6

Answer the following questions briefly and clearly. Explain your calculations.

Assume a repeatability of weaning weight, as trait of the dam, is 0.4, while heritability is 0.3. If herd average is 200 kg.

(a) Compute the best estimate of the next record of a cow named Kitale which has first calf with a weaning weight of 220 kg. (3 marks)

(b) Repeat (a) above when Kitale has had four calves with weaning weights of 220, 232, 245 and 250 kg. (7 marks)

(c) Consider weaning weight as a trait of the dam, calculate the breeding value of Kitale using her first record only. (3 maks)

(d) Repeat (c) above using all records available on Kitale.. (7 marks)