



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

**SECOND YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE IN ANIMAL SCIENCE**

2024/2025 ACADEMIC YEAR

REGULAR

COURSE CODE: AAB1211

COURSE TITLE: Population Genetics

EXAM VENUE:

STREAM: BSc. (Animal Science)

DATE:

EXAM SESSION:

TIME: 2 HOURS

Instructions:

1. Answer **ALL** questions in **Section A** and **TWO** questions in **Section B**.
2. Candidates are advised **NOT** to write anything on this 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 five multiple-choice questions. Write your correct answer for each question in the answer booklet

- 1.1 What is a population in population genetics? (2 Marks)
- a) A group of individuals of the same species living in the same area.
 - b) A group of different species living in the same area.
 - c) A group of organisms that can interbreed and produce fertile offspring.
 - d) A group of individuals that are genetically identical.
- 1.2 Which of the following is a key element of a population's genetic structure? (2 Marks)
- a) Gene pool.
 - b) Migration.
 - c) Natural selection.
 - d) All of the above
- 1.3 The Hardy-Weinberg equilibrium assumes that there is no... (2 Marks)
- a) Random mating.
 - b) Migration.
 - c) Mutation.
 - d) All of the above.
- 1.4 What is the main effect of mutation on a population's gene frequency? (2 Marks)
- a) Mutation results in the immediate change of allele frequencies.
 - b) Mutation creates genetic variation, potentially leading to evolutionary changes.
 - c) Mutation guarantees that all alleles become fixed in the population.
 - d) Mutation has no impact on gene frequencies over time.
- 15 In a population with a one-directional mutation where allele B mutates to allele b at a rate of u , what will be the frequency of allele B after one generation? (2 Marks)
- a) $p_1 = p_0 + u$
 - b) $p_1 = p_0 - u$
 - c) $p_1 = p_0 + uP_0$
 - d) $p_1 = p_0 - uP$
- 1.6 Which of the following factors does not affect gene frequencies? (2 Marks)
- a) Mutation.
 - b) Genetic drift.
 - c) Random mating.
 - d) Gene flow.

- 1.7 Which of the following is true about genetic drift in small populations? (2 Marks)
- a) It has no effect on allele frequencies.
 - b) It can cause random changes in allele frequencies.
 - c) It causes directional selection.
 - d) It only affects the dominant alleles.
- 1.8 What effect does random genetic drift have on small populations? (2 Marks)
- a) Keeps allele frequencies constant
 - b) Causes predictable gene frequency changes
 - c) Causes erratic allele frequency fluctuations
 - d) Increases genetic variation
- 1.9 What is the primary role of natural selection in evolution? (2 Marks)
- a) Allows individuals to acquire traits during life
 - b) Creates variation by random processes
 - c) Eliminates individuals with unfavourable traits
 - d) Forces individuals to adapt by acquiring traits
- 1.10 What contributes to competition for survival in a population, according to Darwin? (2 Marks)
- a) Survival of all offspring
 - b) Limited resources
 - c) Inheritance of traits
 - d) Constant environment

Question 2

Assume a population in Hardy-Weinberg equilibrium, consisting of 500 individuals. The following allele frequencies are observed: allele A: 0.7 and allele a: 0.3. Calculate the expected genotype frequencies. (3 Marks)

Question 3

In a population, 200 Shorthorn cattle were observed with the following genotype counts: 80 AA individuals, 100 Aa individuals and 20 aa individuals. Calculate the allele frequencies. (3 Marks)

Question 4

Distinguish between recurrent and non-recurrent mutation. (2 Marks)

Question 5

What are reproductive isolation mechanisms (RIMs)? (2 Marks)

SECTION B [40 MARKS]

Answer TWO questions from this Section.

Question 1

Discuss the following topics briefly:

- a) Speciation (4 Marks)
- b) Polymorphism. (4 Marks)
- c) Founder effect. (4 Marks)
- d) Positive assortative mating. (4 Marks)
- e) Mutation..

Question 2

Explain the conditions for Hardy-Weinberg equilibrium and discuss the factors that can lead to deviations from this equilibrium in a population. (20 Marks)

Question 3

- a) Using an example, demonstrate how genetic drift drift can change gene and genotype frequencies in a small population. (10 Marks)
- b) Explain the concept of founder effect in population genetics. Illustrate your answer. (10 Marks)