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)