JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF AGRICULTURE AND FOOD SCENCES

SECOND YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN ANIMAL SCIENCE 2017/2018 ACADEMIC YEAR

REGULAR

COURSE CODE: AAS 3228

COURSE TITLE: POPULATION GENETICS

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

DATE: **EXAM SESSION:**

TIME: 2 HOURS

Instructions:

Answer **ALL** the questions in section **A** and any **TWO** in section **B.**
Do not write on this question paper.
Each question in section **B** carries equal marks.

SECTION A [30 MARKS]

Answer ALL questions in this Section

Question 1

Question 1 consists of 10 multiple choice questions. Only ONE of the four choices is correct. Write the letter corresponding to the correct answer in your booklet. (1mark each)

1.1 Mendelian genetics:

a) deals with the principles of transmitting genetic material across populations.
b) deals with principles of selection in plants and animals.
c) deals with the principles of transmitting genetic material from one generation to another.
d) none of the above.

1.2 Population genetics:

a) is the study of Mendelian genetics over generations of animals and plants.
b) is the study of Mendelian and quantitative genetics in populations animals and plants.
c) is the study of Mendelian genetics in populations of animals and plants.
d) deals with principles of selection in populations of animals and plants.

1.3 Which of the following is an example of a quantitative trait?

a) butterfat percent.
b) coat colour.
c) weaning age.
d) litter size.

1.4 Hardy – Weinberg equilibrium is used to determine:

a) the different alleles in a population.
b) different genotypes in a population.
c) the mating frequencies in a population.
d) the gene and genotype frequencies in a population.

1.5 Dominance:

a) is the interaction of genes from different loci.
b) is the interaction of genes from the same locus.
c) is the additive action of genes.
d) is the epistasis effect of genes.

1.6 Assume a certain population that is in Hardy-Weinberg equilibrium with respect to an autosomal locus with two alleles R and r. If the frequency of R is 0.60, the frequency of heterozygote individuals will be:

a) 0.48
b) 0.36
c) 0.40
d) 0.16

1.7 When heterozygotes are equal to either of the homozygotes, then the type of gene action involved is:

a) complete dominance.
b) over dominance.
c) partial dominance.
d) Codominance.

1.8 Mutation is:

a) a sudden change in gene action.
b) a sudden change in genetic material.
c) a sudden change in the frequency of a gene.
d) a result of natural selection.

1.9 Fitness in population genetics sense:

a) combines viability and longevity
b) combines hardiness and productivity.
c) is independent of environment.
d) combines survival and fertility.

1.10 The effect of random genetic drift can be:

a) mostly found in small populations.
b) increased by random mating.
c) measured both in amount and direction.
d) increased in large populations.

Question 2

Differentiate between the following:

a) Positive assortative mating and negative assortative mating. (2 marks)
b) Random mating and non-random mating. (2 marks)
c) Recurrent mutation and non-recurrent mutation. (2 marks)

d) Artificial selection and natural selection. (2 marks)

e) Pre-zygotic reproductive isolation and post-zygotic isolation. (2 marks)

Question 3

a) The frequencies of the M-N blood group two populations were as follows:

	Blood group		
	MM	MN	NN
Population: 1	0.24	0.48	0.28
2	0.03	0.44	0.53

Use the above information to demonstrate how random mating operates. (5 marks)

b) In a sample population of 1000 Aberdeen Angus cattle, coat colour was determined to be:

Phenotype	Genotype	Number
Black	BB and Bb	640
Red	bb	360

Use this information to illustrate how of Hardy-Weinberg principle can be used. (5 marks)

SECTION B [40 MARKS]

Answer ANY TWO questions from this Section.

Question 4

In Shorthorn cattle, three coat colours: red, roan and white, are known. In a population of 1000 Shorthorn cattle, the phenotypes and genotypes were distributed as follows:

Phenotype	Genotype	Number
Red	RR	360
Roan	Rr	480
White	rr	160

a) What kind of gene action is this? Qualify your answer. (3 marks)

b) Calculate the phenotypic frequencies. (3 marks)

c) Calculate the genotypic frequencies. (5 marks)

d) Calculate the gene frequencies. (6 marks)

e) Is this population in Hardy-Weinberg equilibrium? (3 marks)

Question 5

a) Using a hypothetical example illustrate how random genetic drift can affect gene frequency. (10 marks)

b) Explain the term reproductive isolation mechanism in the context of speciation. (2 marks)

c) State and explain the different categories of reproductive isolation mechanisms. (8 marks)

Question 6

a) Write short notes on the following:

i. Natural selection. (2 marks)

ii. Random mating. (2 marks)

iii. Mutation. (2 marks)

iv. Assortative mating. (2 marks)

v. Hardy-Weinberg law. (2 marks)

b) Outline the main steps in the proof of Hardy-Weinberg law and state the assumptions in each step. (10 marks)