MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF BIOLOGICAL SCIENCES

FOURTH YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF ENVIRONMENTAL SCIENCES

SBT 401: GENERAL GENETICS

DATE: 26/7/2019 **TIME: 8.30-10.30 AM**

INSTRUCTIONS

1. Anwer Question 1 (compulsory) and **any two** questions in Section B.
2. Use clean well labelled diagrams wherever appropriate.

SECTION A

QUESTION ONE COMPULSORY (30 MARKS)

a) Explain polymeric gene action (3 marks)

b) Explain Autopolyploidy (3 marks)

c) Why are the recombinant gamete types rare? (3 marks)

d) What is the role of chance in heredity? (3 marks)

e) In humans, ABO blood system is an example of a trait determined by a single gene with three possible alleles. (3 marks)

f) A study was performed to estimate the heritability of human height. Heritability estimates were initially performed in children (average age 5 years old), and found to be 0.74. Heritability was estimated again in the same set of individuals when they were adults (average age 40 years old), and found to be 0.30. How can these results be explained? (3 marks)

g) Some substitution mutations have no effect on the protein coded for. Explain. (3 marks)

h) Genetic variation is largely maintained during meiosis. Explain (3 marks)

i) Give four different changes in the number of chromosomes. (3 marks)

j) What factors influence effective population size in natural populations and what is the direction of their effects? (3 marks)

SECTION B

From questions 2 to, choose and answer any two questions (each question is 20 marks).

QUESTION TWO

a) In the fruit fly, Drosophila melanogaster, crossing over is absent in the males. Suppose you are interested in the relationship between two linked genes on chromosome 2. The genes are for black body (b) and for curved wings (c), each of which is recessive to the normal (B) body color and normal (C) wing shape. In your laboratory, females that are heterozygous at the body color and wing shape loci are mated with a black-bodied male with curved wings. The offspring of these matings were counted, with the following results:

367 normal body, curved wing

131 normal body, normal wing

139 black body, curved wing

363 black body, normal wing

i. What is the cross-over frequency between these two loci? (5 marks)

ii. How many map units separate these two loci? (1 mark)

iii. Show the pattern of linkage in the female flies of this mating? (2 marks)

b) The ultimate source of genetic variation in populations is via MUTATION. Explain (12 marks)

QUESTION THREE

a) A farmer wants to increase the average body weight in a herd of cattle. She begins with a herd having a mean weight of 595 kg and chooses individuals to breed that have a mean weight of 625 kg. 20 offspring were obtained, having the following weights in kg: *612, 587, 604, 589, 615, 641, 575, 611, 610, 598, 589, 620, 617, 577, 609, 633, 588, 599, 601, and 611*.

Calculate the mean, variance, and standard deviation for these cattle. (6 marks)

i. Mean: _____

ii. Variance: _____

iii. Standard Deviation: _____

b) Discuss various ways in which inheritance of some traits can deviate from Mendel's laws of heredity. (14 marks)

QUESTION FOUR

a) Population genetics studies variation in alleles and genotypes within the gene pool. How does this variation change from one generation to the next? (15 marks)

b) Explain what is meant by lethal alleles. (5 marks)

QUESTION FIVE

a) Color blindness in humans is most commonly due to an X-linked recessive allele. Betty has normal vision, but her mother is color blind. Bill is color blind. If Bill and Betty marry and have a child together, what is the probability that the child will be color blind? (15 marks)

b) How do complete, incomplete dominance and codominance differ? (5 marks)