CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF EDUCATION (ARTS), BACHELOR OF SCIENCE, BACHELOR OF SCIENCE IN BIOCHEMISTRY, BACHELOR OF SCIENCE IN ANIMAL SCIENCE, BACHELOR OF SCIENCE IN MATHEMATICS, BACHELOR OF SCIENCE IN CHEMISTRY, BACHELOR OF SCIENCE IN BIOLOGY, BACHELOR OF SCIENCE IN FISHERIES, BACHELOR OF SCIENCE IN MICROBIOLOGY, BACHELOR OF SCIENCE IN NATURAL RESOURCES AND BACHELOR OF SCIENCE IN WILDLIFE

BOTA 111: GENERAL GENETICS

STREAMS: **TIME: 2 HOURS**

DAY/DATE: WEDNESDAY 18/12/2024 **11.30 A.M – 1.30 P.M**

INSTRUCTIONS:

Answer all the questions in section A and any **TWO** question in section B.
Use of calculators and statistical tables is allowed.
Do not write anything on the question paper.

SECTION A (30 MARKS): ANSWER ALL QUESTIONS

1. Explain the following terms:
   (i) Sex-linked traits. (1 mark)
   (ii) Sex-limited traits. (1 mark)
   (iii) Sex-influenced traits. (1 mark)
   (iv) Coupling phase. (1 mark)
2. In an experiment, a male parent (AABb) was crossed with a female parent (aaBB), List the genotypes for the following stages of the cross between these two parents:
   (i) Endosperm nuclei. (2 marks)
   (ii) Zygote. (2 marks

3. An individual identified as having an XYY karyotype proved not to be sterile, and he fathered several children. Assume he mated with normal XX female, list possible sex chromosome genotypes among the offspring and give their probability.
   (6 marks)
4. An individual has the genotype Ab/aB. Gene loci (A) and (B) are 15cM apart. Indicate all the possible gametes this individual can produce, and the proportions of expected progeny genotypes if a test cross is performed on this individual. (6 marks
5. Outline the types of structural chromosomal mutations. (4 marks)
6. Given the following sequence of anticodons,
   UAC-CGU-AAC-UCC
   (i) Determine the transcribed DNA strand. (2 marks)
   (ii) Determine the complementary DNA strand. (2 marks)
   (iii) Determine the mRNA codons. (2 marks)

SECTION B (40 MARKS): ANSWER TWO QUESTIONS

7. (a) Discuss possible reasons that make gene frequencies depart from the proportions predicted by the Hardy-Weinberg formula.
   (10 marks)

(b) In certain human population, the frequency of albino population is 1 in 10000. Albinism is due to recessive gene.
   (i) Calculate the frequency of recessive and normal alleles. (4 marks)
   (ii) Calculate the genotypic frequencies at equilibrium. (6 marks)

8. A variety A is resistant to viral disease caused by strain race 1, but it is susceptible to race 2. Variety B is susceptible to race 1 of the pathogen but resistant to race 2. The F_1 hybrid of the two varieties is resistant to both races. In the F_2 the following segregation was observed.
   Resistant to 1 and 2: 128 plants
   Susceptible to 1 and 2: 14 plants
   Resistant to 1 and susceptible to 2: 39 plants
   Susceptible to 1 and resistant to 2: 44 Plants
   (i) How many genes govern resistance to each race? (2 marks)

(ii) Suggest the expected segregation model and test the given data to determine whether it supports your suggested model at 5% probability level (clearly show your working). (18 marks)

9. (a) Discuss the functions of six key enzymes involved in DNA replication.(6 marks)

(b) Differentiate quantitative and qualitative inheritance. (6 marks)

(c) Illustrate the application of chromosomal manipulation to produce an amphihexaploid species. (8 marks)
