CHUKA   **UNIVERSITY**

UNIVERSITY EXAMINATIONS

**EXAMINATION FOR THE AWARD OF DEGREE OF
BACHELOR OF SCIENCE IN BIOCHEMISTRY, BACHELOR OF SCIENCE IN
MICROBIOLOGY AND BACHELOR OF SCIENCE IN BIOCHEMISTRY, BACHELOR
OF SCIENCE IN BIOLOGY AND BACHELOR OF EDUCATION SCIENCE**

BOTA 111: GENERAL GENETICS

STREAMS: BSC (BIOC) YISI   **TIME: 2 HOURS**

DAY/DATE: THURSDAY 17/12/2020   **8.30 AM – 10.30 AM**

INSTRUCTIONS:

- **Answer ALL the questions in Section A and any Two questions 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

QUESTION ONE – 30 MARKS (COMPULSORY)

(a)   Explain the following terms:
        (i)   Submetacentric chromosome   [2 marks]
        (ii)   Homologous chromosome   [2 marks]
        (iii)   Epigenesis   [2 marks]

(b)   The following DNA sequence represents part of a transcribed gene.
        TACCCCCACGAGTTATATATACGGGGGGGTTAAACTCCATCATCAT
        If all the nucleotide triplets that contain a C constitutes intron DNA and all others exon,

        (i)   Show the processed MRNA   [4 marks]

        (ii)   List the first four amino acids synthesized from the above gene transcript.
                                                            [2 marks]

(c) The following three pairs of alleles exist in an organism, $^+/_x$, $^+/_y$ and $^+/_z$. Each mutant allele is recessive to its wild-type allele (+). A testcross between heterozygous females and homozygous males yields the following results.

+++ =30   x++ =0
++z =32   x+z =430
+y+ =441   xy+ =27
+yz =1   xyz = 39

    (i)   List the classes that are parental types. [1 mark]

    (ii)   How are the members of the allelic pairs distributed in the heterozygous females? [1 mark]

    (iii)   Give the sequence of the three genes. [1 mark]

    (iv)   The map distances between the first and second genes, and the second and third genes. [3 marks]

(d) A colour blind woman with Turner syndrome has a colour blind father and a normal mother. From which parent did she receive the aberrant gamete that cause her turner syndrome condition? Justify your answer. [2 marks]

(e) In a given plant population, the frequency of white flowers' population is 16%. White flower colour in this plant population 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]

SECTION B (40 MARKS): ANSWER ANY TWO QUESTIONS

QUESTION TWO (20 MARKS)

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]

QUESTION THREE (20 MARKS)

Describe the DNA replication.   [20 marks]

QUESTION FOUR (20 MARKS)

Discuss recombination in bacteria.   [20 marks]