

CHUKA

UNIVERSITY



UNIVERSITY EXAMINATIONS

**EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF
SCIENCE IN MICROBIOLOGY AND BIOTECHNOLOGY**

BOTA 223: PRINCIPLES OF MOLECULAR GENETICS

STREAMS: Bsc. MICB (Y2S2)

TIME: 2 HOURS

DAY/DATE: WEDNESDAY 07/07/2021

11.30 A.M. – 1.30 P.M.

INSTRUCTIONS:

- Answer all questions in section A and any two in section B
- Do not write anything on the question paper

SECTION A (30 MARKS)

1. State the functions of the following enzymes in DNA replication. (5 marks)
 - (i) DNA polymerase I
 - (ii) DNA polymerase III
 - (iii) DNA Ligase
 - (iv) DNA gyrase
 - (v) SSB proteins
2. Outline point mutations that occur in DNA sequences encoding proteins. (5 marks)
3. a) Double-stranded DNA from a particular species is 22% adenine. What are the proportions of the other nitrogenous bases in this DNA? (2 marks)
b) The following interruption length of DNA constituents a gene in a eukaryotic organism.
3'-TACCGACCC.....TGCATT-5'
5'-ATGGCTGGC.....ACGTAA-3'

Giving reasons, indicate which side of the DNA duplex (left to right) is transcribed?
(3 marks)

4. Illustrate why the genetic code is said to show degeneracy. (5 marks)

5. Briefly describe how a specific gene from *Arabidopsis thaliana* can be introduced into maize (*Zea mays*)? (5 marks)

6. Outline the properties of the mRNA proposed by Jacob and Monod. (5 marks)

SECTION II (40 MARKS)

7. a) The following DNA sequence represents part of a transcribed gene.

TACCCCGACGAGTTATATATACGGGGGGTTAAACTCCATCAT

If all the nucleotide triplets that contain a C constitute intron DNA and all others exon:

(i) Show the RNA transcript. (5 marks)

(ii) Show the processed mRNA. (5 marks)

(iii) List the amino acids synthesized from the above gene transcript. (5 marks)

b) Compare and contrast the prokaryotic and eukaryotic promoter. (5 marks)

8. a) Briefly describe Rho-independent termination method of transcription in eukaryotes.

Indicate the important features of this mechanism. (10 marks)

b) Describe the mechanism of splicing in eukaryotic nuclei. (10 marks)

9. a) Discuss five applications of molecular markers in plant science. (10 marks)

b) Discuss five applications of recombinant DNA technology. (10 marks)

.....