

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

SECOND YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN AGRICULTURE

BOTA 411: INTRODUCTION TO MOLECULAR GENETICS

STREAMS: BSc, Agric (Y4 S1)

TIME: 2 HOURS

DAY/DATE : WEDNESDAY 22 /09/ 2021

11.30 AM – 1.30 PM

INSTRUCTIONS TO CANDIDATES:

- 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. Describe the structure of DNA polymerase I. [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 interrupted length of DNA constitutes a gene in a eukaryotic organism.

3'- TAACCGACCC.....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 B (40 MARKS)

7. (a) Compare and contrast the prokaryotic and eukaryotic promoters. [5 Marks]
- (b) The following DNA sequence represents part of a transcribed gene.

TACCCCCACGAGTTATATATACGGGGGGTTAAACTCCATCATCAT

If all the nucleotide triplets that contain a C constitutes 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 synthesis from the above gene transcript. [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) Illustrate the lac-operon in *E. coli*. [10 Marks]
- (b) Describe gene editing. [10 Marks]
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