

JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF AGRICULTURAL AND FOOD SCIENCES

SECOND YEAR FIRST SEMESTER UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN AGRICULTURAL EDUCATION EXTENSION

2021/2022 ACADEMIC YEAR

REGULAR

COURSE CODE: AAB 3217/SBB 9707

COURSE TITLE: MOLECULAR CELL BIOLOGY

EXAM VENUE: STREAM: BSc. (Agricultural Education Extension)

DATE: EXAM SESSION:

TIME: 2 HOURS

Instructions:

- 1. Answer ALL questions in Section A and ANY other 2 Questions in Section B.
- 2. Candidates are advised not to write on question paper.
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room.

SECTION A 30 MARKS

ANSWER ALL QUESTIONS IN THIS SECTION

| 1. a) Define the following terminologies | S |
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| i) | Replication fork | (1 mark) |
|------|-------------------|----------|
| ii) | Gene expression | (1 mark) |
| iii) | Nucleosome | (1 mark) |
| iv) | DNA Recombination | (1 mark) |

b) What are Watson-Crick base pairs and how are they important? (3 marks)

- c) What difference between RNA and DNA helps to explain the greater stability of DNA and the implication of this feature on the function of DNA? (3 marks)
- 2. a) Briefly describe the general steps involved in DNA replication (6 marks)
 - b) What are sources of high DNA replication fidelity? (4 marks)
- 3. a) Describe three common types of mutations that can alter the genetic code (6 marks)
 - b) The DNA sequence of a gene coding for a hypothetical protein is given below;
 - 5'-AATGGGATGCATGGCAATTTGAAGTGGAGGAAAATTGGC-3'

Using the sequence;

- i) Deduce the complementary DNA strand sequence (1 mark)
- ii) What will be the sequence of mRNA formed? (1 mark)
- iii) Deduce the amino acid sequence of the hypothetical protein. Use the provided Genetic Code Table. (2 mark)

SECTION B 40 MARKS

ANSWER ANY TWO QUESTIONS IN THIS SECTION

- Q4. Agro bacterium-mediated gene transfer is a very important phenomenon in molecular biology.

 Discuss it and its application in plant sciences (20 marks).
- Q5. Discuss the role of tissue culture in plant science highlighting the major advantages and disadvantages offered by in vitro techniques (20 marks).
- 6 a) Discuss protein structure. For full credit include a discussion of peptide bonds, forces that drive protein folding, the common folding patterns that emerge, the levels of higher ordered structure observed (primary–quaternary structure) and the concept of the protein domain. (10 marks)
 - b) Describe the 3 dimensional structure of DNA. For full credit describe the composition of nucleotides, how nucleotides are covalently bonded, the positions of the bases, specific base-pairing between strands and the orientation of the stands relative to each other. (10 marks)

UNIVERSAL GENETIC CODE TABLE

Second letter

| | | U | С | Α | G | | |
|--------------|---|---------------------------|--------------------------|-------------------------------|--------------------------|---------|--------|
| First letter | U | UUU } Phe UUC } Leu UUG } | UCU UCC UCA UCG | UAU Tyr UAC Stop UAG Stop | UGU Cys UGA Stop UGG Trp | U C A G | |
| | | CUU CUC CUA CUG | CCU CCC CCA CCG | CAU His CAA GIn CAG | CGU CGC CGA CGG | U C A G | Third |
| | Α | AUU AUC AUA Met | ACU ACC ACA ACG | AAU ASN AAA AAG Lys | AGU Ser AGA AGG Arg | U C A G | letter |
| | G | GUU GUC GUA GUG | GCU GCC GCA GCG | GAU Asp GAC Asp GAA GAG | GGU GGC GGA GGG | U C A G | |