



(University of Choice)

**MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)**

MAIN CAMPUS

**UNIVERSITY EXAMINATIONS (MAIN PAPER)
2023/2024 ACADEMIC YEAR**

THIRD YEAR FIRST SEMESTER EXAMINATIONS

**FOR THE DEGREE
OF
BACHELOR OF SCIENCE IN MEDICAL BIOTECHNOLOGY**

COURSE CODE: BMB 311

COURSE TITLE: MOLECULAR GENETICS

DATE: 5TH DECEMBER 2023

TIME: 8.00-10.00AM

INSTRUCTIONS TO CANDIDATES

This paper is divided into three sections, **A B** and **C**, carrying respectively: Multiple Choice Questions (**MCQs**), Short Answer Questions (**SAQs**) and Long Answer Questions (**LAQs**). Answer all questions. **DO NOT WRITE ON THE QUESTION PAPER**

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over.

SECTION A: Multiple Choice Questions (20 Marks)

1. What is the central dogma of molecular biology?
 - A. The process of DNA replication
 - B. The storage and expression of genetic information
 - C. The stages of the cell cycle
 - D. The structure of nucleotides

2. Which phase of the cell cycle is characterized by DNA replication?
 - A. G1 phase
 - B. S phase
 - C. G2 phase
 - D. M phase

3. Which phase of the cell cycle involves cell division to form two daughter cells?
 - A. G1 phase
 - B. S phase
 - C. G2 phase
 - D. M phase

4. What is the function of cyclins and cyclin-dependent kinases in the cell cycle?
 - A. They initiate DNA replication.
 - B. They trigger cell division.
 - C. They control checkpoints between cell cycle phases.
 - D. They are involved in reverse transcription.

5. The following nitrogenous bases are found in both DNA and RNA except-----
 - A. Adenine (A)
 - B. Guanine (G)
 - C. Thymine (T)
 - D. Cytosine (C)

6. What type of bond joins nucleotides in a DNA strand?
 - A. Hydrogen bond
 - B. Ionic bond
 - C. Covalent bond
 - D. Peptide bond

7. Which DNA base always pairs with guanine (G) through three hydrogen bonds?
 - A. Adenine (A)
 - B. Thymine (T)
 - C. Cytosine (C)
 - D. Uracil (U)

8. What is the function of telomerase in eukaryotic cells?
 - A. Synthesizing RNA primers
 - B. Correcting DNA replication errors
 - C. Maintaining telomere length
 - D. Repairing thymine dimers

9. Which type of DNA repair mechanism is responsible for correcting thymine dimers caused by UV light?

- A. Nucleotide excision repair
 - B. Base excision repair
 - C. Mismatch repair
 - D. Transcription-coupled repair
10. Which enzyme synthesizes a short RNA primer during DNA replication?
- A. DNA polymerase I
 - B. DNA polymerase III
 - C. Primase
 - D. Helicase
11. In which phase of the eukaryotic cell cycle does most DNA repair occur?
- A. G₁ phase
 - B. S phase
 - C. G₂ phase
 - D. M phase
12. What is the primary role of DNA gyrase (DNA topoisomerase II) during DNA replication?
- A. Initiating DNA synthesis
 - B. Proofreading DNA
 - C. Introducing negative supercoiling
 - D. Sealing nicks in DNA
13. Which genetic disorder is characterized by extreme sensitivity to sunlight and a predisposition to skin cancer?
- A. Xeroderma pigmentosum
 - B. Hereditary nonpolyposis colorectal cancer
 - C. Lynch syndrome
 - D. Alzheimer's disease
14. What is the main consequence of a deficiency in DNA mismatch repair, as seen in hereditary nonpolyposis colorectal cancer (HNPCC)?
- A. Skin freckling and ulcerations
 - B. Extreme sensitivity to sunlight
 - C. Microsatellite instability
 - D. Loss of DNA polymerase activity
15. In eukaryotes, where does RNA polymerase II primarily synthesize hnRNA/mRNA?
- A. Nucleolus
 - B. Nucleoplasm
 - C. Cytoplasm
 - D. Ribosome
16. What is the name of the enzyme responsible for adding a 7-methylguanosine cap to the 5' end of mRNA?
- A. RNA polymerase
 - B. Reverse transcriptase
 - C. RNA ligase
 - D. Capping enzyme

17. During translation, which site on the ribosome is where the growing peptide chain is attached?

- A. P site
- B. A site
- C. E site
- D. T site

18. What is the universal start codon for protein synthesis in both prokaryotes and eukaryotes?

- A. UGA
- B. AUG
- C. UAA
- D. AGU

19. In the genetic code, how many codons code for amino acids?

- A. 20 codons
- B. 61 codons
- C. 64 codons
- D. 3 codons

20. Which type of mutation results in the replacement of a purine-pyrimidine base pair with a different purine-pyrimidine base pair?

- A. Transition
- B. Transversion
- C. Deletion
- D. Insertion

SECTION B: Short Answer Questions (40 Marks)

1. Explain the process of DNA replication in prokaryotes. (4 Marks)
2. Explain the process of DNA replication in eukaryotes. (4 Marks)
3. Describe the repair mechanisms used by cells to maintain the integrity of DNA. (8 Marks)
4. Explain the significance of telomerase in maintaining the stability of eukaryotic chromosomes. (8 Marks)
5. Describe the key steps involved in the initiation of translation in protein synthesis (4 Marks)
6. State the role of ribosomal subunits, tRNA, and the start codon. (4 Marks).
7. Describe the process of mRNA processing in eukaryotes (4 Marks).
8. State the significance of posttranscriptional processing in eukaryotic mRNA (4 Marks).

SECTION C: Long Answer Questions (60 Marks)

1. Explain the roles of ribosomes, tRNA, mRNA, and specific factors involved in each stage providing examples of inhibitors of protein synthesis and their mechanisms of action. (20 Marks)
2. Discuss the various types of mutations and their implications on genetic information and protein synthesis. (20 Marks)
3. Describe the organization of DNA, including its structure, nucleotide composition, and the roles of purines and pyrimidines. (20 Marks)