



(University of Choice)

**MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)
UNIVERSITY EXAMINATIONS (MAIN PAPER)
2023/2024 ACADEMIC YEAR**

FOURTH YEAR FIRST SEMESTER EXAMINATIONS

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

COURSE CODE: BMB 411

**COURSE TITLE: ADVANCED NUCLEIC ACID
TECHNOLOGY**

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

1. _____ are vectors derived from Bacteriophages
 - A. λ and M13
 - B. lacZ and EcoRI
 - C. Retroviruses
 - D. SCV40 viral vectors
2. Yield increases _____ if the recombinant λ DNA is packaged into phage particles *in vitro*
 - A. $10^5 - 10^6$
 - B. $10^6 - 10^7$
 - C. $10^7 - 10^8$
 - D. $10^8 - 10^9$
3. The size of λ gt11 is 43.7 kb, and the vector can therefore accommodate up to-----
 - A. 5.2 kb
 - B. 7.2 kb
 - C. 6.2 kb
 - D. 8.2 kb
4. _____ is a filamentous bacteriophage of male *E. coli*
 - A. Phage λ
 - B. Phage β
 - C. pUC
 - D. M13
5. The M13 vectors consist of which modifications of the M13 wild type DNA-----
 - A. *lacI'OPZ' operon*
 - B. Sex pili
 - C. F' episome
 - D. *lacZ* gene
6. Total length of STR markers is significantly shorter than VNTRs, usually between-----
 - A. 100-450 bp
 - B. 50-100 bp
 - C. 70-100 bp
 - D. 100-200 bp
7. Which one of the following is not a frequently used single-locus probes?
 - A. D1S7
 - B. D2S44
 - C. D4S139
 - D. D5S111
8. _____ is among the most studied Papovaviruses
 - A. M13
 - B. SV40
 - C. *Autographa californica*
 - D. Baculovirus
9. Retrovirus contain _____ as the genetic material
 - A. DNA

- B. gag gene
 - C. RNA
 - D. env gene
10. In the construction of viral vector, most of the viral structural genes are deleted, but the _____ are retained
- A. LTR and PSI
 - B. *Hyg* gene
 - C. pol
 - D. neo gene
11. The *Hyg* gene is for _____ resistance
- A. Ampicillin
 - B. Tetracycline
 - C. Karamycin
 - D. Hygromycine
12. The neo gene is for _____ resistance
- A. Ampicillin
 - B. Tetracycline
 - C. Karamycin
 - D. Hygromycine
13. Protein contamination can be removed by digestion with a proteolytic enzyme such as _____ during RNA isolation
- A. RNase
 - B. Proteinase K
 - C. DNase
 - D. Lysozyme
14. The enzyme that completes the nick between the 3'-OH and the 5'-P by forming a phosphodiester bond is-----
- A. Restriction enzymes
 - B. Ligase
 - C. DNA polymerase
 - D. RNA polymerase
15. Enzymes that cut both DNA strands at the same position resulting in ____ DNA fragments
- A. Sticky
 - B. Hanging
 - C. Cohesive
 - D. Blunt-end
16. In nick translation, the DNA fragment to be labeled is first nicked in a random manner by the action of pancreatic-----
- A. Deoxyribonuclease I
 - B. RNA polymerase
 - C. Restriction enzymes

D. Ligase

17. _____ is a physical mapping technique which is used to determine the relative location of restriction sites on a DNA fragment:
- A. DNA fingerprinting
 - B. Genetic mapping
 - C. Restriction mapping
 - D. Ligation
18. _____ is an important technique for the separation of macromolecules
- A. Northern blotting
 - B. Western blotting
 - C. DNA isolation
 - D. Gel electrophoresis
19. The enzyme Pol I can be cleaved to produce a large fragment known as the:-----
- A. Okazaki fragment
 - B. ssDNA fragment
 - C. Klenow fragment
 - D. ds DNA fragment
20. _____ is particularly useful for analyzing gene expression
- A. Northern blotting
 - B. PAGE
 - C. Southern blotting
 - D. DNA polymerization

SECTION B: SHORT ANSWER QUESTIONS (40 MKS)

1. Outline the essential yeast chromosomal elements and their structural features [5 Marks]
2. Distinguish between the lytic and lysogenic bacteriophage λ life cycle [5 Marks]
3. List the advantages of using short tandem repeats [5 Marks]
4. Describe how a *Baculovirus* transfer vector is constructed [5 Marks]
5. Explain the process of cell lysis in isolation of nucleic acids [5 Marks]
6. Describe what is artificial competence of cells [5 Marks]
7. Distinguish between high and low copy plasmids [5 Marks]
8. Explain the functioning of Klenow fragment [5 Marks]

SECTION C: LONG ANSWER QUESTIONS (60 MKS)

1. Elucidate the process of transfection and in vitro packaging phage λ DNA and recombinant λ DNA [20 Marks]
2. Using a diagram illustrate the production of retrovirus safe vector [20 Marks]
3. Discuss the process of nucleic acid purification [20 Marks]