



(University of Choice)

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

(MAIN CAMPUS)

**UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR**

**SECOND YEAR END OF SECOND SEMESTER
EXAMINATIONS**

**FOR THE BACHELOR OF SCIENCE
IN
1. MEDICAL LABORATORY SCIENCE
2. MEDICAL BIOTECHNOLOGY**

COURSE CODE: BML 222

COURSE TITLE: MOLECULAR BIOLOGY

DATE: 22/04/2022

TIME: 12:00- 2:00 PM

INSTRUCTIONS:

ANSWER ALL QUESTIONS IN SECTION A, B AND C

USE DIAGRAMS IN YOUR EXPLANATIONS, WHENEVER APPLICABLE

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. Sequential nucleotide sequences
 - (a) Fragment lengths range from 100-1000 nucleobases
 - (b) Strictly target complementary sequences for detection
 - (c) Are expressible *in vivo* via plasmids
 - (d) Can be accompanied by ³²P markers
2. Non Coding RNAs
 - (a) Include subsets encoded in extranucleous positions
 - (b) Mediate central dogma special transfers
 - (c) Transfer sequence information in hnRNA synthesis
 - (d) Include primary mRNA transcripts
3. rDNA expression vectors
 - (a) Can be used for anti-diabetic insulin production
 - (b) Are hot plasmids for injection into viral replicons
 - (c) Are cloned by DNA splitting ligases
 - (d) Are extracted using DEAE-dextran
4. Most phage vectors
 - (a) Are coliphage derivatives
 - (b) Are potent replicons
 - (c) Are inserted into targets with poly A tails
 - (d) Are commonly applied in expression of insulin
5. The multistep initial stage in protein biosynthesis
 - (a) Utilises DNA polymerase activities
 - (b) Is mediated by tRNA-involving decoding
 - (c) Translocates rRNA from the nucleus
 - (d) Takes place in the nucleus
6. Exogenous siRNA
 - (a) Can be generated by insertion of cDNA
 - (b) Can be created using short oligonucleotide reagents
 - (c) Are processed using RISC pathways
 - (d) Are altered in the transcriptome
7. The Boveri–Sutton chromosome theory of inheritance
 - a) Were integrated with Mendel's theories by Thomas Hunt Morgan in 1915
 - b) Are the basis for population genetics and modern evolutionary synthesis
 - c) Says an organism with one dominant allele will display the dominant allele
 - d) Explains the law of dominance in phenotypic determination
8. Allele frequency
 - (a) Is the fraction of all chromosomes in a population that carry an allele
 - (b) Provides a raw material for molecular evolution
 - (c) Can be analysed using error-prone replication by-pass
 - (d) Is independent of the total number of chromosome copies in a population
9. In transcription regulation
 - (a) Enhancers bond with activators
 - (b) Special transfers are tRNA-decoded
 - (c) Activators bind mRNA to the polysome
 - (d) Probes anneal exons into the P-site

10. Molecular tautomerism
 - (a) Causes loss of a purine
 - (b) Causes loss of a pyrimidine
 - (c) Alters hydrogen bonding patterns
 - (d) Generates hypoxanthine from 5-methyl cytosine
11. The PCR technique
 - (a) Has an occasional final elongation at 70°C to 74°C
 - (b) Involves Taq-polymerase-mediated elongation at 76°C to 87°C
 - (c) Involves annealing for 60 minutes
 - (d) Can only be done via automation thermocycling
12. In DNA extraction
 - (a) Used surfactants also serve in cell lysis
 - (b) RNase purifies DNA
 - (c) Sonication aids in protein removal
 - (d) Chelating agents sequester trivalent ions
13. The Creutzfeldt-Jakob disease
 - (a) Originated from cadaver HGH effects
 - (b) Emanated following transposition
 - (c) Is an outcome of a glycine-altering point mutation
 - (d) Is triggered by insertional activation of rDNA
14. The following statements are UNTRUE of molecular transfection EXCEPT
 - (a) It can involve supercoiled plasmid DNA
 - (b) Gene gun coupling can be used for chemical DNA delivery
 - (c) Optical methods mediate infection
 - (d) Transduction is done with a virus
15. Which one of the following statements is NOT TRUE concerning TFs
 - (a) They bind to promoter DNA zones
 - (b) They have DBDs for adjacent positioning
 - (c) They mediate DNA polymerase attachment to ssDNA templates
 - (d) They independently mediate codon sequence copying
16. In DNA therapeutic delivery into cells
 - (a) Bacteria can carry agent for introduction
 - (b) Repeated treatments are required
 - (c) Viral methods offer large scale production advantages
 - (d) Electroporation and *in situ* hybridization mediate agent transfers
17. Post translational modification
 - (a) Causes splicing of protein disulphides
 - (b) Takes place inside SER
 - (c) Starts after entry into cisternae mediated by a leader sequence
 - (d) Involves moiety addition in RER
18. Molecular evolution
 - (a) Commences with transposon drifts
 - (b) Explains principles of computational biology
 - (c) Emphasizes effects of single nucleotide changes
 - (d) Deals with depurination effects on assortative outcomes
19. In Northern blotting
 - (a) Endonucleases target specific recognition sites
 - (b) Data outcomes can be used to quantify stress levels
 - (c) DNA molecules are blotted onto nitrocellulose
 - (d) DNA ligase plays a DNA regulatory role
20. From NNI definition molecular nanoparticles
 - (a) Range in size from 1 to 110 nm

- (b) Can be generated in plasmids
- (c) Can be attrition-prepared
- (d) Can be generated using transcription mechanosynthesis

SECTION B: SHORT ANSWER QUESTIONS

[40 MARKS]

1. Describe what is involved in the performance of a Gene knock out **(4 marks)**
2. Outline a procedure that can be used in the transformation of cells using a vehicular plasmid **(4 marks)**
3. Distinguish between the over- and under-winding of a DNA strand **(4 marks)**
4. Describe primer hybridization to the ssDNA template a during in vitro DNA amplification **(4 marks)**
5. Identify any currents challenges in applications of rDNA capabilities? **(4 marks)**
6. Which features distinguish the central adaptor molecule in extranuclear translation. **(4 marks)**
7. Outline how a base change by repositioning of a hydrogen atom can affect DNA. **(4 marks)**
8. Explain change in the sequence composition of cellular molecules such as DNA and RNA **(4 marks)**
9. Identify a lab. Method that can be used to detect specific types of RNA in a mixture **(4 marks)**
10. Describe the features of various mRNA intermediates **(4 marks)**

SECTION C: LONG ANSWER QUESTIONS

[60 MARKS]

1. Illustrate and explain hybridization mechanisms between T and A **(20 marks)**
2. Explain the detailed residue by residues transfer of sequential information amongst sequential information carrying biopolymers **(20 marks)**
3. Discuss the natural mechanism requiring Polymerase holoenzyme catalysis **(20 marks)**