(*University of Choice*)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

SPECIAL/SUPPLEMENTARY EXAMINATIONS
2019/2020 ACADEMIC YEAR

FOURTH YEAR SEMESTER TWO EXAMINATIONS

FOR THE DEGREE OF
BACHELOR OF MEDICAL BIOTECHNOLOGY

COURSE CODE: BMB 423

COURSE TITLE: HUMAN GENOMICS, PROTEOMICS & PROTEIN ENGINEERING

DATE: 21st October 2020 **TIME: 8.00 AM -10.00 AM**

INSTRUCTIONS TO CANDIDATES:

This examination paper consists of three sections. Answer all questions in ALL the sections.

1) SECTION **A:** Single Best Answer Questions
2) SECTION **B:** Short Answer Questions
3) SECTION **C:** Long Answer Questions

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 5 Printed Pages. Please Turn Over.

SECTION A: CHOOSE SINGLE BEST ANSWER (20 MARKS)

Q1. Which of the following **is not** a method of studying DNA methylation?
a) Histone dimethylation
b) Bisulfite treatment of DNA
c) Methylated DNA immunoprecipiation
d) Methylation hybridization

Q2. Which of the following **is not true** of protein engineering?
a) Develops proteins of desired function
b) Manipulates stability and specificity of proteins
c) Protein production is via altered site-directed or -specific mutagenesis
d) Rationale protein gene design is done by chemical synthesis

Q3. Which of the following **is not true** about development of the *one gene, one enzyme* concept?
a) G. Beadle
b) E.L. Tatum
c) Developed in 1941
d) J.V. Neel

Q4. Which of the following **is not true** about the construction of the first recombinant DNA molecule?
a) P. Berg
b) F. Sanger
c) Insertion of *E. coli* galactose metabolism genes into SV40 genome
d) Inception in 1972

Q5. Which of the following **is not true** regarding the human genome?
a) Size of 3,234.8 Mbp per haploid genome
b) Coding DNA constitute <2% of the genome
c) Excludes mitochondrial genome
d) 23 pairs of chromosomes

Q6. Which of the following **is not true** about functional genomics?
a) Examines gene transcription, translation and protein-protein interactions
b) Examines single gene phenotypes
c) Examines DNA function at gene, transcript and protein levels
d) Describes gene and protein function and interactions

Q7. Which of the following statements about structural genomics **is false**?

a) Evaluates 2-dimenstional structure of proteins from a genome
b) Describes 3-dimenstional structure of protein of a specific genome
c) Genome-based approach allows high throughput method of structure determination
d) Experimental and modelling approaches are used in structure determination

Q8. Which of the following **is not** a step in environmental shortgun sequencing technique in metagenomics?

a) Sampling from habitat and filter particles by size
b) Culture and DNA extraction
c) Cloning, library construction and clone sequencing
d) Sequence assembly into contigs and scaffolds

Q9. Which, if any, of the following statements **is false**?

a) Most of the inherited changes in our DNA arise because of exposure to extracellular mutagens, including radiation sources and chemical mutagens
b) Most of the inherited changes in our DNA arise because of unavoidable endogenous errors in cellular mechanisms and harmful effects of certain natural molecules and atoms within our cells
c) Errors in DNA replication and DNA repair are a major source of mutations in our cells
d) Significant chemical damage is sustained by DNA because of its proximity to water molecules in our cells

Q10. With reference to base cross-linking, which, if any, of the following statements, **is false**?

a) Base cross-linking means that covalent bonds form between two bases
b) The cross-linked bases are on opposing DNA strands
c) The anti-cancer agent cisplatin causes a type of cross-linking between two guanine residues
d) Pyrimidine dimers are a type of base cross-linking that is commonly induced by excess exposure to sunlight

Q11. What, approximately, is the fraction of genetic variation in the nuclear genome is that is expected to have a harmful effect on gene function?

a) 50%
b) 25%
c) 10%
d) 1%

Q12. With reference to aberrant methylation of bases, which of the following statements, if any, **is false**?
   a) *S*-adenosylmethionine donates methyl groups to different molecules in cells and frequently inappropriately methylates bases in DNA
   b) Guanine is occasionally methylated to give *O*-6-methylguanine which base pairs with adenine rather than with cytidine
   c) In each nucleated cell, about 300-600 adenines are converted to 3-methyladenine per day
   d) 3-methyladenine can be a cytotoxic base: it distorts the double helix and that can disrupt crucial DNA-protein interactions

Q13. The effects of protein on an entire organism is described in:
   a) Cellular function
   b) Molecular function
   c) Phenotypic function
   d) Structural genomics

Q14. Genes of different species but possessing a clear sequence and functional relationship to each other are:
   a) Ortholog
   b) Synteny
   c) Paralog
   d) Microarray

Q15. Collection of microscopic DNA spots attached to solid surface are:
   a) Ortholog
   b) Synteny
   c) Microarray
   d) Paralog

Q16. Which of the following **is not** a DNA sequencing methods?
   a) Dideoxy sequencing
   b) Pyrosequencing
   c) Edman degradation
   d) Fluorescent *in situ* sequencing

Q17. Which of the following **was not** a stage in the human genome project?
   a) RNA extraction
   b) Obtaining a DNA clone to sequence
   c) Sequencing the DNA clone
   d) Assembling sequence data from multiple clones to determine overlap and establish a contiguous sequence

Q18. Which of the following organisms **is not** used in third generation biofuel production?
   a) *Clostridium acetobutylicum*
   b) Microalgae
   c) Cyanobacteria
   d) Blue-green algae

Q19. Which of the following **is not true** about pharmacogenomics?
   a) Drug metabolism gene pathways
   b) Genetic variations in drug responses
   c) Adverse drug reaction gene mutations
   d) Drug dose protocols

Q20. The structure of mitochondrial DNA is described as:

a) Linear
b) Circular
c) Double helix
d) Ladder like

SECTION B: SHORT ANSWER QUESTIONS (40 MARKS)

Q18. Define the following terms as used in human genomics and proteomics (8 marks).
a) Nutrigenomics
b) Metabolomics
c) Transcriptomics
d) Ontology

Q19. Define and explain the importance of comparative genomics (8 marks).

Q20. Outline the two different approaches to protein engineering (8 marks).

Q21. State the advantages of microarray-based comparative genomic hybridization technology (8 marks).

Q22. Outline a genomic approach to drug discovery (8 marks).

SECTION C: LONG-ANSWER QUESTIONS (60 MARKS)

Q23. Citing specific examples, discuss the applications of proteomics (20 marks).

Q24. Discuss the ethical issues arising from the human genome project (20 marks).

Q25. Citing specific examples, discuss the applications of human genomics (20 marks).