OF

(*University of Choice*)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS
2018/2019 ACADEMIC YEAR

FOURTH YEAR FIRST SEMESTER EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF SCIENCE MEDICAL BIOTECHNOLOGY SUPPLEMENTARY/SPECIAL EXAM

COURSE CODE: BMB 421

COURSE TITLE: GENE EXPRESSION SYSTEMS AND SEQUENCING

DATE:

TIME:

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**).

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

SECTION A: MULTIPLE CHOICE QUESTIONS (20 MARKS)

1. When scientists were attempting to determine the features of the genetic code, Crick and co-workers found that when three base additions or three base deletions occurred in a single gene, the wild type phenotype was sometimes restored. This observation supported the hypothesis that
   A. The code is triplet.
   B. AUG is the initiating triplet.
   C. The code is overlapping.
   D. There are three amino acids per base.

2. In 1964, Nirenberg and Leder used the triplet binding assay to determine specific codon assignments. A complex of which of the following components was trapped on the nitrocellulose filter?
   A. Ribosomes and DNA
   B. Free tRNAs
   C. Charged tRNA, RNA triplet, and ribosome
   D. Uncharged tRNAs and ribosomes

3. Which of the following is true?
   A. Every amino acid is coded for by a single codon.
   B. There are more amino acids than there are codons.
   C. Every codon codes for an amino acid.
   D. Each codon in a gene codes for no more than one single amino acid.

4. The genetic code is “degenerate” because
   A. There are more codons than amino acids.
   B. There are more amino acids than codons.
   C. Different organisms use different codons to encode the same amino acid.
   D. Some codons specify more than one amino acid.

5. What is the name given to the three bases in a messenger RNA that bind to the anticodon of tRNA to specify an amino acid placement in a protein?
   A. Protein
   B. Anti-anticodon
   C. Cistron
   D. Codon

6. When studying the initiation of transcription, one often finds consensus sequences located in the region of the DNA where RNA polymerase(s) bind. Which are common consensus sequences?
   A. CAAT, TATA
   B. GGTTC, TTAT
   C. TTTTAAAA, GGGGCCCC
   D. Any trinucleotide repeat

7. An intron is a section of
   A. Protein that is clipped out post-translationally.
   B. RNA that is removed during RNA processing.
   C. DNA that is removed during DNA processing.

D. Transfer RNA that binds to the anticodon.

8. Three posttranscriptional modifications often seen in the maturation of mRNA in eukaryotes are
   A. 5'-capping, 3'-poly (A) tail addition, splicing
   B. 3'-capping, 5'-poly (A) tail addition, splicing
   C. Removal of exons, insertion of introns, capping
   D. 5'-poly (A) tail addition, insertion of introns, capping

9. What is the initiator triplet in both prokaryotes and eukaryotes and what is the amino acid coded for by this triplet?
   A. UAA, no amino acid coded.
   B. UAA, methionine.
   C. AUG, arginine.
   D. AUG, methionine.

10. Which type of RNA molecule carries an amino acid to the ribosome?
   A. tRNA
   B. rRNA
   C. mRNA
   D. siRNA

11. The term “peptidyl transferase” relates to
   A. Base additions during mRNA synthesis.
   B. Peptide bond formation during protein synthesis.
   C. Elongation factors binding to the large ribosomal subunit.
   D. 5' capping of mRNA.

12. By their experimentation using the *Neurospora* fungus, Beadle and Tatum were able to propose the hypothesis that:
   A. Prototrophs will grow only if provided with nutritional supplements.
   B. Several different enzymes may be involved in the same step in a biochemical pathway.
   C. The role of a specific gene is to produce a specific enzyme.
   D. More than one codon can specify a given amino acid.

13. What is the term which refers to a contiguous set of bacterial genes which are under coordinate control?
   A. Lysogen.
   B. Prototroph.
   C. Operon.
   D. Allosteric.

14. Which term most appropriately refers to a *trans* acting regulatory factor?
   A. Translation
   B. RNA processing
   C. DNA binding protein
   D. Helicase activation

15. The *lac* operon

A. Is under negative and positive control.
B. Is under positive control *only*.
C. Is normally expressed constitutively.
D. Is an example of tissue-specific expression?

16. What is the function of cAMP in regulation of the *lac* operon?
A. Activates a repressor protein
B. Activates an activator protein
C. Inactivates a repressor protein
D. Inactivates an activator protein

17. When a repressor binds to an operator, what process is affected?
A. Transcription of the operon is prevented.
B. DNA replication of the operon is prevented.
C. mRNA made from the operon cannot be translated.
D. Protein made from the operon does not function.

18. A mutant *E. coli* strain, grown under conditions that normally induce the *lac* operon, produces high amount of ß-galactosidase. What is a possible genotype of the cells? (*I* = *lac* repressor gene; *Z, Y, A* = *lac* operon structural genes; *P* = *lac* promoter; *O* = *lac* operator)
A. $lacI^+\ lacP^+\ lacO^+\ lacZ^-\ lacY^+\ lacA^+$
B. $lacI^+\ lacP^+\ lacO^c\ lacZ^+\ lacY^+\ lacA^+$
C. $lacI^-\ lacP^+\ lacO^+\ lacZ^-\ lacY^+\ lacA^+$
D. $lacI^+\ lacP^-\ lacO^+\ lacZ^+\ lacY^+\ lacA^+$

19. Consider a bacterial strain that has a mutant *lac* operator region that cannot bind repressor. If you were to introduce into this strain a wild type operator region on an F' element, the cell would
A. Synthesize lactose.
B. Display inducible expression of the *lac* operon.
C. Display constitutive expression of the *lac* operon.
D. Probably not catabolize lactose.

20. With regards to the *trp* operon,
A. Tryptophan is an inducer.
B. Tryptophan is a co-repressor.
C. Attenuation can halt replication.
D. None of the above.

SECTION B: SHORT ANSWER QUESTIONS (40 MARKS)

1. Give a detailed structure of a gene. [8 Marks]
2. a) List any four eukaryotic promoter elements. [4 Marks]
   b) Differentiate between splicing and alternative splicing. [4 Marks]
3. Describe RNA processing. [8 Marks]
4. Describe characteristics of the genetic code. [8 Marks]
5. a) List requirements for translation. [4 Marks]
   b) Which factors control gene expression? [4 Marks]

SECTION C: LONG ANSWER QUESTIONS (40 MARKS)

1. Discuss the Sanger dideoxy-sequencing technique. [20 Marks]
2. Describe the human genome project. [20 Marks]