(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR

FOURTH YEAR SEMESTER TWO EXAMINATIONS

FOR THE DEGREE OF
BACHELOR OF MEDICAL BIOTECHNOLOGY

COURSE CODE: BMB 324

COURSE TITLE: POPULATION GENETICS

DATE: 8th December 2020   **TIME: 2.00 -4.00PM**

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 true** about the mechanisms of new gene evolution?
   a) Gene duplication
   b) Vertical gene transfer
   c) Gene fusion and fission
   d) Transposable element protein domestication

Q2.   Which of the following **is not true** regarding genetic mutations?
   a) Genetic sequence changes
   b) Affect individuals carrying them or descendants
   c) Occur randomly in the genome
   d) Cause genetic homogeneity

Q3.   Which of the following **is not** a selection that shapes evolution?
   a) Stabilizing selection that maintains the population at a stable optimal value
   b) Unbalancing selection that selects the optimal compromise among several constraints
   c) Directional selection that transforms the value of a trait by increasing the frequency of individuals closer to a distant optimum
   d) Disruptive selection that increases the frequency of large and small values of a trait at the expense of intermediate values

Q4.   If there is only one allele for a gene in a population, that gene is referred to as:
   a) Common
   b) Fixed
   c) Monocistronic
   d) Monoallelic

Q5.A wild type is:
   a) the phenotype found most commonly in nature
   b) the dominant allele
   c) designated by a small letter if it is recessive or a capital letter if it is dominant
   d) a trait found on the X chromosome

Q6.   In a cross that follows a single trait, if a homozygous dominant is crossed with a heterozygote for a given trait, the offspring will be:
   a) all homozygous dominant
   b) ¼ of the recessive phenotype
   c) all homozygous recessive
   d) all of the dominant phenotype

Q7. A 1:1 phenotypic ratio in a test cross indicates that
   a) the alleles are dominant
   b) one parent must have been homozygous dominant
   c) the alleles segregated independently
   d) the alleles are co-dominant

Q8. In population genetics, migration is synonymous with?
   a) Gene flow
   b) Genetic drift
   c) Selection
   d) Mutation

Q9. Which of the following statements regarding the founder effect **is false**?
   a) Explains the low frequency of genetic diseases in some island populations of humans
   b) Tends to reduce genetic variability in the founder population compared to the source population
   c) Tends to lead to lowered heterozygosity
   d) Is a process that randomly affects allele frequencies

Q10.   Which of the following is the most common genetic disease in malaria endemic regions of Kenya?
   a) Sickle cell disease
   b) Lactose intolerance
   c) Thalassaemia
   d) Tay-Sachs disease

Q11.   Which of the following **is true** of genetic distance?
   a) Measure of the number and diversity of different alleles and haplotypes within a population
   b) Measure of the number of base pair differences between two homologous sequences
   c) Measure of the number and diversity of variable nucleotide positions within sequences of a population
   d) Proportion of nucleotide substitutions that do not or that do result in amino acid replacement

Q12.   Which of the following **is not** an effect of consanguinity?
   a) Prenatal deaths
   b) Decreased genetic diversity
   c) Increased intelligence
   d) Sensoneural defects

Which of the following **is true** of copy number variation?
   e) Single nucleotide polymorphisms
   f) Minisatellites
   g) Microsatellites
   h) Variation in number of copies of one or more genes

Q13.   Which of the following **is not** an autosomal recessive disorder?
   a) Haemophilia
   b) Albinism
   c) Sickle cell disease
   d) Cystic fibrosis

Q14.   Which of the following **does not** affect the gene pool?
   a) Deaths
   b) Immigration
   c) Emigration
   d) Crossing

Q15.   Which of the following **is not** a method of measuring whole genome variation in the population?
   a) Whole genome shotgun sequencing
   b) Allozymes
   c) RNA-Seq (sequence complete transcriptome)
   d) Restriction-site associated DNA markers (RAD-Seq)

Q16.   Who among the following developed the mathematical theory of gene frequency change under selection?
   a) John Burdon Haldane
   b) Gregor Mendel
   c) Sewall Wright
   d) Sir Ronal Fisher

Q17.   Which of the following **is not true** of a species?
   a) Distinguishes organisms
   b) Gene pool dissimilarity
   c) Shared reproduction
   d) Shared evolution

Q18.   Which of the following **is not true** of multifactorial genetic disorders?
   a) Familial segregation and/or aggregation
   b) Influenced by the environment
   c) Occur more frequently in specific ethnic groups
   d) Monozygotic and dizygotic disconcordance

Q19.   Which of the following **is not** an exception to Mendel's principle of uniformity
   a) Penetrance
   b) Dominance
   c) Expressivity
   d) Sex-linkage

SECTION B: SHORT ANSWER QUESTIONS (40 MARKS)
Q20.   a) Differentiate between genetic epistasis and pleiotropy (5 marks).

b) State the neutral theory of evolutionary changes in populations (3 marks).

Q21. Given that 49 out of 100 individuals in a population express the recessive phenotype. Calculate the percentage of heterozygotes and alleles (8 marks).

Q22. Define and state the assumptions of the Hardy Weinberg equilibrium (8 marks).

Q23. Outline the types and importance of dimorphism and threshold traits (8 marks)

Q24. State the uses and tools of the HuGE Pub Lit database (8 marks).

SECTION C: LONG-ANSWER QUESTIONS (60 MARKS)

Q25. Citing specific examples, discuss the importance of studying population genetics (20 marks).

Q26. Discuss the mechanisms that cause genetic diversity in human populations (20 marks).

Q27. Calculate (showing all steps) the genotypes and alleles from a genetic cross predicted to give a phenotypic ratio of 9:3:3:1 (20 marks).