THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

A. M. E. C. E. A

P.O. Box 62157
00200 Nairobi - KENYA
Telephone: 891601-6
Fax: 254-20-891084
E-mail:academics@cuea.edu

MAIN EXAMINATION

AUGUST – DECEMBER 2018 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF BIOLOGY

REGULAR PROGRAMME

BIO 200: GENERAL GENETICS

Date: DECEMBER 2018	**Duration: 2 Hours**
INSTRUCTIONS: Answer Question ONE and any other TWO Questions	

Q1. a) A dominant allele W confers black fur on guinea pigs. A guinea pig that is homozygous recessive (ww) has white fur. A farmer would like to know the genotype of her black-furred guinea pig. How might she determine her pets' genotype? **(3 marks)**

b) Individuals showing Down syndrome usually have an extra chromosome 21, so their body cells contain 47 chromosomes.

i) At what stage in meiosis could a mistake occur resulting in the altered chromosome number? **(2 marks)**

ii) In a few cases, 46 chromosomes are present, including two normal-appearing chromosome 21 and a larger-than –normal chromosome 14. Explain how this situation can arise. **(2 marks)**

c) A double stranded DNA polynucleotide contains 80 thymine and 110 guanines. What is the total nucleotide number in this DNA fragment? **(4 marks)**

d) In humans, the condition for normal vision dominates colour blindness. Both genes are linked to the X chromosome. A normal-visioned male marries a colour-blind woman. She gives birth to a colour-blind daughter. The husband claims the child is not his. The wife claims the child is his. Can you support the argument of either parent? If yes, which one? Why? **(5 marks)**

e) i) Briefly describe steps/stages involved in a typical gene cloning procedure **(6 marks)**

ii) Discuss any four ethical concerns of cloning **(4 marks)**

d) Make a distinction between the following:

i) Linkage and crossing over **(2 marks)**

ii) Transformation and transduction **(2 marks)**

Q2. a) Briefly describe the conditions required for the Hardy- Weinberg equilibrium to be maintained. **(10 marks)**

b) A group of 100 people splits away from a larger population and establishes a separate society. With respect to the MN blood types, the emigrants number: type M = 41, type MN = 38, type N = 21

i) What are the allelic frequencies? **(5 marks)**

ii) If this group and their descendants meet the condition of the Hardy-Weinberg Law, what are the expected frequencies of the MN phenotypes in the subsequent generations? (Because the group is fairly small, assume the genetic drift is negligible) **(5 marks)**

Q3. a) What is Gene interaction? **(2marks)**

b) In some organisms where each of two gene pairs affects the same character, there is complete dominance at both gene pairs; new phenotypes result from interaction between dominants, and also from interaction between both homozygous recessives. For example comb shape in poultry is determined by two gene pairs A and B. For gene pair A rose comb is dominant over nonrose. For gene pair B, pea comb is dominant over nonpeak. The genes interact in such a way that dominants for rose and pea produce walnut comb; while homozygous recessives for rose and pea produce single comb. Individuals heterozygous for the two gene pairs were crossed. What are the expected genotypes and phenotypes? Indicate the phenotypic ratio. **(18 marks)**

Q4. a) Discuss any of the experiments conducted from the late 1920s that led to the conclusion that DNA was the genetic material **(10 marks)**

b) Briefly describe the process of protein synthesis **(10 marks)**

Q5. a) Describe sex determination mechanisms in *Drosophila melanogaster* **(10 marks)**

b) A variety of inheritance of genes occurs in man i.e. autosomal dominant, autosomal recessive, X-linked dominant, X-linked recessive and Y-linked. The diagram below is a pedigree of a rare human trait. Determine the mode of inheritance of the gene that is causing the trait **(10 marks)**

END