National Open University of Nigeria
Plot 91, Cadastral Zone, Nnamdi Azikiwe Expressway, Jabi - Abuja
Faculty of Science
Department of Pure and Applied Sciences
APRIL/MAY, 2019 EXAMINATIONS

COURSE CODE: BIO403
COURSE TITLE: POPULATION CYTOGENETICS
CREDIT: 2 Units
TIME ALLOWED: 2 Hours
INTRUCTION: Answer Question ONE (1) and any other THREE (3) Questions

1a. In a population, the initial allelic frequencies are **p** = 0.9 and **q** = 0.1 and the forward and reverse mutation rates are **u** = $5x10^{-5}$ and **v** = $2x10^{-5}$ respectively. Calculate the:
i. change in allelic frequency in the first generation. (3 marks)
ii. frequency of **a** allele at equilibrium. (3 marks)
b. In a population of 100,000 people carrying the recessive allele, **a** for albinism, there are 100 **aa** albinos, 98,100 **AA** homozygous none albino carriers and 1,800 **Aa** heterozygous carriers.
i. Compute the allelic frequencies in the parent population. (7 marks)
ii Using Hardy-Weinberg equation, predict the number of individuals of each genotype in the next generation. (3 marks)
c. Write short notes on the following:
i. Complete dominance. (3 marks)
ii. Incomplete dominance. (3 marks)
iii. Co-dominance. (3 marks)

2a. How can allelic frequency be calculated? (3 marks)
b. Briefly describe the following:
i. Small Populations. (4 marks)
ii. Founder Effect. (4 marks)
iii. Bottleneck Effect. (4 marks)

3a. How does mutation affect evolution? (1 mark)
b. Distinguish between population genetics and transmission genetics. (6 marks)
c. Write short notes on the following:
(i) Natural selection. (4 marks)
(ii) Darwinian fitness. (4 marks)

4a. How can genotype frequencies of the next generation be predicted from the genotype and allele frequencies? (3 marks)

b. Consider a locus that code for transferring a blood protein in *Clethrinomys gapperis* where three genotypes are found at the transferring locus: MM, MJ and JJ. In a population of C. *gapperis* trapped in Asia in 2015 are 12 MM, 53 MJ, 12 JJ individuals. Calculate the:
i. allelic frequencies of the population. (9 marks)
ii. expected number of individuals with each of the observed genotypes. (3 marks)

5a. Define sex-linked traits (3 marks)
b. The hemoglobin variants among Egyptians where multiple alleles are present are shown in the Table below.
Hemoglobin genotypes:

AA	AS	SS	AC	SC	CC	Total
2,017	783	4	173	14	11	3,002

Calculate:
i. the genotypic frequencies. (6 marks)
ii. the allelic frequencies. (6 marks)