NATIONAL OPEN UNIVERSITY OF NIGERIA
Plot 91, Cadastral Zone, Nnamdi Azikiwe Expressway, Jabi - Abuja
Faculty of Science
JULY, 2017 EXAMINATION

COURSE CODE: BIO 403
COURSE TITLE: POPULATION CYTOGENETICS
CREDIT: 2 units
TIME ALLOWED: 2 Hours
INTRUCTION: Answer question ONE (1) and any other THREE (3) questions

1. (a) Explain how genotype frequencies of the next generation can be predicted using the genotype and allele frequencies. (2 marks)
   (b) Write short notes on the following:
   i. Bottleneck effect (4 marks)
   ii. founder effect (4 marks)
   iii. small population. (4 marks)
   (c) 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. (5 marks)
   ii. Using Hardy-Weinberg equation, predict the number of individuals of each genotype in the next generation. (6 marks)

.2. (a) What is the significance of a Chi square test in population genetics studies? (3 marks)
   (b) List the assumptions upon which Hardy-Weinberg law depends. (5 marks)
   (c) Consider a locus that code for transferring a blood protein in *Clethrinomys Gapperis* (red-backed vole); three genotypes are found at the transferring locus: MM, MJ and JJ. In a population of C. *gapperis* trapped in South Africa in 2006, 12 MM, 53 MJ, 12 JJ individuals are found. Calculate the expected number of individuals with each of the observed genotypes. (7 marks)

3. (a) Distinguish between population genetics and transmission genetics. (6 marks)
   (b) Write **short notes** on the following:
   i. Complete dominance (3 marks)
   ii. In complete dominance (3 marks)
   iii. Co-dominance (3 marks)

4. (a) It takes over several generations to approach equilibrium frequencies if the alleles are sex- linked and the sexes differ in allelic frequency- Discuss. (8 marks)
   (b) 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:

i. the change in allelic frequency in the first generation. (3 marks)

ii/ the frequency of a allele at equilibrium. (4 marks)

5. (a) Use equations to show how the allelic frequencies at an X-linked locus can be determined from the genotypic frequencies? (3 marks)

(b) Calculate the genotypic and allelic frequencies for hemoglobin variants among Europeians where multiple alleles are present. (12 marks)

Hemoglobin genotypes:

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