**NATIONAL OPEN UNIVERSITY OF NIGERIA**
**14/16 AHMADU BELLO WAY, VICTORIA ISLAND, LAGOS**
**SCHOOL OF SCIENCE AND TECHNOLOGY**
**JUNE/JULY EXAMINATION**

**COURSE CODE: BIO403**
**COURSE TITLE: POPULATION GENETICS (2 units)**
**TIME ALLOWED:2 HOURS**
**INSTRUCTION: ANSWER ANY FOUR QUESTIONS**

1ai. What do you understand by genetic drift?
ii. Write short notes on the following:
(i) Bottleneck effect (ii) small population (iii) founder effect.

b. The population size of a small village in Southern Nigeria is one thousand. A population genetic study revealed the following results about the number of people with different ABO blood group phenotype : A = 450; B = 80; AB =30; O = 440.
Determine (i) the genotypic frequencies and (ii) the allelic frequenciesof IA, IB and IO alleles in the village.

2ai. What is the significance of a Chi square test in population genetics studies?
ii. Consider a locus that codes for transferring a blood protein in *Clethrinomysgapperis*, three genotypes are found at the transferring locus: MM, MJ and JJ in a population of *gapperis* trapped in North America in 1998, 24 MM, 106 MJ, 24 JJ individuals are found. Calculate the expected number of individuals with each of the observed genotypes.
bi. How does mutation affect evolution?
ii. 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.
(ii) The frequency of a allele at equilibrium.

3ai.How can genotype frequencies of the next generation be predicted using the genotype and allele frequencies?
ii. Write short notes on the following:
(i) Natural selection (ii) Darwinian fitness
b. In a population of 200,000 people carrying the recessive allele, a for albinism, there are 200 aa albinos, 196,200 AA and 3,600 Aa heterozygous carriers.
(i) Compute the allelic frequencies in the parent population,

(ii) Using Hardy-Weinberg equation, predict the number of individuals of each genotype in the next generation

4ai. How can allelic frequency be calculated?
ii. The number of individuals living in a town is 600. A study showed that the number of individuals in the town with different M-N blood group phenotypes are as follows:

| **Phenotype** | **No. of individuals** |
|---|---|
| M | 180 |
| MN | 300 |
| N | 120 |

Calculate the genotypic frequency and the allelic frequency,
bi. List the assumptions upon which Hardy-Weinberg law depends.
ii, Are there Hardy-Weinberg populations in real life?

5ai. Differentiate between population genetics and transmission genetics.
ii. How can allelic frequencies at an X-linked locus be determined from the genotypic frequencies?
b. Calculate the genotypic and allelic frequencies for hemoglobin variants among Europeans where multiple alleles are present.
Hemoglobin genotypes:

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

6ai. What is the consequence of having many alleles at a locus?
ii. Write short notes on the following:
(i) Selective mating (ii) Adaptation (iii) Migration

bi. What do you understand by sex-linked traits?
ii. How long does it take to approach equilibrium frequencies if the alleles are sex-linked and the sexes differ in allelic frequency? Give reasons for your answer.