

2025

M.Sc. 3rd Semester Examination

ZOOLOGY

Paper : ZOO - 303

(Molecular Evolution)

Full Marks : 25

Time : One Hour

*The figures in the margin indicate full marks.
Candidates are required to give their answers
in their own words as far as practicable.*

Answer any *two* questions : $2 \times 2 = 4$

1. The following two genetically caused diseases are considered lethal. Retinoblastoma caused by a dominant gene and infantile idiocy caused by a recessive gene. Assuming that both genes arise at a mutation rate of 3×10^{-6} , what are their respective equilibrium frequencies?
2. In which way effective population size (N_e) can be reduced?
3. Why human and horse alpha-globin genes are more similar than human alpha and beta globin gene?
4. What do you mean by heterosis? Give example.

P.T.O.

Answer any *two* questions : 4×2=8

5. In a region where industrial pollution has been under control, the fitness of *Biston betularia* is 0.67 for dark (r) and 1 for light (q) form. Calculate the change in allele frequency Δp after one generation of selection when (1) $p = 0.25$ and (2) $p = 0.75$.
6. A population of 1000 adult mice reside in a local campus, the frequency of Esterase allele among them is 0.67. Another population of mice residing nearby forest having Esterase frequency of 0.37. During flood 250 mice migrate to campus for shelter and mate with resident. What will be the Esterase allele frequency in the campus population after migration?
7. Calculate the frequency of A_2 after one generation of selection in the following population :

Genotype :	A_1A_1	A_1A_2	A_2A_2
	0.40	0.40	0.20
Fitness	0.2	0.70	0.10

8. With regard to genetic drift, are the following statements true or false, if a statement is false : explain
 - (i) Over the long run drift will lead to fixation or loss.
 - (ii) Genetic drift promotes genetic diversity in large population.
 - (iii) Genetic drift is more significant in small population.

(3)

- (iv) When a new mutation occur within a population genetic drift is more likely to cause the loss of new allele rather than fixation of the new allele.

Answer any *one* question : $8 \times 1 = 8$

9. An overdominant locus has relative fitness of AA Aa aa given by 0.90, 1.00, 0.50.

- (i) What is the expected frequency of a allele?
(ii) What is the expected frequency of heterozygote genotypes at equilibrium? $4+4$

10. (I)

Elephant : P T A V H S T M N S T P L S L G G P M A

Tiger : . . . - . . - A . . . M . . .

Baboon : . . . A . . M . . - . . - . G . L M A P

Chimpanzee: - - . S M

Gorilla : . . . - - - A . - . T . . . S .

Monkey : . . . - - . . L G . . . - . . . L . A .

- (i) Make a distance matrix comparing the amino acid sequences above.
(ii) Make a gene tree using UPGMA method.
(II) What is orthology gene? Give example.

$3+3+2$

Internal Assessment : 5 marks