PG/IIIS/ZOO/302.1 & 302.2/22
(Day)

M.Sc. 3rd Semester Examination, 2022

ZOOLOGY

(Molecular Evolution/Microbiology)

PAPER – ZOO-302.1 & 302.2(Day)

Full Marks : 40

Time : 2 hours

The figures in the right hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

PAPER – ZOO-302.1

(Molecular Evolution)

Answer any **two** of the following questions : 2×2

1. (*a*) A certain stock of Drosophila shows a mutation rate for normal (w^+) to eosin(w^e) of 1.3×10^{-4} and a reverse mutation rate $w^e \rightarrow w^+$ of 4.2×10^{-5}. What is the equilibrium value of w^e ?

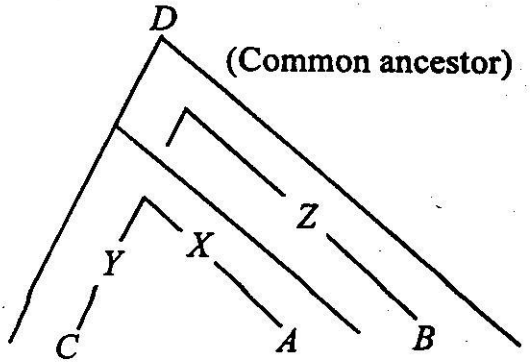
(*b*) Why homologous genes have sequences that are similar but not identical ?

(*c*) What is differences between ortholog gene and paralog gene. Give example.

(*d*) Differentiate rooted phylogenetic tree from unrooted phylogenetic tree.

Answer any **two** questions of the following : 4×2

2. (*a*) The parsionial mutational distance for a particular protein comparison between species *A* and *B* is 25; between *A* and *C* is 20 ; and *B* and *C* is 30.



Find out the value of *X*, *Y*, and *Z*.

(*b*) Individuals with genotype bb are 20 percent less fit that individuals with genotypes *BB* or *Bb*. If *B* mutates to *b* at a rate of 10^{-6} per generation, what is the expected frequency of the allele *b* when population reaches mutation-selection equilibrium.

(*c*) A population of 600 adult squirrels reside in a campus and the frequency of G6PD allele *b* 0.75 among them. Another population of squirrels residing near forest and their G6PD frequency is 0.65. During flood 300 squirrels . from the forest migrate to campus for shelter and mate with resident. What will be the allele frequency of G6PD allele is the campus after migration.

(*d*) In a forest habitat assume that allele frequency of *A* is = 0.5 (p) and the selection pressure is 0.25. Let us assume that population randomly mate and the genotypes are HWE. Calculate the frequency of a allele after one generation of selection.

Answer any **one** question of the following : 8×1

3. (*a*) In a virgin forest of Dorset, 400 Dark moths and 300 light moths are released. After sometime 175 Dark moth recaptured from there whereas 225 light moths are recaptured. Dark moth (D) are dominant over light moth (d). Initial frequency of *D* allele is 0.6 and *d* allele is 0.4. Calculate the relative fitness, selection pressure and the changes of allele frequency made after selection.

(*b*) The 20 amino acid sequence of β-globin genes are analysed between 6 mammals. The following differences are tabulated. Make a distance matrix and a molecular phylogenetic tree.

Elephant	P	T	A	V	H	S	T	M	N	S	T	P	L	S	L	G	G	P	M	A
Tiger	.	.	.	–	–	–	.	.	A	.	.	A	.	.	V	–	.	.	–	.	.	V
Baboon	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Chimpanzee	.	.	.	.	–	.	.	T	.	.	.	.	.	.	.	.	.	V	.	.		
Gorilla	.	A	.	.	–	.	.	M	.	.	.	T	.	.	.	.	A	.	.	K		
Monkey	.	.	.	.	.	.	.	N	.	.	.	V	.	.	V	.	.	.	A	N		

PAPER – ZOO-302.2

(*Microbiology*)

Answer any **two** questions from the following : 2×2

4. (*a*) Why is Virus not included properly in microbial taxonomy ?

   (*b*) Define *H-O* variation and the causal factors.

   (*c*) State the basic difference between bacterial and archaeal cell membranes.

   (*d*) How does capsule vary from microcapsule ?

Answer any **two** questions from the following : 4×2

5. (*a*) Depict the arrangement of cocci resulting from different planes of division.

   (*b*) Represent the growth of bacteria under different temperature preferences.

(*c*) Compare the advantages and disadvantages of solid and liquid culture media.

(*d*) Motility of bacteria depend on both pili and flagella-explain.

Answer any **one** question from the following : 8×1

6. (*a*) (*i*) Discuss various methods of measuring bacterial growth.

(*ii*) Elaborate the 8-kingdom classification system. 4 + 4

(*b*) (*i*) How are various flagellar arrangements related to bacterial movement patterns ?

(*ii*) Classify Bacteria on the basis of their nutritional requirements. 4 + 4