

PG CBCS
M.SC. Semester- III Examination, 2021
ZOOLOGY
PAPER: ZOO 302
(MOLECULAR EVOLUTION AND MICROBIOLOGY)

Full Marks: 40

Time: 2 Hours

Write the answer for each unit in separate sheet

UNIT: ZOO 302.1

(Molecular Evolution)

Answer any **TWO** questions of the following:

2X10=20

1. a) Distinguish between silent mutation and neutral mutation with examples. 1+1
 b) What do you mean by 'selection pressure' against a phenotype? The following table shows the number of dark and light coloured moths released (P_1) and recaptured (F_1) in 3 different places of England. Calculate the selection pressure operative against the two phenotypes and state which of the phenotypes is favoured by natural selection. 1+3

Place	Dark moth: Released (P_1)	Dark moth: Recaptured (F_1)	Light moth: Released (P_1)	Light moth: Recaptured (F_1)
Birmingham	100	90	100	10
Dorset	100	82	100	64
Birmingham/Dorset border	100	60	100	50

- c) Genetic drift is an alternative to natural selection in eliminating a particular allele from a population – explain with the help of a natural example. 1+3
2. Construct a molecular phylogenetic tree using the table provided below. Number of dissimilar amino acids in the alpha globin of representative vertebrates among 141 amino acids

	Mouse	Chicken	Newt	Carp	Shark
Human	16	35	62	68	79
Mouse		39	63	68	79
Chicken			63	72	83
Newt				74	84
Carp					85

Estimates the extent to which the amino acids sequence of these six organisms differ.

[2]

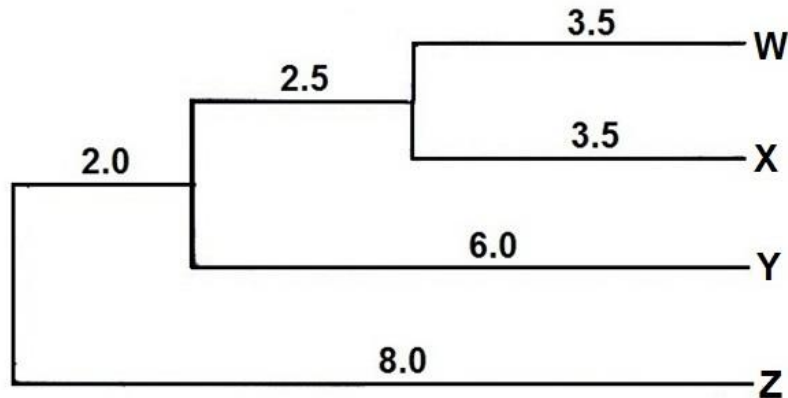
2. a) What is heterozygote advantage? Cite a concrete example. 1+1
- b) The frequency of an allele 'a' in South Africa was 0.630 in 1935. Some people migrated to South Africa from the Madagascar Island where the frequency of the same allele was found to be 0.028. The migrants maintained marital relationship for 2 generations (60 years) with the people of South Africa. Consequently, the frequency of the allele 'a' changed to 0.446 in South Africa in 1995. Calculate the percentage of 'a' allele that entered into the people of South Africa from the migrants. 4
- c) Explain Francois Jacob's concept of 'molecular tinkering in evolution' with at least two supporting examples. 4
4. a) Individuals with the genotypes bb are 20 percent less fit than individuals with the genotypes BB or Bb. If B mutates to b at the rate of 10^{-6} per generation, what is the expected frequency of the allele b when the population reaches mutation–selection equilibrium? 5
- b) Two small separated populations A and B have respective frequencies of phenylthiocarbamide taster (caused by dominant allele) 0.85 and 0.25. If 5 percent of population B comes from population A each generation, what will be the frequency of the tasting gene in population B after 2nd generation and 3rd generation? 5
5. a) How does a phylogram differ from a cladogram? 2
- b) Amino acid difference in a protein 'x' in between four species A, B, C and D are shown below. Construct a gene tree from the given data. 4

	A	B	C	D
A	-	8	15	19
B	-	-	18	16
C	-	-	-	5
D	-	-	-	-

- c) From the following gene tree, calculate the amino acid differences in a protein under study in between the four species W, X, Y and Z. 4

[P. T. O]

[3]

**UNIT: ZOO 302.2****(Microbiology)****Answer any TWO questions of the following:****2X10=20**

1. How is divisome complex formed? Briefly describe transpeptidation reaction during bacterial cell wall synthesis. What is pure culture? 4+4+2
2. What is the generation time of a bacterial population that increases from 10^4 cells to 10^7 cells in four hours of growth? What is chemostat? How it is maintained? 4+2+4
3. Differentiate between solid substrate and sub-merged fermentation. Schematically represent and describe the preparation process of cheese. 4+6
4. Write the agricultural importance of Azotobacter and Rhizobium. Describe the process of streak plate technique with suitable diagram. 4+6
5. Describe the life cycle of retrovirus with diagram. Write a short note on viroid. 6+4
