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**PG CBCS**

**M.Sc. Semester-III Examination, 2022**

**ZOOLOGY**

PAPER: ZOO 302

**(MOLECULAR EVOLUTION AND MICROBIOLOGY)**

**Full Marks: 40** **Time: 2 Hours**

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**Write the answer for each unit in separate sheet**

## UNIT: ZOO 302.1
## MOLECULAR EVOLUTION

### GROUP-A

**1. Answer any TWO questions.** **2×2=4**

a) Distinguish between stabilizing and directional selections with respective examples.

b) What is orthologous gene? Give an example. 1+1

c) What is heterozygote advantage? Cite a concrete example. 1+1

d) How does a phylogenetic tree differ from a gene tree?

### GROUP-B

**2. Answer any TWO questions:** **4×2=8**

a) 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.

| 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 |

1+3

(P.T.O.)

b) A rat population has 64% black members. Find out the frequencies of (i) the alleles for albinism and black body colour, and (ii) the homozygous and heterozygous black rats in the given population. 2+2

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.

d) Achondroplasia, a type of dwarfism in human is caused by an autosomal dominant allele. The rate for achondroplasia is $5.0 \times 10^{-5}$ and the fitness of achondroplastic dwarf has been estimated to be about 0.2, compared with unaffected individuals, what is the equilibrium frequency of the achondroplasia allele based on this mutation rate and fitness value?



## GROUP-C

**3. Answer any ONE question:** **8×1=8**

a) In a homologous region containing 10,000 bp following number of sequence differences are found in α globin sequence. Construct a gene tree.

| | Human | Chimpanzee | Gorilla | Orangutan | Rh Monkey |
|---|---|---|---|---|---|
| Human | - | 145 | 151 | 298 | 751 |
| Chimpanzee | 145 | - | 157 | 294 | 755 |
| Gorilla | 151 | 157 | - | 304 | 739 |
| Orangutan | 298 | 294 | 304 | - | 710 |
| Rh Monkey | 751 | 755 | 739 | 710 | - |

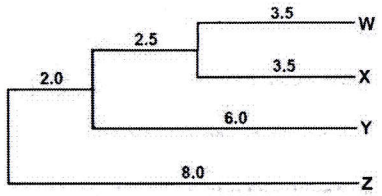
b) (i) Amino acid difference in a protein 'x' in between four species A, B, C and D are shown below. Construct a gene tree from the given data. 4

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

(ii) 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










## UNIT: ZOO 302.2
## MICROBIOLOGY

## GROUP-A

**4. Answer any TWO questions.** **2×2=4**

a) What is the significance of lipid A?

b) What is the role of FtsZ in bacterial cell division?

c) What do you mean by enrichment culture?

d) Distinguish between Monera and Protista?

## GROUP-B

**5. Answer any TWO questions:** **4×2=8**

a) Classify bacteria on the basis of environmental pH and temperature? 2+2

b) Write a short note on role of microbes in wine production.

c) Provide an illustrated account of Gram-positive bacterial cell wall.

d) Write a short note on bacterial quorum sensing.

## GROUP-C

**6. Answer any ONE question:** **8×1=8**

a) How do microbes become influential in maintaining abiotic stress tolerance and phytostimulation in plants? 4+4

b) Write down the difference perspectives in formulating culture media? Write down the different modes of microbial nutrition. 4+4

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