

PG (CBCS)  
M.SC. Semester- III Examination, 2023  
ZOOLOGY  
PAPER: ZOO 302  
(MOLECULAR EVOLUTION AND MICROBIOLOGY)



Full Marks: 40

Time: 2 Hours

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

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

**UNIT: ZOO 302.1**

**MOLECULAR EVOLUTION**

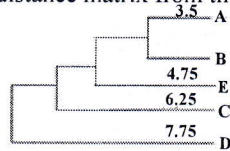
**GROUP-A**

1. Answer any **TWO** of the following questions: 2×2=4
- Distinguish between directional and stabilizing types of natural selection with examples.
  - What do you mean by heterozygote advantage? Give an example of this phenomenon.
  - Differentiate rooted phylogenetic tree from unrooted one.
  - Distinguish between orthologous and paralogous genes.

**GROUP-B**

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

- a) Make a distance matrix from the following gene tree



- A rodent population has 96% black members. Find out the frequencies of (i) the alleles for albinism and black body colour, and (ii) the homozygous and heterozygous black animals in the given population. 2+2
- The frequency of an allele 'a' in England was 0.630 in 1935. Some people migrated to England from Africa where the frequency of the same allele was found to be 0.028. The migrants had marital relationship for 2 generations (60 years) with the people of England. Consequently, the frequency of the allele 'a' changed to 0.446 in England in 1995. Calculate the percentage of 'a' allele that entered into the people of England from the African migrants. 4
- A certain stock of *Drosophila* shows a mutation rate of  $2 \times 10^{-6}$  from the normal eye colour allele ( $w^+$ ) to an eosin ( $w^e$ ) allele. On the other hand, the rate of reverse mutation is found to be  $4 \times 10^{-8}$ . Assuming that no other factors are involved, what will be the equilibrium frequencies of the two alleles? 4

(1)

P.T.O

**GROUP-C**3. Answer any **ONE** of the following questions:

1×8=8

- a) In a virgin forest of Dorset, 155 dark and 64 light moths were released. After a month, 82 dark and 16 light moths could be recaptured from the same forest. The 'dark' allele (D) is known to be dominant over the 'light' allele (d). Calculate (i) the relative fitness of the dark and (ii) the light phenotypes, (iii) the selection coefficients acting upon the two phenotypes and (iii) the changes in allele frequencies that occurred after one generation of selection.

2+1+5

- b) In a homologous region containing 10,000 bp, the following number of sequence differences are found. Construct a gene tree using UPGMA method

	Human	Chimpanzee	Gorilla	Orangutan	Rhesus Monkey
Human		145	151	398	851
Chimpanzee	145		197	294	855
Gorilla	151	197		304	840
Orangutan	398	294	304		810
Rhesus Monkey	851	855	840	810	

8

UNIT: ZOO 302.2

**MICROBIOLOGY****GROUP-A**4. Answer any **TWO** of the following questions:

2×2=4

- a) What is the resolving power of a microscope?  
 b) What is mesosome?  
 c) Write the name of two process of measurement of microbial growth.  
 d) What do you mean by shadow casting?

**GROUP-B**5. Answer any **TWO** of the following questions:

2×4=8

- a) Classify algae and state its medical importance.  
 b) Draw and describe bacterial growth curve mentioning different phases. What is growth rate?  
 c) Write a short note on bacterial quorum sensing.  
 d) Discuss the theory behind bacterial gram staining procedure. What is biofilm?

3+1

4

3+1

6. Answer any **ONE** of the following questions:

1×8=8

- a) Define bacterial generation time. Calculate the generation time of a bacterial population that increases from 10,000 cells to 10,000,000 cells in four hours of growth. What do you mean by cytokinesis?  
 b) Write a note on importance of fermented products. What is GPM? state their importance.

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5+1+2

**GROUP-C**

P.T.O

(2)

(3)