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M.Sc. RNLK-/Zoology/302/21

2021

Zoology

[Third Semester]

Paper - 302

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.*

*Illustrate the answers wherever necessary.*

**Group - A**

**Molecular Evolution**

1. Answer any two questions from the following : 2×2

- a) What is Genetic drift?
- b) Why the sequence of human and horse  $\beta$ -globin gene are much similar than the sequence of  $\alpha$  and  $\beta$  globin gene of human?

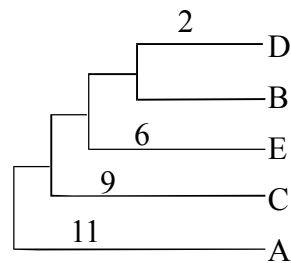
*(Turn Over)*

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- c) If  $U=10^{-5}$  and  $V=10^{-6}$  then find out the value of  $\hat{p}$  and  $\hat{q}$ .
- d) State the differences between rooted tree and unrooted tree.

2. Answer any two questions from the following. 2×4

- a) Make a distance matrix from the following gene tree. 4



- b) Let us suppose that the starting allele frequencies of a population are  $A=0.5$  and fitness values of the three genotypes AA, Aa and aa are 1.0, 0.75, 0.25 respectively. What will be the allele frequencies of A and a after one generation? 4
- c) A population of *D. melanogaster* is polymorphic for two alleles,  $A_1$  and  $A_2$ . One thousand populations are

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desired and each is maintained by selecting random ten females and ten males in each generation as parent of the following generations. After many generations it is observed that 220 populations are fixed for Allele  $A_1$  and 780 for Allele  $A_2$ . Estimate the allele frequencies in the original population. Assuming that only genetic drift is involved. 4

- d) In *Escherichia coli* the rate of mutation from ( $his^+$ ) histidine independence to ( $his^-$ ) histidine requirement and the rate of mutations have been estimated as  $his^+ \longrightarrow his^- = 2 \times 10^{-6}$  and  $his^- \longrightarrow his^+ = 4 \times 10^{-8}$ .

Assuming that no other processes are involved. What will be the equilibrium frequencies of the two alleles?

4

**3. Answer one question from the following : 1×8**

- a) (i) If the nucleotide sequences of three species in

Species	Sequence
A	5' ATCGTGGTACTG 3'
B	5' CCGGAGAACTAG 3'
C	5' AACGTGCTACTG 3'

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Construct a phylogenetic tree using UPGMA method.

(ii) Consider three species X,Y,Z are widely distributed in different regions of Medinipur across two different habitats A and B. If habitat A consists at 70 (X-species), 60 (Y-species), 12 (Z-species) and habitat B consists of 20 (X-species), 10 (Y-species), 30 (Z-species), then determin the extent dissimilarity among the two habitats using Bray-crutis Canberra metric coefficients. 4+4

- b) In a homologous region containing 25000 bp the following number of sequence differences are found

	Human	Chimpanzee	Gorilla	Orangutan	Rh.Monkey
Human		145	151	398	851
Chimpanzees	145		197	294	855
Gorilla	151	197		304	840
Oranjutan	398	294	304		810
Rh. Monkey	851	855	840	810	0

Construct a gene tree using UPGMA method.

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**Group - B**

**(Microbiology)**

4. Answer any two from the following :  $2 \times 2 = 4$
- a) What is Fuller's earth? Write the usefulness of Fuller's earth. (1+1)
  - b) What is the role of plasmid? 2
  - c) Difference between protoplast and spheroplasts. 2
  - d) What do you mean by 'VBNC'? 2
5. Answer any two from the following :  $4 \times 2 = 8$
- a) What are the common biochemical pathways leading to bioluminescence in bacteria. 4
  - b) Suppose the generation time of a bacterium is 90 minutes and the initial number of cells in a culture is  $10^3$  cells at the start of the Log phase. How many bacteria will there be after 8 hours of exponential growth? 4

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- c) How L-forms bacteria are generated? How LPS can act as an endotoxin? 2+2
- d) State the difference between solid and liquid culture media with example. 4

**6. Answer any one from the following ? 8×1=8**

- a) Discuss the detailed mechanism behind quorum sensing in Gram positive and Gram negative bacteria. 4+4
- b) Discuss the septation process in *E.Coli*. Schematically and briefly discuss the formation of cell division apparatus in *E.Coli*. 3+5