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PG CBCS

M.Sc. Semester-III Examination, 2020

ZOOLOGY

PAPER: ZOO 302

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.

Group-A
(Marks: 20)
(Molecular evolution)

1. Answer two questions of the following: 2x10=20

a. i. Distinguish between Mendelian and non-Mendelian populations. What is a panmictic population?

ii. What do you mean by 'relative fitness' of a genotype? In a capture-recapture study, 154 black morphs and 64 white morphs of the moth, *Biston betularia* were released in the wild and 90 black and 10 white individuals could be recaptured in the next generation. If *B* and *b* are the alleles responsible for black and white colorations respectively, calculate the selection coefficient acting against the recessive allele.

iii. Distinguish between orthologous and paralogous genes. State their phylogenetic significance. 1+1+1+3+2+2

b. i. Cite an example of selective advantage enjoyed by heterozygotes?

ii. A panmictic population contains 1 albino per 10,000 people. Find the frequencies of 'black' and 'white' alleles. Also, find the frequencies of homozygous and heterozygous blacks.

iii. What do you mean by Sewall Wright effect? Cite a concrete example. 2+4+1+3

c. i. Distinguish between directional and stabilizing selections with respective examples. .

ii. The frequency of an allele 'a' in England was 0.630 in 1930. 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 1990. Calculate the percentage of 'a' allele that entered into the people of England from the African migrants.

iii. Explain F. Jacob's concept of 'evolution and tinkering' with suitable supporting examples. 2+4+4

d. i. Distinguish between a gene tree and a phylogenetic tree.

ii. In a bacterium, the rate of mutation from histidine independence (his^+) to histidine dependence (his^-) and the rate of reverse mutation have been estimated as follows:

$$his^+ \rightarrow his^- = 2 \times 10^{-6}$$

$$his^- \rightarrow his^+ = 4 \times 10^{-8}$$

Assuming that no other factors are involved, what will be the equilibrium frequencies of the two alleles?

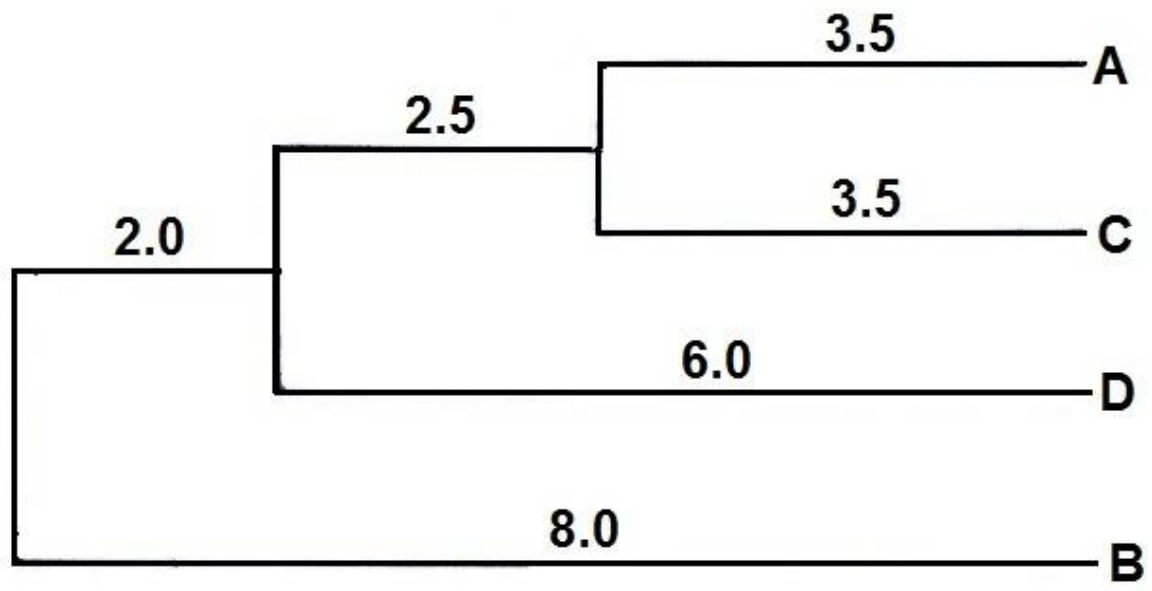
iii. Write a note on the application of monoclonal antibody and lectin in distinguishing between different infraspecific categories in protozoans. 2+4+4

e. i. How does a phylogram differ from a cladogram?

ii. 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.

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

iii. From the following gene tree, calculate the amino acid differences in a protein under study in between the four species A, B, C and D.



2+4+4

Group-B
(Marks: 20)
(Microbiology)

2. Answer two questions of the following: 2x10=20

a. What is the role of ZipA protein in bacterial cell division? What is bactoprenol? Why do the bacteria enter into the stationary phase? What is the generation time of a bacterial population that increases from 10^4 cells to 10^7 cells in four hours of growth? 2+2+3+3

b. Describe different asexual spores of fungi with example. State the life cycle of yeasts with diagram. 4+6

c. What is chemotaxis? How do *Vibrio harveyi* exhibit quorum sensing for expression of the luciferase structural operon *luxCDABE*?Differentiate between vegetative cell and endospore. 2+5+3

d. State the different steps of lytic life cycle of bacteriophage. What is the superimmunity of the bacteria after bacteriophage infection?Describe the life cycle of Retrovirus. 4+2+4

e. Write short notes on (any two): 5+5
   a. Strain improvement of microorganisms
   b. Protista
   c. Archeabacteria

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