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PG 3rd Semester Examination, 2024

ZOOLOGY

PAPER — ZOO-302.1 & 302.2

Full Marks : 50

Time : 2 hours

Answer all questions

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

PAPER : ZOO-302.1

(Molecular Evolution)

GROUP — A

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

(Turn Over)

- (a) What happens to allele frequencies during the bottleneck effect? What is the relevance of this effect with regard to species approaching extinction?
- (b) Mention the impact of genetic drift in a natural population.
- (c) What is meant by molecular clock?
- (d) Why human α globin gene sequence is much similar to horse α -globin gene sequence than human α and human β -globin gene sequence?

GROUP – B

2. Answer any *two* questions from the following : 4 × 2
- (a) In an insect species pigmentation is controlled by two alleles D=dark, d=light. In a heterogenous environment allele frequency D=0.7 and d=0.3 (dimly lit forest). During a hurricane 1000 insects

is blown to a sunny area where the fitness values are $DD=0.3$, $Dd=0.7$ and $dd=1.00$. Calculate allele frequencies in next generation.

- (b) The effective size of a population N_e can be estimated by the equation 2 + 2

$$N_e = \frac{4N_m N_f}{N_m + N_f} \quad \begin{array}{l} N_m = \text{no of males} \\ N_f = \text{no of females} \end{array}$$

- (i) In a cattle ranch 500 cows all are artificially inseminated with the sperm of a single bull, what is effective population size in this case ?
- (ii) If 1000 diploid populations are each founded with a gene frequency of $q=0.5$ and each continued for another generation by 10 male and 40 female parents, what average range of gene frequencies (standard deviation) ?

2 + 2

(c) Let us assume that three generations ago a tribe of South American Indians has only blood type O(i gene). A recent sampling of this population now shows approximately 3% of the A gene (iA). A neighbouring population, many times the size of this tribe has frequencies of $i = 0.90$ and $I^A = 0.10$. Assuming no other factor are operative, what percentage of genes are introduced into this tribe through migration ?

(d) In an infinite population, if a recessive allele having the initial frequency of q_0 changes to a frequency of q_t after 't' generation time, then prove that $t = \frac{1}{q_t} - \frac{1}{q_0}$, if selection coefficient (s) = 1. If the initial and final frequencies of a recessive homozygous allele are 0.1 and 0.000001 respectively, and if $s = 1$, calculate how much time has elapsed for the change in the frequency. 2 + 2

GROUP – C

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

- (a) In three different populations the relative fitness of genotypes differing in respect to one pair of genes A and a was found to be as follows :

<u>Population</u>	<u>Relative Fitness</u>		
	<u>AA</u>	<u>Aa</u>	<u>aa</u>
I	.50	1.00	00
II	0.75	1.00	0.50

- (i) Assuming that only selection is operating on these genotypes, what are the equilibrium frequencies for the gene A and a in each of these population ?
- (ii) If the two populations began with exactly the same gene frequencies $A=0.400$ and $a=0.600$, explain which

of these populations would approach
their equilibrium gene frequencies
fastest ?

4 + 4

(b)

MOAS: CCAGATACTTACCCTACACAAGTAT
KIWI: . . T . G G T . . . CT C
EMU: . T T C . . . T . . . CTG . . C . .
CASSOWARY: . T T CG . TA . . . CTG
OSTRICH: . A T C . . CT
RHEA: . . T C . . CT

The data illustrate a multiple sequence
alignment of the amplified DNA sequences,
make a phylogenetic tree using UPGMA
method.

4 + 4

PAPER : ZOO-302.2

(*Microbiology*)

GROUP – A

4. Answer any *two* questions from the following :

2 × 2

- (a) What are the unusual characteristics of virus ?
- (b) Highlight the difference between magnification and resolution.
- (c) Explain the significance of Quorum sensing in bacteria.
- (d) What is selective media ? Define Growth rate.

GROUP – B

5. Answer any *two* questions from the following : 4 × 2
- (a) Differentiate Inoculation from Incubation. Contrast Total count from Viable count with proper reasons. 2 + 2
 - (b) Compare the characteristics of cell wall of gram-positive and gram-negative bacteria. Define optimum temperature for growth. 3 + 1

(c) State the role of Pili. Mention the types of flagellar movements associated with chemotaxis. 2 + 2

(d) What is biofilm ? State its importance. 2 + 2

GROUP – C

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

(a) (i) Define S-R variation. Briefly explain Benchtop tests.

(ii) How is Bergey's manual of Systematic Bacteriology different from that of Determinative Bacteriology ? Explain endosymbiotic theory. (2+2)+(2+2)

(b) Classify bacteria on the basis of oxygen requirement. What is pure culture ? How would you identify colony patterns in test tubes with liquid culture ? 4 + 1 + 3

[Internal Assessment – 10 Marks]
