

**2020**  
**ZOOLOGY**  
**M.Sc. Fourth Semester Examination**  
**ZCT 433**  
**(Evolution)**  
**Full Marks 40**

*Answer any four of the following questions*

- Q1. (a) Can selection have any evolutionary consequence among genetically identical members of a clone, even though they differ in phenotype? Explain within four sentences.
- (b) Robins typically lay 4 eggs. Larger clutch size may have malnourished chicks while there may not be any survivor in the smaller clutch. What kind of selection is this? Illustrate this kind of selection graphically.
- (c) What is Genotype fitness? Illustrate 'Directional Selection' with a suitable example.

$3+3 + (1 +3) =10$

- Q2. (a) What were the major novelties of the 'Theory of Natural Selection' in contrast with the previous theories? Answer within 20 sentences.
- (b) What is stasis? Compare speciation with stasis and phyletic speciation with suitable diagram.

$4 + (2 + 4) =10$

- Q3. (a) What are selectively neutral mutations? Explain genetic polymorphism with suitable example.
- (b) Consider a gene is evolving under the influence of genetic drift. What will be the probability of fixation and the extent of heterozygosity with reference to the gene? Will the probability of fixation change with the population size? Explain.

$(2+3) + (1+2+2) = 10$

- Q4. (a) Define heritability. What are 'narrow sense heritability and 'broad sense heritability'?
- (b) What is induced response? Provide examples from plants and animals. Illustrate canalization and phenotypic plasticity in terms of reaction norms.
- (c) Point out the costs and limits to phenotypic plasticity.

$3 + (2+2) + 3 = 10$

- Q5. (a) Citing suitable examples, illustrate - (a) vicariant and (b) peripatric modes of speciation.
- (b) Point out the propositions of coalescent theory.
- (c) What is effective population size,  $N_e$ ? Show that the value of the  $N_e$  changes with the sex ratio of the concerned population.

$(2+2)+2 + (2+2) = 10$

- Q6. (a) Discuss about 'exon shuffling' and 'horizontal gene transfer' as mechanisms of gene evolution.  
(b) Illustrate orthology and paralogy using globin gene as example.  
(c) Enumerate the evolutionary significance of pseudogenes.  
 $(2 + 3) + 3 + 2 = 10$
- Q7. (a) "Jukes- Cantor and Kimura-2 Parameter models of evolution are widely used in reconstructing a phylogeny". Explain the differences in their approaches in counting the number of substitution among the given pair of taxa.  
(b) Comment on the disadvantages of using the UPGMA method in phylogenetic reconstruction.  
 $(4 + 4) + 2 = 10$
- Q8. (a) Explain the two contradictory hypotheses on the origin of modern humans. Which of these hypotheses do you support? Substantiate your answer with suitable example.  
(b) Outline the advantage of using Y-chromosome as genetic markers in understanding human paternal lineages.  
 $(3 + 3 + 2) + 2 = 10$
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