M.Sc. 4th Semester Examination, 2010

ZOOLOGY

PAPER—Z-401

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

Write the answers to questions of each Group in separate books

GROUP—A

(*Animal Physiology*)

1. Answer any *two* questions of the following : 2 x 2

(*a*) Explain what is refractory period for a nerve membrane.

(*b*) State the important functions of sodium in glucose and amino acid transport.

(*c*) Describe the rapid action of steroid hormones.

(*d*) Briefly mention how pKa is activated by cAMP.

2. Answer any *two* questions of the following : 2 x 4

(*a*) Illustrate the steps involved in the binding of synaptic vesicles with presynaptic membrane.

(*b*) What causes a plateau and prolonged action potential in the cardiac muscle ?

(*c*) Graphically represent the pressure changes in a ventricle.

(*d*) Write briefly the role of vitamin E as antioxidant.

3. Answer any *one* question of the following : 8 x 1

(*a*) (*i*) Describe the effects of sympathetic and parasympathetic control on myocardial performance. 2 + 2

(*ii*) Draw the structure of voltage-gated Na-channel. 4

(*b*) Write short notes on any *four* : 2 x 4

(*i*) Role of vitamin-K in blood coagulation

(*ii*) Saltatory conduction and nodes of Ranvier

(*iii*) Frank-Starling mechanism

(*iv*) Excitatory and inhibitory neurotransmetter

(*v*) Spare receptor

(*vi*) Relation between speed of conduction of nerve impulse and diameter of nerve fibre.

GROUP–B

(*Adaptation & Evolution*)

4. Answer any *two* of the following : 2 x 2

(*a*) Mention the evidence in favour of the punctuated equilibrium theory of evolution.

(*b*) Distinguish between sweating and panting.

(*c*) State the conditions that can induce oxidative stress.

(*d*) What is T_{50} H? How is it used in evolution?

5. Answer any *two* of the following: 4 x 2

(*a*) Achondroplasia, a type of dwarfism in humans, is caused by an autosomal dominant allele. The mutation rate for achondroplasia is about $5{\cdot}0 \times 10^{-5}$ and the fitness of this mutation has been estimated to be about 0·2, compared with unaffected individuals. What is the equilibrium frequency of the achondroplasia allele based on this mutation rate and fitness value?

(*b*) A completely recessive allele (q^1) has a frequency of 0·7 in a large population, and the $q'q'$ homozygote has a relative fitness of 0·6.

(*i*) What will be the frequency of q' after one generation of selection?

(*ii*) If q' is dominant, what will be the allele frequency after one generation of selection.

(*c*) Explain schematically the response stages in general adaptation syndrome of a species.

(*d*) State the role of whole genome duplication in the tinkering process.

6. Answer any *one* of the following : 8 x 1

(*a*) (*i*) Carefully observe the sequences of a bacterial gene beginning with the start codon.

ATG CCG GAT TAC CCG GTC CCA AAC AAA ATG ATG GGC CGC CGA ATC TAT CCC

This is the changed sequence of that bacterial gene –

ATG CCG GAT TAT CCG GTC CCA AAT AAA ATG ATC GGC CGC CGA ATC TAC CCC

What type of changes you find here ? Which type of mutation is this ? What is its role in evolution ?

(*ii*) What do you mean by persimony and maximum persimony?

(*iii*) What is a gene tree? $5+1\frac{1}{2}+1\frac{1}{2}$

(*b*) A homologous DNA region, which was 20,000 bp in length, was sequenced among four different species. The following number of nucleotide differences were obtained:

	SpeciesA	SpeciesB	SpeciesC	SpeciesD
species A	0	443	719	465
species B	443	0	744	423
species C	719	744	0	723
species D	465	423	723	0

Construct a phylogenetic tree that describes the evolutionary relationship among these four species. Your tree should indicate evolutionary distance. 8