M.Sc 1st Semester Examination, 2009

ZOOLOGY

PAPER—Z-102

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

Write the answers to questions of each Group in separate books

GROUP—A

(*Ecology*)

1. Answer any *two*:   2 × 2

  (*a*) Differentiate between fundamental niche and realized niche.

(b) Distinguish between semelparity and iteroparity.

(c) What is ecological guild ?

(d) What is fertility schedule ?

2. Answer any *two*:   4 × 2

   (a) Define linkage density and connectance of food web. Calculate linkage density and connectance of a food web with 5 species and 6 links.   2 + 2

   (b) A square forest and a rectangular forest have identical areas, 100 km². Which one of these two has higher edge to area ratio ? If a strip of 2 × 10 km is cleared from the square forest what will be its E/A ratio ?   2 + 2

   (c) What is niche pre-emption hypothesis ? In an unoccupied area total resource is ' 1 '. If first species pre-empts 'K' fraction of the total resource then what fraction of resource will be available to the third species ?   1 + 3

   (d) Discuss resistance stability and resilience stability of an ecosystem.   4

(*Continued*)

3. Answer *one* of the following : 8 × 1

   (*a*) Deduce Lotka-Volterra equation for predator-prey interaction. Give an experimental proof of the predator-prey interaction. 5 + 3

   (*b*) How stability of an ecosystem is maintained through feedback control ? In what way redundancy of components influence ecosystem stability ? 6 + 2

GROUP—B

(*Biostatistics*)

1. Write briefly about any *two* of the following : 2 × 2

   (*i*) Level of significance

   (*ii*) Null hypothesis

   (*iii*) Kruskal-Wallis test

   (*iv*) Degrees of freedom.

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

(a) Write brief notes on : $2 + 2$

(i) Continuous and discontinuous variables,

(ii) Kurtosis.

(b) Find whether 'Lipistat, a newly formulated drug, has any significant hypocholesterimic effect or not based on the following data that depict the serum cholesterol level (mg/dl) of 10 patients before and after 2 months treatment with 'Lipistat. ($\alpha = 0 \cdot 05$) 4

Patient :	1	2	3	4	5	6	7	8	9	10
Before :	23	32	21	23	31	25	28	26	31	41
After :	18	17	11	11	20	22	14	15	23	19

One-tail t-scores :

$t_{0 \cdot 05 (8)} = 1 \cdot 86$; $t_{0 \cdot 05 (9)} = 1 \cdot 833$;

$t_{0 \cdot 05 (18)} = 1 \cdot 734$; $t_{0 \cdot 05 (19)} = 1 \cdot 729$.

Two-tail t-scores :

$t_{0 \cdot 05 (8)} = 2 \cdot 306$; $t_{0 \cdot 05 (9)} = 2 \cdot 262$;

$t_{0 \cdot 05 (18)} = 2 \cdot 101$; $t_{0 \cdot 05 (19)} = 2 \cdot 093$.

(c) Give the assumptions and properties of Poisson-distribution. 4

(d) From the data provided, find out whether a significant correlation exists between the body weight (in mg; X) and longevity (in days; Y) of the non-biting mosquito *Lutzia fuscana*.

$\Sigma X = 15 \cdot 5$; $\Sigma X^2 = 24 \cdot 85$; $n = 10$

$\Sigma Y = 124$; $\Sigma Y^2 = 1612$; $\Sigma XY = 200$
$t_{0 \cdot 01 (8)} = 3 \cdot 355$. 4

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

(a) (i) Discuss the assumptions underlying the t-test.

(ii) What is correlation coefficient ?

(iii) Work out the product-moment 'r' between the predatory nematode counts and the soil moisture contents (%) sampled from 10 randomly selected sites at Vidyasagar University campus and test its significance. ($\alpha = 0 \cdot 05$)

Site :	1	2	3	4	5	6	7	8	9	10
Nematode count :	3	4	6	2	3	3	5	6	1	2
Soil moisture :	33	42	51	22	27	44	55	63	12	21

Critical t - scores (two-tail):

$$t_{0.05(8)} = 2 \cdot 306; \ t_{0.05(9)} = 2 \cdot 262;$$

$$t_{0.05(18)} = 2 \cdot 101; \ t_{0.05(19)} = 2 \cdot 093.$$

$$2 + 1 + 5$$

(b) Define type-I and type-II error. Applying ANOVA, find whether or not there is a significant difference between the mean tracheal ventilation scores (ml/min) of the two groups of beetles treated respectively after two different doses of pesticide.

Gr-I : 80, 81, 75, 80, 88, 70, 74, 71, 84, 72

Gr-II : 70, 74, 68, 67, 72, 59, 61, 57, 68, 54

[Given that. $F_{1, 18}(\cdot 05) = 4 \cdot 41$

$$F_{1, 18}(\cdot 01) = 8 \cdot 28]$$

$$2 + 6$$