

2025

M.Sc. 1st Semester Examination

ZOOLOGY

Paper : ZOOE404A1/B1

Full Marks : 35

Time : 1 Hour 30 Minutes

*The figures in the margin indicate full marks.
Candidates are required to give their answers
in their own words as far as practicable.*

Paper : ZOOE404A1

[Bioinformatics and Biostatistics]

Group - A

Answer any five questions : 2×5=10

1. What are the differences between the SWISS-PROT and TrEMBL databases?
2. Explain types of correlation with examples.
3. Explain standard error and its biological relevance.
4. Differentiate between a nucleotide sequence database and a genome database, giving one example of each.
5. What do you understand by central tendency? Name the five common measures of central tendency.
6. Write a short note on the error of inference.

P.T.O.

7. A nucleotide sequence file contains 1,500 bases of a human gene stored in standard FASTA format. State what is the first line of a FASTA file must begin with and explain the role of the accession number for this sequence.
8. Write short note on the measure of dispersion.

Group - B

Answer any *three* questions : $4 \times 3 = 12$

9. According to long-term ecological records, the mean dissolved oxygen (DO) concentration of an unpolluted freshwater lake is 8.5 mg/L, with a population standard deviation of 1.2 mg/L. An environmental scientist collected a large random sample of water from the lake after a nearby industrial discharge. The given data are as follows :
- Population mean $\mu = 8.5 \text{ mg/L}$; Population SD, $\sigma = 1.2 \text{ mg/L}$; Sample size, $n = 64$; Sample mean DO, $\bar{X} = 8.0 \text{ mg/L}$.
- (a) Frame the null hypothesis (H_0) and alternative hypothesis (H_1).
- (b) Perform a Z-test at 5% level of significance to test whether the mean dissolved oxygen level has significantly changed. (Critical value ± 1.96) $1+3$
10. Define normal distribution. List its main propositions and illustrate the normal curve showing area distribution. $1+2+1$

11. (a) A multiple sequence alignment file in PHYLIP format starts with the line :

5 300..... followed by 5 rows of sequence IDs and aligned sequences. Explain what the numbers 5 and 300 represent in terms of the data that PHYLIP will use.

- (b) You have an alignment of 8 DNA sequences in FASTA format that you want to analyze with PHYLIP's distance-based methods (e.g., Neighbor-Joining). Outline the sequence of PHYLIP programs you would run to compute a distance matrix, and then visualize a phylogenetic tree, briefly stating what is produced at each step. 2+2

12. An immunologist examined how circulating IL-6 levels (X_1) and neutrophil count (X_2) together influence the severity of inflammation score (X_3) in mice ($n = 20$). Given correlation coefficients are : Inflammation score and IL-6 = 0.69; Inflammation score and neutrophil count = 0.74; IL-6 and neutrophil count = 0.63. Determine the multiple correlation coefficient between inflammation severity and the two immune parameters and test its significance.

Critical t value : $t_{0.05(19)} = 2.09$, $t_{0.05(18)} = 2.101$,
 $t_{0.05(16)} = 2.12$, $t_{0.05(17)} = 2.11$. 2+2

13. A researcher studied the relationship between blood hemoglobin concentration and maximal oxygen consumption (VO_2 max) in adult laboratory rats.

P.T.O.

Hemoglobin concentration is known to influence oxygen-carrying capacity and aerobic performance. To quantify this relationship, hemoglobin levels and VO_2 max were measured in a sample of rats. Use the regression equation to predict VO_2 max for a rat with a hemoglobin concentration of 13.0 g/dL.

Observed Data : $\bar{X} = 12.56$, $\bar{Y} = 56.75$,

$$\sum(X - \bar{X})^2 = 14.61, \quad \sum(Y - \bar{Y})^2 = 280.48,$$

$$\sum(X - \bar{X})(Y - \bar{Y}) = 64.34$$

Group - C

Answer any *one* question : $8 \times 1 = 8$

14. A study was conducted to evaluate the effect of a heavy metal pollutant (cadmium) on liver enzyme activity (ALT; U/L) in freshwater fish. Fish were exposed to three different cadmium concentrations for 30 days, along with an unexposed control group. After the exposure period, ALT activity was measured.

Observed ALT activity (U/L):

Group (Cadmium concentration)	ALT activity (U/L)				
Control (0 ppm)	22	24	23	21	25
Low dose (5 ppm)	28	30	27	29	31
Medium dose (10 ppm)	35	37	36	34	38
High dose (20 ppm)	45	47	46	44	48

Using one-way ANOVA, test whether cadmium concentration has a significant effect on liver enzyme activity.

(5)

Critical $F_{0.05(4,16)} = 3.01$; $F_{0.05(3,16)} = 3.24$; $F_{0.05(3,17)} = 3.20$;

$F_{0.05(3,18)} = 3.16$.

15. A zoologist studied the relationship between habitat disturbance level and nesting success in a population of ground-nesting birds. Both variables were recorded on ordinal (qualitative) scales. Observed Data are as follows:

Nest Site	Habitat disturbance level	Nesting success score
A	High	Poor
B	Moderate	Fair
C	Low	Good
D	High	Poor
E	Moderate	Fair
F	Low	Very Good
G	Low	Good
H	Moderate	Fair

Scoring Scheme: Habitat disturbance (X): Low = 1, Moderate = 2, High = 3

Nesting success (Y): Poor = 1, Fair = 2, Good = 3, Very Good = 4

Compute Spearman's rank correlation coefficient (ρ). State whether the relationship between habitat disturbance and nesting success is positive or negative. Comment on the biological significance of the correlation in terms of conservation ecology.

5+1+2

Internal Assessment : 5 marks

P.T.O.

(6)

Paper : ZOOE404B1

[Applied Zoology]

Group - A

Answer any *five* questions : $2 \times 5 = 10$

1. Name two mulberry varieties which are cultivated in hilly region?
2. Name two major pests of mulberries?
3. Name two economically important cultivable varieties of freshwater prawns in India.
4. What is stick lac?
5. What do you mean by a breed?
6. What is mastitis?
7. What are the three main types of poultry?
8. State the significance of egg grading.

Group - B

Answer any *three* questions : $4 \times 3 = 12$

9. What is the ideal soil pH for mulberry cultivation? How to prepare land for mulberry cultivation? $2+2$
10. Write a brief note on pearl oyster farming.
11. Write down the name of few suitable earthworms which is used for vermicomposting.

(7)

12. Write an explanatory note on the primary raw materials for dairy farming.
13. Which chicken breeds are mostly considered for production of eggs and meat, and why?

Group - C

Answer any *one* question : $8 \times 1 = 8$

14. Discuss the key factors to be considered for breed selection for poultry farming. What are the threats of poultry farming? $4+4$
15. Describe the important by-products available from the dairy and their utilization.

Internal Assessment : 5 marks
