

POST-GRADUATE COURSE

Term End Examination — June, 2023/December, 2023

ZOOLOGY

Paper-6A : QUANTITATIVE BIOLOGY AND BIOTECHNOLOGY

Time : 2 hours]

[Full Marks : 50

Weightage of Marks : 80%

Special credit will be given for precise and correct answer. Marks will be deducted for spelling mistakes, untidiness and illegible handwriting. The figures in the margin indicate full marks.

Use of scientific calculator is strictly prohibited.

1. Answer the following :

9 × 1 = 9

- A) i) Determine class boundaries, class marks, class width, and frequency density from the following frequency distribution table :

Wt. of fish (gm)	Frequency
20-24	34
25-29	21
30-34	12
35-44	09
45-59	06

- ii) Use the following ANOVA table choose the correct answer for the problems (a - g) :

Source	df	SS	MS	Variance ratio
Blocks	2		24	$F_t = 2$
Treatment		36		
Error			6	
Total	11	120		

- a) The sums of squares for blocks are (i) 22, (ii) 24, (iii) 26, (iv) 12, (v) 48.

- b) The degrees of freedom for treatments are (i) 3, (ii) 6, (iii) 2, (iv) 9, (v) 8.
- c) The degrees of freedom for error are (i) 3, (ii) 6, (iii) 2, (iv) 9, (v) 8.
- d) The sums of squares for error are (i) 84, (ii) 36, (iii) 48, (iv) 24, (v) 12.
- e) The mean squares for treatments are (i) 30, (ii) 36, (iii) 18, (iv) 12, (v) 72.
- f) The denominators for the variance ratio used to test treatments are (i) 3, (ii) 12, (iii) 6, (iv) 2, (v) 4.
- g) If the table value to test treatments is $F_{(0.05, V_1, V_2)} = 3.59$, we would conclude that the treatment means are
- (i) not significantly different, (ii) significantly different, (iii) no sufficient information. 4 + 5

OR

- B) i) The monthly outputs of fish in quintal of 100 ponds distributed are as follows :

Output per pond	0-100	100-200	200-300	300-400	400-500	500-600
No. of ponds	12	18	27	20	17	6

Prepare a histogram based on the above data.

- ii) Deviations taken from the mean of X and Y (two variables) are given below. Find 'r' by Pearson's product-moment method and explain their significance.

X - 4, - 3, - 2, - 1, 0 1, 2, 3, 4

Y - 3, - 3, - 4, 0, 4, 1, 2, - 2, - 1

3 + 6

2. Answer the following : $9 \times 1 = 9$

- A) What are the uses of Southern blots ? With the diagram discuss the procedural steps in the Southern blotting technique. What is the difference between a Southern, Northern and Western blots in terms of gel and membrane material used ? $1 + 5 + 3$

OR

- B) What is affinity chromatography ? State its principle. Discuss the different steps of affinity chromatography. $(2 + 3) + 4$

3. Answer *three* questions taking at least *one* from each unit : $6 \times 3 = 18$

Unit - I

- A) Define pi-chart. State the working procedure for pi-chart preparation. $2 + 4$

- B) Ovary weight (gm) of 50 fishes and their frequency are given in class interval. Find the standard deviation and coefficient of standard deviation. $4 + 2$

Weight of ovary	2 - 2.9	3 - 3.9	4 - 4.9	5 - 5.9	6 - 6.9
Frequency	6	13	11	8	12

- C) Following is the frequency of 50 fishes of a species of fish in frequency distribution in continuous series. Find the median fecundity. 6

Frequency in C.I.	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80
Frequency	3	15	2	8	11	4	1	6

Unit - II

- D) What is the objective of the comet assay ? State the procedure of comet assay. $3 + 3$

- E) What is biosensor ? Explain the functional activity of the biosensor with a schematic diagram. $2 + 4$

F) What are the main differences between a colorimeter and a spectrophotometer ? What is the principle of Beer-Lambert law ? 3 + 3

4. Answer *two* questions taking at least *one* from each unit : $4 \times 2 = 8$

Unit - I

A) Discuss different types of errors in testing of hypothesis. 4

B) A coin is tossed 12 times. What is the probability of getting exactly 7 tails ? 4

Unit - II

C) What is the difference between excitation and emission filters used in a fluorescent microscope ? 4

D) How does agglutination differ from hemagglutination ? State two similarities between agglutination and hemagglutination. 2 + 2

5. Answer *two* questions taking at least *one* from each unit : $3 \times 2 = 6$

Unit - I

A) Explain degrees of freedom in statistics. 3

B) What are the three categories of kurtosis ? 3

Unit - II

C) State different steps of cryopreservation of spermatozoa. 3

D) What is the role of TEMED and APS in SDS-PAGE ? 3
