BINDURA UNIVERSITY OF SCIENCE EDUCATION

BIOLOGICAL SCIENCES DEPARTMENT

HBScBZ/HBScBioTec/HBScED/BScED

BIOMATHEMATICS (BZH209)/BIOSTATISTICS (BTEC216)/RESEARCH METHODS FOR BIOLOGISTS (BZH216)

EXAMINATION

2 HOURS (100 MARKS) OCT 2024

INSTRUCTIONS

Answer FOUR questions. You MUST answer QUESTION 1 (Section A) and any THREE questions from Section B. Each question carries 25 MARKS. Where a question contains subdivisions, the mark value of each subdivision is given in brackets. Illustrate your answers where appropriate with large, clearly labelled diagrams. You should not spend more than thirty minutes on each question.

SECTION A (COMPULSORY)

1. The table 1 below shows concentration of CO_2 (in parts per million) and average atmospheric temperatures (in °C) for ten years.

CO_2 (ppm)	314	317	320	326	331	339	346	354	361	369
Temp (°C)	14.0	14.3	14.2	14.7	14.9	15.1	15.0	15.4	15.5	15.7

(a) Compute the linear correlation coefficient, r, of the data. (10 marks)
(b) Interpret the value of r and conclude on the relationship between CO_2 concentration and temperature. (2 marks)
(c) Perform a hypothesis test for the population linear correlation coefficient for the data in the table. (13 marks)

SECTION B

2. A machine is used to pack fruit juice. A random sample of 20 bottles was taken from the machine and the volume of each bottle was measured to the nearest millilitre and recorded in Table 2 below.

Table 2: Volume of fruit juice bottles

196	198	198	199	200	201	201	201	202	205
192	194	195	198	200	201	203	204	204	205

Find the:

(a) Mode. (2 marks)
(b) Range. (2 marks)
(c) Interquartile range. (8 marks)
(d) Variance. (10 marks)
(e) Standard deviation. (3 marks)

3. Table 3 below shows bacterial colonies from randomly selected petri dishes when three antibiotics, X, Y, and Z, were used.

Antibiotic	**Bacterial colonies per petri dish**						
X	9	7	2	6	5	8	
Y	2	9	11	10	7	6	8
Z	15	11	12	9	10		

At 5% significance level, determine whether there is any difference in the number of bacterial colonies from the petri dishes. Assume variances from the yields are the same.

4. The following data show pH levels of 15 dams.

7.2	7.3	6.1	6.9	6.6	7.3	6.3	5.5	6.3	6.5	5.7	6.9
6.7	7.9	5.8									

At 5% significance level, do the data provide sufficient evidence to conclude that the dams are non-acidic? A dam is classified as non-acidic if it has a pH greater than 6.

5. A study on the number of native tree species between wetland and cropland yielded summary data in Table 4.

Table 4 Summary data of native tree species in wetland and cropland

Cropland	Wetland
$x_1 = 14.56$	$x_2 = 14.06$
$\sigma_1 = 4.95$	$\sigma_2 = 4.83$
$n_1 = 98$	$n_2 = 126$

At 5% significance level, do the data provide sufficient evidence to conclude that a difference exists in the mean number of native species in the two regions?

6. Describe any **FIVE** random sampling methods.

END OF EXAMINATION QUESTION PAPER