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)

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.

Table 1: Concentration of CO_2 and average atmospheric temperatures

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. In a study of the effect of two fertilisers on yield, summary statistics shown below were observed from randomly selected plots.

Fertiliser A	**Fertiliser B**
Mean harvest = 134 kg / ha	Mean harvest = 143 kg / ha
s = 6.9 kg / ha	s = 2.6 kg / ha
n = 8 plots	n = 10 plots

At 5% significance level, can you conclude that the fertilisers have different effects on yield? Assume population variances are equal.

3. Table 2 shows yields, in tonnes per hectare, from randomly selected plots when three fertilisers, A, B, and C, were used.

Table 2: Yields, in tonnes per hectare, from plots in which three different fertilisers were used.

Fertiliser	**Yield (Tonnes per hectare)**
A	9 7 2 6 5 8
B	2 9 11 10 7 6 8
C	15 11 12 9 10

At 5% significance level, determine whether there is any difference in yields from the plots. Assume variances from the yields are the same.

4. In a 2015 survey at Bindura University, it was observed that 1.1% of students were Hindus, 6.3% were Muslims, 28.6% practised Traditional African and 64% were Christians. Table 3 shows results of a 2022 survey of religions of 500 students from Bindura University.

Table 3: Students' religions at Bindura University

Religion	**Number of Students**
Hinduism	3
Islam	37
Traditional African	154
Christianity	306

At 5% significance level, determine whether the 2022 distribution of students according to religion is different from the 2015 results.

5. A student claims that the mean of the number of individual fish caught per trap is less than 8.5 fish. A random sample of 35 traps yielded a mean of 8.2 individual fish with a standard deviation of 0.5 fish. At 5% significance level, test the student's claim.

6. Write an essay on scales/levels of measurement.

END OF EXAMINATION QUESTION PAPER