

(iv) What conclusion would be drawn from the findings?

(Given: $-t_{(10+8-2), 0.01} = -2.583$)

(Given: $-t_{(n_1+n_2-2), \alpha} = -2.583$) (12)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 8069 L

Unique Paper Code : 2533012002

Name of the Paper : Applications of Statistics in Biology (DSE)

Name of the Course : **B.Sc. (H) Microbiology**

Semester : VIII – UGCF (NEP), Part-IV

Duration : 2 Hours Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **five** questions.
3. **All** questions carry equal marks.
4. Use of non-scientific calculator/log tables is allowed.

1. (a) Fill in the blanks (any six) : (1×6=6)

- (i) Test used to compare two variances is called _____ .
- (ii) The difference between highest and lowest values is called _____ .
- (iii) Normal distribution is also called _____ curve.
- (iv) Standard normal distribution has mean _____ and variance _____ .
- (v) Probability of an event lies between _____ and _____ .
- (vi) Large sample test is based on _____ distribution.
- (vii) The probability of rejecting a true hypothesis is called _____ .

age group, same gender, similar sugar level, etc. and out of these patients 10 were kept randomly under new treatment and the rest under old treatment. After three months, they measured the HbA1c of the patients and obtained HbA1c levels which are given as follows :

HbA1c Level

New Treatment	5.7	6.4	5.3	6.3	6.2	5.6	5.4	5.0	6.4	5.7
Old Treatment	6.2	5.3	6.8	5.6	6.4	5.7	6.8	6.8		

If the HbA1c levels for both groups of patients follow normal distribution with equal variances, then

- (i) Formulate the null and alternative hypotheses for this situation.
- (ii) Whether the Z-test or t-test is appropriate for testing the belief and why?
- (iii) Conduct a hypothesis test to see whether the new treatment is more effective than the old treatment at the 1% significance level.

- (b) A researcher is testing the effectiveness of a new disinfectant against *Escherichia coli*. They apply varying concentrations of the disinfectant (in % solution) to standardized agar plates and count the number of surviving bacterial colonies after 24 hours.

Disinfectant Concentration (%) (X)	1	2	3	4	5
Bacterial Count (CFU in hundreds) (Y)	45	38	25	18	10

(i) Find the regression equation of Y on X.

(ii) Find Y for X = 1.5%, 3.5%, 6.0%.

(6)

6. A medicine research team invented a new treatment for sugar patients and believes that it controls high sugar levels more effectively than the old one. To test their belief, they conducted a study and selected 18 sugar patients of similar conditions, that is, same

- (b) Find the Karl Pearson's coefficient of correlation (r) between X and Y from the following data (Nutrient concentration vs microbial enzyme activity)

X (Nutrient mg/ml)	1	2	3	4	5
Y (Enzyme units)	10	12	11	15	14

(6)

2. (a) Briefly explain the following (any four) –

(1.5×4=6)

(i) Sampling

(ii) Estimator

(iii) Level of significance

(iv) Central limit theorem

(v) Tabulation of data

- (b) The bacterial colony count from different plates is 32, 60, 40, 58 and 42. Calculate the variance and standard deviation.

(6)

P.T.O.

8069**4**

3. (a) State true or false (**any six**) : (1×6=6)

(i) Regression analysis predicts one variable from another. (T/F)

(ii) Scatter diagram shows relationship between variables. (T/F)

(iii) Probability can be greater than 1. (T/F)

(iv) Poisson distribution is discontinuous. (T/F)

(v) Normal distribution is symmetric. (T/F)

(vi) If $p\text{-value} < \alpha$, reject null hypothesis. (T/F)

(vii) F-test compares means. (T/F)

(b) If, $n = 10$, $\bar{x} = 5$, $\sum x^2 = 340$, find the coefficient of variation. (6)

4. (a) Differentiate between the following (**any two**) – (3×2=6)

8069**5**

(i) Poisson vs Normal Distribution.

(ii) Type I Error and Type II Error.

(iii) Regression and Correlation.

(b) Let X be the number of heads when a coin is tossed twice. Find the probability distribution.

(2)

(c) What is the mean of the range, mode and median of the data 5, 10, 3, 6, 4, 8, 9, 3, 6, 5, 3, 2, 6, 2, 6

(4)

5. (a) Write short notes on the following (**any two**) : (3×2=6)

(i) Hypothesis Testing

(ii) Characteristics of normal distribution.

(iii) Standard distributions

P.T.O.