

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-IV EXAMINATION – WINTER 2025****Subject Code:3144007****Date:24-11-2025****Subject Name:Numerical and Statistical Methods****Time:02:30 PM TO 05:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

MARKS

- Q.1 (a)** A university has 1000 students out of which 650 can speak Gujarati, 400 can speak Hindi, and 150 can speak both Gujarati and Hindi. If a student is selected at random, what is the probability that he/she speaks at least one of the two languages? **03**

- (b)** Perform 3 iterations of secant method to obtain positive root of the equation $\cos x - xe^x = 0$. **04**

- (c)** Consider the exponential relation $y = pe^{qx}$. Find the values of constants p and q such that the relation fits the data, **07**

x	1	3	5	7	9
y	115	105	95	85	80

- Q.2 (a)** Find the mode of the following distribution. **03**

Class	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	5	8	7	12	28	20	10	10

- (b)** Calculate the approximate standard deviation for the following data. **04**

Class	0-10	10-20	20-30	30-40	40-50	50-60
Frequency	27	10	7	5	4	2

- (c)** Use the Runge-Kutta formula of fourth order to find the numerical solution at $x = 0.6$ for $\frac{dy}{dx} = \sqrt{x + y}$, $y(0.4) = 0.41$ with step size $h=0.2$. **07**

OR

- (c)** Find $y(0.5)$ for $y' = -2x - y$, $y(0) = -1$, with step length 0.1 using Modified Euler method. **07**

- Q.3 (a)** Find rank correlation of the following data. **03**

A	10	5	7	3	6	1	9	8	4	2
B	8	5	4	1	9	3	10	2	6	7

- (b)** The function $y=f(x)$ is given at the points (7,3), (8,1), (9,1) and (10,9). Find the value of y for $x=9.5$ using Lagrange's interpolation formula. **04**

- (c)** Consider the following data regarding y and x of 100 college students are given: $\sum x = 15000$, $\sum x^2 = 2272500$, $\sum y = 6800$, $\sum y^2 = 463025$, $\sum xy = 1022250$. Find the coefficient of correlation between y and x and also the equations of regression of y on x and x on y. **07**

OR

- Q.3 (a)** The coefficient of correlation between two variables X and Y is 0.48. The covariance is 36. The variance of X is 16. Find the standard deviation of Y. **03**

- (b)** The population is tabulated below. Estimate population for 1895. **04**

Year	1891	1901	1911	1921	1931
Population (in thousands)	46	66	81	93	101

- (c) Calculate Karl Pearson's coefficient of skewness from the following data: 07

Class	40-50	50-60	60-70	70-80	80-90	90-100	100-110	110-120	120-130	130-140
frequency	5	6	8	10	25	30	36	50	60	70

- Q.4 (a)** An industrial plant has three machines, M1, M2 and M3 each of which produces 23%, 30% and 47% products respectively. It is known that 2%, 2.25% and 7% of products produced by each of the machines are faulty. Find the probability of getting a faulty product if any item is randomly selected. 03

- (b) What is the probability of getting 8 heads in a row with 8 trials on an unbiased coin? What is the probability of getting a tail on 9th trial on the same coin? 04

- (c) If 300 LED lights are installed assuming normality, with a mean of 68 months of burning life and a standard deviation of 3 months. Find probability that the LED lights have burning life (i) greater than equal to 72 months? (ii) less than equal to 64 months? 07

OR

- Q.4 (a)** It is observed from the previous year's data that a mango-forest produces an average of 500 mangoes during the first week of May, 540 during second week, 565 during third week and 400 items during the last week of the month, the probability for these being 0.33, 0.20, 0.23 and 0.24 respectively. Determine the expected value of the production. 03

- (b) A document with data collected from a survey consisting of 698 pages has 49 errors. If these errors are randomly distributed throughout the document, what is the probability that 10 pages, selected at random, will be free from errors? 04

- (c) Three vessels A1, A2 and A3 contain 4 balls. A1 has 3 blue balls and 1 yellow balls, A2 has 2 blue balls and 2 yellow balls and A3 has 1 blue ball and 3 yellow balls. Given that a yellow ball was selected, what is the probability that it came from A2 vessel? 07

- Q.5 (a)** A machine produced 16 defective articles in a lot of 500. After servicing the machine, it produced 3 defectives in a lot of 100. Has the machine improved? 03

- (b) A brain sharpening activity was carried out in a university for 9 students. Their mental ability was measured based on scores of a test taken before and after the activity. State whether the activity was effective or not from the data of their scores given below. 04

Before	10	15	9	3	7	12	16	17	4
After	12	17	8	5	6	11	18	20	3

- (c) Test whether the following samples A1 and A2 are drawn from the same normal population. 07

A1	17	27	18	25	27	29	13	17
A2	16	16	20	27	26	25	21	

OR

- Q.5 (a)** A random sample of 900 members has mean 3.4. Can it be reasonably regarded as a sample from a large population of mean 3.2 and standard deviation 2.3? 03

- (b) A sample of 20 items has mean 42 units and standard deviation 5 units. Test the hypothesis that it is a random sample from a normal population with mean 45 units. 04

- (c) It is predicted that the proportion of 4 varieties of the books in four groups A1, A2, A3 and A4 should be in the ratio 9:3:3:1. In an experiment in library, 1600 books were categorized in four groups as 882, 313, 287 and 118. Does the experiment support the prediction made? 07
