

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE- SEMESTER-IV (NEW) EXAMINATION – WINTER 2024****Subject Code: 3144007****Date: 27-11-2024****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 bag contains 2 green, 3 red, and 5 blue beads. Three beads are drawn at once randomly. Find the probability that the two beads drawn are blue and 1 bead drawn is red. **03**
- (b) Perform 4 iterations to find the real root of the equation  $x^3 - 4x - 9 = 0$  between 2 and 3 using bisection method. **04**
- (c) Using curve fitting technique, find a straight line  $y = a + bx$  to the following data. **07**

|   |    |    |    |    |    |
|---|----|----|----|----|----|
| x | 1  | 2  | 3  | 4  | 5  |
| y | 14 | 27 | 40 | 55 | 68 |

- Q.2** (a) Find the mean from the table given below. **03**

|           |       |       |       |       |       |        |
|-----------|-------|-------|-------|-------|-------|--------|
| Class     | 10-25 | 25-40 | 40-55 | 55-70 | 70-85 | 85-100 |
| Frequency | 2     | 3     | 7     | 6     | 6     | 6      |

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

|       |   |    |    |    |    |
|-------|---|----|----|----|----|
| $x_i$ | 6 | 10 | 12 | 14 | 24 |
| $f_i$ | 2 | 3  | 4  | 5  | 4  |

- (c) Use the fourth order Runge-Kutta-4 formula to find the numerical solution at  $x = 0.1$  for following equation with step size  $h=0.1$ . **07**

$$\frac{dy}{dx} = \frac{x^2 + y^2}{10}, y(0) = 1.$$

**OR**

- (c) Use the fourth order Runge-Kutta formula to find the numerical solution at  $x = 1.05$  for  $\frac{dy}{dx} = x^2 + y^2$ ,  $y(1) = 1.2$  with step size  $h=0.05$ . **07**

- Q.3** (a) Find rank correlation coefficient if rank of 10 candidates in singing competitions I and II are as tabulated below. **03**

|    |    |   |   |   |   |   |   |   |    |   |
|----|----|---|---|---|---|---|---|---|----|---|
| I  | 5  | 7 | 8 | 9 | 4 | 3 | 2 | 6 | 10 | 1 |
| II | 10 | 8 | 9 | 6 | 4 | 5 | 2 | 7 | 3  | 1 |

- (b) Find  $f(1.6)$  using Newton's forward interpolation formula from the following table. **04**

|      |      |      |      |     |
|------|------|------|------|-----|
| x    | 1    | 1.4  | 1.8  | 2.2 |
| f(x) | 3.49 | 4.82 | 5.96 | 6.5 |

- (c) Find the regression coefficient of y on x. **07**

|   |     |     |     |     |     |
|---|-----|-----|-----|-----|-----|
| x | 1   | 2   | 3   | 4   | 5   |
| y | 160 | 180 | 140 | 180 | 200 |

**OR**

- Q.3 (a)** Find the coefficient of correlation between two variables x and y using following table. **03**

|   |    |    |    |    |    |    |
|---|----|----|----|----|----|----|
| x | 10 | 14 | 18 | 22 | 26 | 30 |
| y | 18 | 12 | 24 | 6  | 30 | 36 |

- (b)** Compute y at x=9.2 using Lagrange's interpolation formula. **04**

|   |        |        |        |
|---|--------|--------|--------|
| x | 9      | 9.5    | 11     |
| y | 2.1972 | 2.2513 | 2.3979 |

- (c)** Calculate Karl Pearson's coefficient of skewness for the end semester examination marks for a total of 100 students as tabulated below. **07**

|           |      |       |       |       |       |       |       |
|-----------|------|-------|-------|-------|-------|-------|-------|
| Class     | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 |
| Frequency | 10   | 15    | 24    | 25    | 10    | 10    | 6     |

- Q.4 (a)** A manufacturer produces bulbs whose distribution X is normal with mean 12 and SD 4. Find the probability of  $X \geq 20$ . **03**

- (b)** Let X be a random variable with Poisson distribution. If mean of the Poisson variable is 1.8, find  $P(X=5)$ . **04**

- (c)** Find k, mean and variance for the following probability distribution **07**

|        |     |    |     |    |     |    |
|--------|-----|----|-----|----|-----|----|
| X      | -2  | -1 | 0   | 1  | 2   | 3  |
| P(X=x) | 0.2 | k  | 0.1 | 2k | 0.1 | 2k |

**OR**

- Q.4 (a)** The probability that event A occurs is  $\frac{2}{5}$  and the probability that B occurs is  $\frac{2}{3}$  and  $P(A \cap B) = \frac{4}{15}$ . Find the probability  $P(A \cup B)$ . **03**

- (b)** A sample of 3 items is selected at random from a box containing 10 items of which 4 are defective. Find the expected number of defective items. **04**

- (c)** Find the probability distribution of the number of heads when three coins are tossed. **07**

- Q.5 (a)** An experiment with possible 6 outcomes {0,1,2,3,4,5} is carried out 9000 times and 3 or 4 is obtained 3240 times. Can the experiment be considered as unbiased at 5% level of significance, i.e.,  $|z| < 1.96$ ? **03**

- (b)** A random sample of 10 experiments had the following data: 100, 120, 110, 101, 98, 83, 95, 88, 107 and 70. Is it true that the data supports the assumption of a population mean of 100?  $|t|$  at 5% is 2.262. **04**

- (c)** The number of customers in a 5-star restaurant was found to vary as 1124, 1125, 1110, 1120, 1126, 1115 on Saturday, Sunday, Monday, Tuesday, Wednesday, Thursday. Test whether the hypothesis that the number of customers does not depend on the day of week at 5% level of significance. **07**

**OR**

- Q.5 (a)** A computer program is written for creating random output for binary digits, that is, the output can be either 0 or 1. If the program was executed 1,600 times and the 0 turned up 864 times. Test the hypothesis that the program is unbiased at 1% level of significance (value at 1% confidence is 2.58). **03**

- (b)** Consider the given data for two samples. Sample I: 44, 34, 22, 10, 47, 31, 40, 30, 32, 35, 18, 21, 25, 29, 22 & Sample II: 25, 32, 30, 34, 24, 14, 32, 24, 30, 31, 35, 25. Check whether the mean of two samples differ significantly. **04**

- (c)** In one sample of 8 observations, the sum of squares of derivations of the sample values from the sample mean was 84.4 and in other sample of 10 observations it was 102.6. Test whether this difference is significant at 5% level of significance. **07**

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