

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER– IV (New) EXAMINATION – WINTER 2019****Subject Code: 2141703****Date: 07/12/2019****Subject Name: Numerical Techniques & Statistical Methods****Time: 10:30 AM TO 01:30 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

MARKS**Q.1 (a)** Find the relative error if the number $X = 0.004997$ is **03**

- (1) Truncated to three decimal digits
- (2) Rounded off to three decimal digits

(b) Calculate mean, median and standard deviation from the following data: **04**

Wages (Rs.'000):	0-10	10-20	20-30	30-40	40-50	50-60
No. of workers:	12	17	23	39	16	03

(c) Explain diagonally dominant system of equations. Solve the following system of equations by Gauss Jacobi method. **07**
 $3x + 20y - z = -18$, $2x - 3y + 20z = 25$, $20x + y - 2z = 17$ **Q.2 (a)** The following data gives the velocity of a particle for 20 seconds at an interval of 5 seconds. Find the initial acceleration using the entire data: **03**

Time t (sec):	0	5	10	15	20
Velocity v(m/sec):	0	3	14	69	228

(b) A curve passes through the points (0, 18), (1, 10), (3, -18) and (6, 90). Find the slope of the curve at $x = 2$ using Lagrange Interpolation technique. **04****(c)** Evaluate the integral **07**

$$\int_0^{0.5} \left(\frac{x}{\sin x} \right) dx$$

Using Romberg's method, correct to 3 decimal places.

OR**(c)** Evaluate **07**

$$\int_{0.2}^{1.5} e^{-x^2} dx$$

Using Gaussian quadrature formula for $n = 2$ and $n = 3$.**Q.3 (a)** Find by Newton's method, the real positive root of the equation $x^4 - x = 10$, correct to three decimal places. **03****(b)** Using Taylor's series method find approximate value of y at $x = 0.2$ for the differential equation $dy/dx = 2y + 3e^x$, $y(0) = 0$. Compare the numerical solution obtained with the exact solution. **04****(c)** The following values of x and y are given: **07**

x:	1	2	3	4
y:	1	2	5	11

Find the cubic splines and evaluate $y(1.5)$ and $y'(3)$.**OR**

- Q.3 (a) For the given set of order pairs $(x_0, y_0), (x_1, y_1)$, define first order forward difference, first order backward difference and first order divided difference. 03
- (b) Using modified Euler's method, find $y(0.2)$, given 04
 $dy/dx = y + e^x$, $y(0) = 0$
- (c) Apply Runge-Kutta method to find approximate value of y for $x = 0.2$, 07
in steps of 0.1, if $dy/dx = x + y^2$, given that $y = 1$ when $x = 0$.
- Q.4 (a) A salesman wants to know the average number of units he sells per 03
sales call. He checks his past sales records and comes up with the following probabilities:
- | | | | | | | |
|-----------------|------|------|------|------|------|------|
| Sales in units: | 0 | 1 | 2 | 3 | 4 | 5 |
| Probability: | 0.15 | 0.20 | 0.10 | 0.05 | 0.30 | 0.20 |
- What is the average number of units he sells per sales call?
- (b) The mean and standard deviation of a population are 225 and 278 04
respectively. What can we assert with 95% confidence about the maximum error if $\bar{x} = 225$ and $n = 100$. Also, construct 95% confidence Interval.
- (c) Out of 800 families with 4 children each, what percentage would be 07
expected to have (a) 2 boys and 2 girls (b) at least one boy (c) no girls and (d) at the most 2 girls. Assume equal probabilities for boys and girls.
- OR**
- Q.4 (a) 500 apples are taken at random from a large basket and 50 are found to 03
be bad. Estimate the proportion of bad apples in the basket and assign limits within which the percentage most probably lies. (critical value at the most is 3)
- (b) Before an increase in excise duty on tea, 800 people out of a sample of 04
1000 were consumers of tea. After the increase in duty, 800 people were consumers of tea in a sample of 1200 persons. Find whether there is a significant decrease in the consumption of tea after the increase in duty. Use a 1% level of significance (z at 1% level of significance is 2.580)
- (c) Test made on the breaking strength of 10 pieces of a metal gave the 07
following results: 578, 572, 570, 568, 572, 570, 570, 572, 596 and 584 kg. Test at 5% Level of significance if the mean breaking strength of the wire can be assumed as 577 kg. (for $v = 9$, $t_{0.05} = 2.26$)
- Q.5 (a) In a sample of 1000 the mean is 17.5 and S.D is 2.5. In another sample 03
of 800 the mean is 18 and S.D. is 2.7. Assume that the sample are independent. Discuss at 1% level of significance, whether the two samples can have come from a population which have the same S. D. (Z at 1% LOS is 2.58)
- (b) The following data give the number of aircraft accidents that occurred 04
during the various days of a week.
- | | | | | | | |
|-------------------|-----|-----|-----|-----|-----|-----|
| Day: | Mon | Tue | Wed | Thu | Fri | Sat |
| No. of accidents: | 15 | 19 | 13 | 12 | 16 | 15 |
- Using χ^2 distribution, test whether the accidents are uniformly 07
distributed over the week at 95% confidence level.
(for $v = 5$, $\chi_{0.05}^2 = 11.07$)
- (c) A small project is composed of 7 activities whose time estimates are 07
listed in the table below. Activities are identified by their beginning i and ending j node numbers.

Activity (i – j)	Estimated Duration (weeks)		
	Optimistic	Most likely	Pessimistic
1-2	3	5	8
1-3	2	4	8
1-4	6	8	12
2-5	5	9	12
3-5	3	5	9
4-6	3	6	10
5-6	2	4	8

- (a) Draw the network for this project
 (b) Determine the expected time and variance for each activity
 (c) Find the critical path and the project variance.
 (d) What is the probability that the project will be completed in 22 days?

OR

- Q.5** (a) A little league baseball coach wants to know if his team is representative of other teams in scoring runs. Nationally the average number of runs scored by a little league team in a game is 5.7. He chooses five games at random in which his team scored 5,9,4,11 and 8 runs. Is it likely that his team's scores could have come from the national distributions? Assume $\alpha = 0.05$. **03**
- (b) In large city A, 20% of a random sample of 900 school children had defective eye sight. In another large city B, 15% of a random sample of 1600 children had the same defect. Obtain 95% confidence limits for the difference in the population proportions. **04**
- (c) An architect has been awarded a contract to prepare plans for an urban renewal project. The job consists of the following activities and their estimated times: **07**

Activity	Description	Immediate Predecessors	Time (days)
A	Prepare preliminary sketches	--	2
B	Outline specifications	--	1
C	Prepare drawings	A	3
D	Write specifications	A, B	2
E	Run off prints	C, D	1
F	Have specification	B, D	3
G	Assemble bid packages	E, F	1

- (a) Draw the network diagram of activities for the project
 Indicate the critical path and calculate the total float and free float for each activity.
