

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-IV(NEW) – EXAMINATION – SUMMER 2019****Subject Code:2140606****Date:09/05/2019****Subject Name: Numerical and Statistical Methods for Civil Engineering****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.

**Q.1 (a)** Define and give an example of: **03**  
 (i) Exhaustive Events, (ii) Mutually Exclusive Events.

**(b)** Using Newton-Raphson Method find a real root of  $x^4 - x - 10 = 0$  correct to three decimal places (using  $x_0 = 2$  initial value). **04**

**(c)** Raw material used in the production of a synthetic fiber is stored in a place which has no humidity control. Measurements of the relative humidity in the storage place and the moisture content of a sample of the raw material (both in %) on 7 days yielded the following results: **07**

|                      |    |    |    |    |    |    |    |
|----------------------|----|----|----|----|----|----|----|
| Humidity (x):        | 42 | 35 | 50 | 43 | 48 | 62 | 31 |
| Moisture content(y): | 12 | 8  | 14 | 9  | 11 | 16 | 7  |

Find the lines of regression of Y on X and X on Y.

**Q.2 (a)** The average grade of male students in the class was 6.2 and that of females was 7.3. The mean grade of all the students was 6.53. Find the percentage of male and female students. **03**

**(b)** If 6 of 18 new buildings in a city violate the building code, what is the probability that a building inspector, who randomly selects 4 of the new buildings for inspection, will catch **04**

(i) None, (ii) One, (iii) at least 3, of the new buildings that violate the building code?

**(c)** Apply Gauss-Seidel method to solve the following system of equation correct to three decimal places. **07**

$$5x - y - z = 3, -x + 10y - 2z = 7, -x - y + 10z = 8$$

**OR**

**(c)** From the following table values of x and f(x), determine: **07**  
 (i) f(0.21) and (ii) f(0.29) using Newton's Forward and Newton's Backward Interpolation formula respectively:

|       |        |        |        |        |        |        |
|-------|--------|--------|--------|--------|--------|--------|
| x:    | 0.2    | 0.22   | 0.24   | 0.26   | 0.28   | 0.30   |
| f(x): | 1.6596 | 1.6698 | 1.6804 | 1.6912 | 1.7024 | 1.7139 |

**Q.3 (a)** Find the missing value in the following table using finite difference: **03**

|    |   |   |   |   |    |
|----|---|---|---|---|----|
| x: | 0 | 1 | 2 | 3 | 4  |
| y: | 1 | 3 | 9 | ? | 81 |

**(b)** Find a real root of the equation  $x^5 - 2x - 5 = 0$  using secant method up to first 3 iterations. **04**

- (c) State Bayes theorem. 07  
 In a block factory, machines A, B and C manufacture respectively 25%, 35% and 40% of the total. Of their output 5%, 4% and 2% are defective. A block is drawn at random from the product and is found to be defective, what are the probabilities that it was manufactured by machines A, B and C?

**OR**

- Q.3** (a) Show that: (i)  $E\nabla = \nabla E = \Delta$ , (ii)  $\nabla = 1 - E^{-1}$  03  
 (b) Using Euler's Method for the equation  $y' = x + y$ ,  $y(0) = 0$  to compute  $y(0.4)$  and  $y(0.6)$ , taking  $h=0.2$ . 04  
 (c) Find the mean and median of the following data: 07

| Classes: | 0 – 30 | 30 – 60 | 60 – 90 | 90 – 120 | 120 – 150 | 150 – 180 |
|----------|--------|---------|---------|----------|-----------|-----------|
| f:       | 8      | 13      | 22      | 27       | 18        | 7         |

- Q.4** (a) Using Simpson's  $1/3^{rd}$  rule to evaluate  $\int_0^{1.2} x e^{-x} dx$ , taking  $h=0.2$ . 03  
 (b) Given that the equation  $e^{(2.2)x} = 69$  has a root between 1 and 2, using the method of false position determine it up to two iterations. 04  
 (c) Fit the curve  $y = a e^{bx}$  to the following data using least square technique. 07

|    |   |    |    |    |    |
|----|---|----|----|----|----|
| x: | 1 | 2  | 3  | 4  | 5  |
| y: | 7 | 11 | 17 | 27 | 43 |

**OR**

- Q.4** (a) Define: Mathematical Expectation. 03  
 Given that  $f(x) = k/2^x$  is probability distribution for a random variable that can take on the values  $x = 0, 1, 2, 3, 4$ . Find  $k$ .  
 (b) Using Lagrange Interpolation formula find the  $y(7)$  from the following data: 04

|    |   |    |    |
|----|---|----|----|
| y: | 1 | 3  | 4  |
| x: | 4 | 12 | 19 |

- (c) Use Runge-Kutta Method of fourth order for  $y' = x + y^2$ ,  $y(0) = 1$  to find approximate value of  $y(0.2)$  correct to 3 decimal places (with step size  $h = 0.1$ ). 07  
**Q.5** (a) Calculate  $f(4)$  using Newton's Divided Difference Interpolation formula from the following data: 03

|       |   |   |     |    |
|-------|---|---|-----|----|
| x:    | 1 | 2 | 3   | 5  |
| f(x): | 7 | 4 | 5.5 | 40 |

- (b) The ranks of same 16 students in Maths and MOS are as follows: 04  

|        |   |    |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
|--------|---|----|---|---|---|---|---|---|---|----|----|----|----|----|----|----|
| Maths: | 1 | 2  | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| MOS:   | 1 | 10 | 3 | 4 | 5 | 7 | 2 | 6 | 8 | 11 | 15 | 9  | 14 | 12 | 16 | 13 |

 Calculate the rank correlation coefficient for proficiencies of this group in given subjects.  
 (c) Using Bisection method find a real root of the equation  $x^3 - 4x + 9 = 0$  between  $-2$  and  $-3$  correct up to two decimal places. 07

**OR**

- Q.5** (a) A car hire firm has two cars which it hires out day to day. The number of demands for a car on each day is distributed as Poisson variate with mean 1.5. Calculate the proportion of days on which (i) neither car is used, and (ii) some demand is refused. 03  
 (b) Using Taylor series method, find  $y(0.1)$  correct to three decimal places if  $y(x)$  satisfies  $y' = x - y^2$ ,  $y(0) = 1$ . 04  
 (c) State Sterling's Interpolation formula. 07  
 Apply Gauss's forward formula to obtain  $\sin 45^\circ$  from the following table:

|                |        |        |        |        |        |
|----------------|--------|--------|--------|--------|--------|
| $x^\circ$      | 20     | 30     | 40     | 50     | 60     |
| $\sin x^\circ$ | 0.3420 | 0.5020 | 0.6428 | 0.7660 | 0.8660 |

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