

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-IV (NEW) EXAMINATION – WINTER 2024****Subject Code:2140606****Date:19-11-2024****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.
4. Simple and non-programmable scientific calculators are allowed.

MARKS

Q.1 (a) Write sample space of random experiment of tossing three coins together and obtain the probability of the event that one head and two tails obtained. **03**

(b) Using Newton's Raphson method, find a real root of $x^3 - 5x + 3 = 0$, correct up to three decimal places. **04**

(c) Solve the following system of equations by Gauss Seidel method: **07**

$$\begin{aligned} 83x + 11y - 4z &= 95 \\ 7x + 52y + 13z &= 104 \\ 3x + 8y + 29z &= 71 \end{aligned}$$

Q.2 (a) Find a real root of the equation $\log x - \cos x = 0$ using Regula Falsi method correct up to three decimal places. **03**

(b) Using Newton's divided difference formula find $f(x)$ as a polynomial in x for the table. **04**

x	0	1	2	4	5	6
y	1	14	15	5	6	19

(c) Using Newton's forward formula, find the value of $f(218)$ if **07**

x	100	150	200	250	300	350	400
$f(x)$	10.63	13.03	15.04	16.81	18.42	19.90	21.27

OR

(c) Evaluate $\int_0^6 \frac{1}{1+x} dx$ taking $h=1$, using Simpson's 1/3 rule. Hence obtain an approximate value of $\log_e 7$. **07**

Q.3 (a) A machine produces 10 objects of which 3 are defective. If 4 objects are chosen at random, what is the probability that none of them is defective? **03**

(b) Three bags contains 10%, 20% and 30% defective items. An item is selected at random which is defective. Determine the probability that it came from 3rd bag. **04**

(c) Determine the curve of the form $y = ax^b$ which is best fit to the following data according to least squares principle. **07**

x	1.0	1.5	2.0	2.5	3.0	3.5
y	0.01	0.405	0.693	0.916	1.098	1.252

OR

- Q.3** (a) What is correlation? Give methods to measure it. **03**
- (b) Find an approximate value of $f(3.6)$ using Newton's backward difference formula from the following table: **04**

x	0	1	2	3	4
f(x)	-5	1	9	25	55

- (c) Using the method of least squares, Fit a parabola $y = a + bx + cx^2$ to the following data: **07**

x	2	4	6	8	10
y	3.07	12.85	31.47	57.38	91.29

- Q.4** (a) Prove that (1) $E = 1 + \Delta$ (2) $E = e^{hD}$ **03**
- (b) Using Lagrange's formula, find $f(9.2)$ from the following table. **04**

x	9	9.5	11
y	2.1972	2.2513	2.3979

- (c) Solve the system of linear equations by Gauss-Jordan method: **07**
 $5x - 2y + 3z = 18, x + 7y - 3z = -22, 2x - y + 6z = 22$

OR

- Q.4** (a) Using Newton's divided difference interpolation, find $f(9)$. **03**

x	-1	0	2	5	10
y	-2	-1	7	124	999

- (b) Using Euler's method, find $y(1.4)$ given that $\frac{dy}{dx} = xy^{\frac{1}{2}}$, $y(1) = 1$ **04**

- (c) Obtain the line of regression of y on x for the data given below: **07**

x	1	2	3	4	5	6	7	8	9	10
y	10	12	16	28	25	36	41	49	40	50

- Q.5** (a) Derive the formula of Trapezoidal rule for numerical integration. **03**

- (b) Compute $\int_0^3 \frac{1}{1+x} dx$ with $n = 6$ by using Simpson's 3/8 rule. **04**

- (c) Dividing the range into 10 equal parts, find the approximate value of $\int_0^\pi \sin x dx$ by (a) Trapezoidal rule (b) Simpson's 1/3 rule **07**

OR

- Q.5** (a) From a pack of 52 cards three are drawn at random. Find the chance that they are a king, a queen and a jack. **03**

- (b) Using Taylor Series method, find $y(0.1)$ given that $\frac{dy}{dx} = x^2 + y^2$, $y(0) = 1$, Take $h = 0.1$ **04**

- (c) Use 4th order Range – Kutta method to find $y(0.2)$, given that $\frac{dy}{dx} = x + y^2$, $y(0) = 1$; (use $h = 0.1$). **07**
