

Enrolment No./Seat No _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-IV EXAMINATION – SUMMER 2025

Subject Code:2140606

Date:08-05-2025

Subject Name:Numerical And Statistical Methods for Civil Engineering

Time:10:30 AM TO 01:00 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) Four cards are drawn from a pack of cards. Find the probability that there are two spades and two hearts. **03**
- (b) Evaluate $\int_0^2 (1+x) dx$ by Gaussian two point quadrature formula. **04**
- (c) Solve $y' = 3x + \frac{y}{2}$ using 4th order Runge – Kutta method with $y(0) = 1$ and $h = 0.05$. **07**
- Q.2** (a) Prove that $\nabla - \Delta = -\nabla\Delta$ **03**
- (b) Construct the difference table for $f(x) = (x+2)^2$ for $x = 1, 2, 3, 4$ and find $\nabla^2 f(3)$. **04**
- (c) Apply Gauss-Seidel iteration method correct to four decimal places to solve the system **07**
- $$\begin{aligned} 20x + y - 2z &= 17 \\ 3x + 20y - z &= -18 \\ 2x - 3y + 20z &= 25 \end{aligned}$$
- OR**
- (c) Employ Stirling's formula to compute $y(35)$ from the following table: **07**
- | | | | | |
|---|-----|-----|-----|-----|
| x | 20 | 30 | 40 | 50 |
| y | 512 | 439 | 346 | 243 |
- Q.3** (a) Calculate the median from the following frequency distribution of marks obtained by 22 students: **03**
- | | | | | | |
|-----------------|----------|----------|----------|----------|----------|
| Marks | Below 10 | Below 20 | Below 30 | Below 40 | Below 50 |
| No. of students | 3 | 8 | 17 | 20 | 22 |
- (b) The random variable X is distributed in a Poisson form. If $P(X = 1) = P(X = 2)$, what is $P(X = 0 \text{ or } 1)$? **04**
- (c) Estimate $y(2)$ corrected up to two decimal places for $\frac{dy}{dx} = \frac{y}{x}$ where $y(1) = 1$, using Euler's method taking $h = 0.2$. **07**
- OR**
- Q.3** (a) Find the value of $\frac{1}{31}$ by using Newton-Raphson method corrected up to four decimal places. **03**

- (b) In a company, the coefficient of variation of wages of male and female workers were 55% and 70% respectively. The standard deviations were Rs. 22 and Rs. 15.40 respectively. Calculate the combined average wages for all workers if 80% of the workers were male. **04**

- (c) Let X be a random variable with probability density function **07**

$$f(x) = 6x(1 - x), \quad 0 \leq x \leq 1$$

Determine a number b such that $P(X < b) = P(X > b)$

- Q.4 (a)** Using the method of least squares, find the best fitting straight line to the given data: **03**

x	1	2	3	4	5
y	1	3	5	6	5

- (b) Find a real root of the equation $x \log_{10} x = 1.2$ using Regula-Falsi method, correct up to four decimal places. **04**

- (c) Fit a linear regression of y on x for the following data: **07**
 $x : 11 \quad 14 \quad 14 \quad 17 \quad 17 \quad 21 \quad 25$
 $y : 15 \quad 27 \quad 27 \quad 30 \quad 34 \quad 38 \quad 46$

OR

- Q.4 (a)** Two Math tests are taken in a class. 25% passed both tests and 42% passed the first test. What percent of those who passed the first test also passed the second? **03**

- (b) Compute $f(0.4)$ from the data presented in the table using Lagrange's interpolation: **04**

x	0.3	0.5	0.6
f(x)	0.61	0.69	0.72

- (c) Solve using partial pivoting by Gaussian elimination method **07**

$$8y + 2z = -7$$

$$3x + 5y + 2z = 8$$

$$6x + 2y + 8z = 26$$

- Q.5 (a)** Estimate $f(0.5)$ using Newton's forward interpolation formula from the given data: **03**

x	0	1	2	3	4
f(x)	1	7	23	55	109

- (b) Let $p(x)$ be the probability mass function of the discrete random variable X which assumes the values x_1, x_2, x_3, x_4 such that $2p(x_1) = 3p(x_2) = p(x_3) = 5p(x_4)$. Construct a table for the mass function and the distribution function of the random variable X . **04**

- (c) Find a real root of $x^3 + 2x^2 - 3x - 1 = 0$ correct up to two decimal places by Secant method starting from $x_0 = 2$ and $x_1 = 1$. **07**

OR

- Q.5 (a)** Evaluate $\int_0^3 \frac{1}{1+x} dx$ with $n = 6$ using Simpson's $3/8^{\text{th}}$ rule. **03**

- (b) The overall percentage of failures in a certain examination is 40. What is the probability that out of a group of 6 candidates, at least 4 passed the examination? **04**

- (c) Using Taylor's series method, evaluate $y(0.1)$ correct to four decimal places for the differential equation $y' = x - y^2$ with $y(0) = 1$. **07**
