Enrollment No./ Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY

MASTER OF ENGINEERING - SEMESTER - 1 EXAMINATION – SUMMER 2026

Subject Code: 3713301 **Date: 16-06-2026**

Subject Name: Numerical 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)** Find a root of $x^3 + x - 1 = 0$ correct to six decimal places by Newton -Raphson method. **07**

(b) Find the real root of the equation $xe^x - 2 = 0$ which lies between 0.8 and 0.9 correct to three decimal places by False Position method. **07**

Q.2 **(a)** Find the positive root of $x = \cos x$ correct to three decimal places by Bisection method. **07**

(b) Use Euler's method to find an approximate value of y at $x = 0.1$ from $\frac{dy}{dx} = x + y + xy$, $y(0) = 1$ and take $h = 0.025$. **07**

OR

(b) Construct Newton's forward interpolation polynomial for the following data. Use it to find the value of y for $x = 5$. **07**

x	4	6	8	10
y	1	3	8	16

Q.3 **(a)** Find the Lagrange interpolation polynomial for the following data. Use it to find the value of y for $x = 2$. **07**

x	0	1	4	5
y	1	3	24	39

(b) Use Secant method to solve $xe^x - 1 = 0$ correct to three decimal places between 0 and 1. **07**

OR

Q.3 **(a)** Find the largest Eigen values for **07**

$$A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}.$$

(b) Prove that (i) $\Delta = E - 1$ (ii) $\nabla = 1 - E^{-1}$ (iii) $(1 + \Delta)(1 - \nabla) = 1$ **07**

Q.4 **(a)** Using Newton's divided difference interpolation, find the polynomial satisfying the following data. **07**

x	-1	0	1	3
y	2	1	0	-1

(b) Fit a straight line to the following data. Also estimate the value of y at $x = 2.5$. **07**

x	0	1	2	3	4
y	1	1.8	3.3	4.5	6.3

OR

Q.4 **(a)** Ten participants on a contest are ranked by two judges as follows: **07**

x	1	3	7	5	4	6	2	10	9	8
y	3	1	4	5	6	9	7	8	10	2

Calculate the rank correlation coefficient.

(b) Solve the following system of equations by Gauss Seidel method. **07**

$20x+2y+z=30,\ x-40y+3z=-75,\ 2x-y+10z=30$

Q.5 **(a)** Use Laplace transform to solve the initial value problem: $y''+y'=\sin 2t$, **07**
$y(0)=2$ and $y'(0)=1$.

(b) Apply Runge-kutta method of fourth order to calculate $y(0.2)$ given $\frac{dy}{dx}=x+y$, **07**
$y(0)=1$ by taking $h=0.1$.

OR

Q.5 **(a)** State Simpson's $3/8$ rule and evaluate **07**

$\int_0^1 \frac{dx}{1+x^2}$ by taking $h=\frac{1}{6}$.

(b) Fit a second degree Parabola $y=a+bx+cx^2$ to the following data. **07**

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

****