

GUJARAT TECHNOLOGICAL UNIVERSITY**BACHELOR OF ENGINEERING – SEMESTER 4 – EXAMINATION – SUMMER 2026****Subject Code: 3142008****Date: 21/05/2026****Subject Name: Numerical Methods****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.**

Q.1 (a) Using Simpson's 3/8 rule, evaluate $\int_0^1 dx(1+x^2)$ by taking $h=1/6$. **03**

(b) Using Newton's divided difference formula, estimate the value of $f(1)$ from the following table: **04**

x	0	2	3	4	7	9
f(x)	4	26	58	112	466	922

(c) Solve the following equations by Gauss-Jacobi method: $5x+2y+z=12$, $x+4y+2z=15$, $x+2y+5z=20$ **07**

Q.2 (a) Prove that: $1+\Delta=E$. **03**

(b) Identify a positive root of the equation $x^4-x-10=0$ by using Bisection method correct up to 2 decimal points. **04**

(c) Identify a root of an equation $x \cos x = \cos x$ using False Position method correct to 4 significant digits. **07**

OR

Q.2 (c) Identify the positive real root of equation $x \cos x = 2$ using Newton-Raphson method, correct up to 3 decimal places. **07**

Q.3 (a) Estimate $f(4)$ from the tabular value : **03**

x	0	1	3	4
y=f(x)	-12	0	12	24

Using Lagrange's interpolation formula.

(b) Use Euler's methods to estimate the value of $y(0.1)$ for the equation $dy/dx=(y-x)(y+x)$, $y(0)=1$. **04**

(c) Using fourth order Runge-Kutta method, estimate $y(0.2)$ with $h=0.1$ given that $dy/dx=2x+y$, $y(0)=1$. **07**

OR

Q.3 (a) Estimate the dominant eigenvalue of $\begin{bmatrix} 2 & -11 & -132 \\ 123 & & \end{bmatrix}$ using power method. Take initial vector as $\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$. **03**

(b) Estimate the value of y using improved Euler's method when $x=0.2$ given that $y(0)=0$ and $y'=1-y$. Choose the step size $h=0.1$. **04**

(c) Using the finite difference method, evaluate $y(0.5)$ satisfying the differential equation $y''+y+1=0$ subject to the boundary conditions $y(0)=y(1)=0$, take step size $h=0.25$. **07**

Q.4 (a) Estimate $\int_0^1 dx(x+1)$ using Gaussian formula for $n=2$. **03**

- (b) Given that : 04

x	1.0	1.1	1.2	1.3	1.4	1.5	1.6
y	7.989	8.403	8.781	9.129	9.451	9.750	10.031

Estimate $\frac{dy}{dx}$ at $x=1.1$.

- (c) Solve the following systems by Gauss-elimination method. 07
 $2x+4y+z=3$, $3x+2y-2z=-2$, $x-y+z=6$

OR

- Q.4 (a) Consider the following tabular values: 03

x	25.0	25.1	25.2	25.3	25.4	25.5	25.6
y	3.205	3.217	3.232	3.245	3.256	3.268	3.280

Estimate the area bounded by the given curve and X-axis between $x=25$ to $x=25.6$ by Trapezoidal rule.

- (b) Given that : 04

x	1.0	1.1	1.2	1.3	1.4	1.5	1.6
y	7.989	8.403	8.781	9.129	9.451	9.750	10.031

Estimate $\frac{d^2y}{dx^2}$ at $x=1.6$.

- (c) Solve the following system using matrix inversion method. $x+y+z=3$, $x+2y+3z=4$, $x+4y+9z=6$ 07

- Q.5 (a) Evaluate $f(1.3)$ using Newton forward formula from the following table: 03

x	1	2	3	4
$f(x)$	1.1	4.2	9.3	16.4

- (b) Describe accuracy and Precision. 04

- (c) Find the cubic spline in the interval $[0, \pi]$ and evaluate $y(\pi/6)$ for the following data: 07

x	0	$\pi/4$	$\pi/2$	$3\pi/4$	π
y	0	12	1	12	0

OR

- Q.5 (a) Estimate the straight line of best fit to the given data : 03

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

- (b) If $\pi=227$ is approximated as 3.14. Explain the absolute error, relative error and percentage error. 04

- (c) Estimate a second degree parabola from the following data: 07

x	1	1.5	2	2.5	3	3.5	4
y	1.1	1.3	1.6	2.0	2.7	3.4	4.1
