

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV EXAMINATION – SUMMER 2025****Subject Code:3142008****Date:12-05-2025****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.

Marks

Q.1 (a) Evaluate $\int_0^1 \sqrt{1-x^2} dx$ by using Trapezoidal rule taking $h = 0.25$. **03**

(b) The population of the town in decennial census was as given below estimate the population for the year 1895 by using Newton's forward interpolation formula. **04**

Year	1891	1901	1911	1921	1931
Population (in thousand)	46	66	81	93	101

(c) Solve the following systems using Gauss-Jacobi method. **07**
 $8x - y + 2z = 13, x - 10y + 3z = 17, 3x + 2y + 12z = 25$

Q.2 (a) Prove that $\nabla \nabla = \nabla E = \Delta$. **03**

(b) Find a real root of the equation $x^3 - 7x + 3 = 0$ using Bisection method, correct up to 3 decimal places. **04**

(c) Find the positive real root of equation $x^3 - 5x - 7 = 0$ using Newton-Raphson method, correct up to 4 decimal places. **07**

OR

(c) Find a real root of the equation $\cos x - xe^x = 0$ using Secant method starting from $x_0 = 2, x_1 = 1.9$ correct up to 3 decimal places. **07**

Q.3 (a) Find the dominant Eigen value of $A = \begin{bmatrix} 2 & 3 \\ 5 & 4 \end{bmatrix}$ by using power method and the corresponding Eigen vector. **03**

(b) Use Euler's methods to obtain an approximate value of $y(2)$ for the differential equation **04**

$$\frac{dy}{dx} = x + 2y, y(1) = 1.$$

(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**

OR

Q.3 (a) Find a real root of the equation $x^3 - x - 1 = 0$ using method of fixed iterations, correct up to 3 decimal places. **03**

(b) Using fourth order Runge-Kutta method, find $y(0.2)$ with $h = 0.1$ given that **04**

$$\frac{dy}{dx} = x + y^2, y(0) = 1.$$

(c) Use improved Euler's method to find the value of y up to four decimal places satisfying the equation $\frac{dy}{dx} = 1 - y, y(0) = 0$ for $x = 0.2$ by taking $h = 0.1$. **07**

Q.4 (a) Evaluate $\int_0^3 \frac{dx}{1+x}$ with $n = 6$ Simpson's 3/8 rule. **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

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

(c) Apply Gauss elimination method to solve the equations: **07**
 $2x + 4y - 6z = -4, x + 5y + 3z = 10, x + 3y + 2z = 5$

OR

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

(b) Given that **04**

x	0	1	2	3	4
y	4	8	15	7	6

Find $\frac{dy}{dx}$ at $x = 0$.

(c) Solve the following system using matrix inversion method. **07**
 $-3x + 6y - 11z = 14, 3x - 4y + 6z = -5, 4x - 8y + 13z = -17$

Q.5 (a) Fit the curve $y = ax^b$ to the following data: **03**

x	61	26	7	2.6
y	350	400	500	600

(b) If $\Delta x = 0.005$ and $\Delta y = 0.001$ be the absolute errors in $x = 2.11$ and $y = 4.15$ then find the relative error in the computation of $x + y$. **04**

(c) Obtain the value of $f(8)$ from the following data by using Newton's divided difference method: **07**

x	4	5	7	10	11	13
$f(x)$	48	100	294	900	1210	2028

OR

Q.5 (a) Certain corresponding values of x and $\log_{10} x$ are (300, 2.4771), (304, 2.4829), (305, 2.4843) and (307, 2.4871). Find $\log_{10} 301$ using Lagrange's interpolation formula. **03**

(b) Describe accuracy and Precision. **04**

(c) Fit a saturation growth rate equation to: **07**

x	5	10	15	20	25	30`	35	40	45	50
y	16	25	32	33	38`	36	39	40	42	42
