

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER– IV(NEW) EXAMINATION – SUMMER 2023****Subject Code:2140505****Date:07-07-2023****Subject Name:Chemical Engineering Maths****Time:10:30 AM TO 01:30 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) What do you mean by truncation error? Explain with examples. | 03 |
| (b) Use Regula Falsi method to solve the equation $x \tan x = -1$, starting with $x_0 = 2.5$ and $x_1 = 3$, correct up to three decimal places. | 04 |
| (c) Using Newton Raphson method, find the real root of $x \log_{10} x = 1.2$ correct up to five decimal places. | 07 |
| Q.2 (a) Prove that (1) $\Delta = E - 1$ (2) $(1 + \Delta)(1 - \nabla) = 1$ | 03 |
| (b) Write short note on Bracketing methods to find the roots of non-linear equations. | 04 |
| (c) Using Bisection method determine a real root of the equation $8x^3 - 2x - 1 = 0$. | 07 |
| OR | |
| (c) Using Newton's Raphson method, find an iterative formula to find $\sqrt{N}$ and hence find $\sqrt{5}$ | 07 |
| Q.3 (a) Define curve fitting. What is meant by the curve of best fit? | 03 |
| (b) Fit a straight line to the following data: | 04 |

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

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|--|-----------|
| (c) Solve the following system of equations by Gauss elimination method: | 07 |
| $5x + 5y + 2z = 12$ $2x + 4y + 5z = 2$ $39x + 43y + 45z = 74$ | |
| OR | |
| Q.3 (a) Define Eigen values and Eigen vectors. | 03 |
| (b) Find the inverse of $A = \begin{bmatrix} 2 & 6 & 6 \\ 2 & 7 & 6 \\ 2 & 7 & 7 \end{bmatrix}$ | 04 |
| (c) Solve the equations using Gauss Jacobi method: | 07 |
| $20x + y - 2z = 17$ $3x + 20y - z = -18$ $2x - 3y + 20z = 25$ | |

- Q.4 (a)** Discuss fourth order Runge Kutta method for solving ordinary differential equations. **03**
- (b)** Use the Taylor series method to find $y(0.1)$, given that $\frac{dy}{dx} = 2y + 3e^x$, $y(0) = 1$, Taking $h = 0.1$. **04**
- (c)** Use Euler's method to find $y(0.1)$ from $\frac{dy}{dx} = x + y + xy$, $y(0) = 1$ in five steps. **07**

OR

- Q.4 (a)** Compute $f(9.2)$ from the following data using Lagrange's interpolation formula. **03**

x	9	9.5	11
y	2.1972	2.2513	2.3979

- (b)** Use Newton's forward interpolation formula, find the value of $f(1.6)$ **04**

x	1	1.4	1.8	2.2
f(x)	3.49	4.82	5.96	6.5

- (c)** Using Runge Kutta method of fourth order, find $y(0.2)$, for $\frac{dy}{dx} = \frac{y+x}{y-x}$, $y(0) = 1$, $h = 0.2$ **07**

- Q.5 (a)** Describe Milne's predictor-corrector method. **03**

- (b)** Following table shows speed in m/s and time in second of a car **04**

t	0	12	24	36	48	60	72	84	96	108	120
v	0	3.60	10.08	18.90	21.60	18.54	10.26	5.40	4.50	5.40	9.00

Using Simpson's 1/3 rule find the distance travelled by the car in 120 second.

- (c)** Evaluate $\int_0^{10} \frac{dx}{1+x^2}$ by using **07**
- (1) Trapezoidal rule (2) Simpson's 3/8 Rule

OR

- Q.5 (a)** Discuss in brief about boundary value problems. **03**

- (b)** Write the general linear partial equation of the second order in two independent variables. Classify the following equations: **04**

(1) $\frac{\partial^2 u}{\partial x^2} + 4 \frac{\partial^2 u}{\partial x \partial y} + 4 \frac{\partial^2 u}{\partial y^2} - \frac{\partial u}{\partial x} + 2 \frac{\partial u}{\partial y} = 0$

(2) $x^2 \frac{\partial^2 u}{\partial x^2} + (1 - y^2) \frac{\partial^2 u}{\partial y^2} = 0$

(3) $(1 + x^2) \frac{\partial^2 u}{\partial x^2} + (5 + 2x^2) \frac{\partial^2 u}{\partial x \partial t} + (4 + x^2) \frac{\partial^2 u}{\partial t^2} = 0$

- (c)** Explain procedure to solve following heat conduction equation **07**
- $K \frac{\partial^2 T}{\partial x^2} = \frac{\partial T}{\partial t}$ using finite difference technique.
