

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV (NEW) EXAMINATION – SUMMER 2024****Subject Code:2140505****Date:15-07-2024****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) Define: 1. Error 2. Truncation error 3. Relative error **03**
- (b) Write an algorithm for Newton-Raphson method. **04**
- (c) Evaluate the sum $S = \sqrt{3} + \sqrt{5} + \sqrt{7}$ to 4 significant digits and find its absolute and relative errors. **07**

- Q.2**
- (a) Derive the formula for Simpson's 3/8 Rule. **03**
- (b) Explain Accuracy and Precision. **04**
- (c) Using Newton Raphson Method root of equation: **07**
- $$x \sin x + x \cos x = 0.$$

OR

- (c) Find a real root of equation $4e^{-x} \sin x - 1 = 0$ by regula falsi method given that root lies between 0 and 0.5. **07**

- Q.3**
- (a) Write an algorithm for Regula Falsi method. **03**
- (b) Describe Jacobi's method. **04**
- (c) Discuss about the pitfalls of Gauss elimination method and techniques for improvement. **07**

OR

- Q.3**
- (a) Define Eigen values and Eigen vectors. **03**
- (b) Explain Descartes' rule of sign. **04**
- (c) Apply the Gauss-Jordan method to solve the equations; **07**
- $$x + y + z = 9; 2x - 3y + 4z = 13; 3x + 4y + 5z = 40.$$

- Q.4**
- (a) Discuss bracketing methods & open methods. **03**
- (b) Establish Newton's forward interpolation formula. **04**
- (c) Using Gauss-Seidel method solve the system of equations, **07**

$$\begin{aligned} 10x_1 - 2x_2 - x_3 - x_4 &= 3 \\ -2x_1 + 10x_2 - x_3 - x_4 &= 3 \\ -x_1 - x_2 + 10x_3 - 2x_4 &= 3 \\ -x_1 - x_2 - 2x_3 + 10x_4 &= 3 \end{aligned}$$

OR

- Q.4**
- (a) Write an algorithm for Trapezoidal Rule. **03**
- (b) Establish Newton's backward interpolation formula. **04**
- (c) Find the polynomial $f(x)$ by using Lagrange's formula and hence find $f(3)$ for **07**

x	0	1	2	3
f(x)	2	3	12	147

- Q.5** **(a)** Describe the method of finite difference approximations to partial derivatives. **03**
- (b)** Derive normal equation to fit a 2nd order polynomial using least square method. **04**
- (c)** Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using **07**
- (i) Trapezoidal Rule
- (ii) Simpson's 1/3 Rule
- (iii) Simpson's 3/8 Rule

OR

- Q.5** **(a)** Discuss in brief about Milne's Predictor-Corrector method. **03**
- (b)** Find by Taylor's series method, the values of y at $x = 0.1$ and $x = 0.2$ to five places of decimals from $\frac{dy}{dx} = x^2y - 1$, $y(0) = 1$. **04**
- (c)** Using modified Euler's method, find an approximate value of y when $x = 0.3$, given that $\frac{dy}{dx} = x + y$ and $y = 1$ when $x = 0$. **07**
