

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER- IV (New) EXAMINATION – WINTER 2019****Subject Code: 2140505****Date: 07/12/2019****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.

- Q.1** (a) Define following, **03**
 1. Error 2. Truncation error 3. Relative error
 (b) Evaluate the sum $S = \sqrt{3} + \sqrt{5} + \sqrt{7}$ to 4 significant digits and find its absolute and relative errors. **04**
 (c) Using the secant method, find a real root of equation $xe^x - 1 = 0$ correct to four decimal places. **07**

- Q.2** (a) Write an algorithm for Regula Falsi method. **03**
 (b) Evaluate $\sqrt{12}$ correct to three decimal places using Newton-Raphson method. **04**
 (c) Find root of the equation $x^3 - 2x - 5 = 0$ using the bisection method correct upto three decimal places. **07**

OR

- (c) Use Gauss elimination method to solve the following system, **07**
 $2x + y + z = 10, 3x + 2y + 3z = 18, x + 4y + 9z = 16$
Q.3 (a) Define Eigen values and Eigen vectors. **03**
 (b) Describe Jacobi's method. **04**
 (c) Solve the system, $6x + y + z = 20, x + 4y - z = 6, x - y + 5z = 7$ using Gauss Seidel method. **07**

OR

- Q.3** (a) Find the inverse of the matrix, **03**

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

- (b) Find the best values of a_0 and a_1 if the straight line $y = a_0 + a_1x$ is fitted to the data (x_i, y_i) : **04**

x	1	2	3	4	5
y	0.6	2.4	3.5	4.8	5.7

Find also the correlation coefficient.

- (c) Find constants a and b such that the function $y = ae^{bx}$ fits the following data: **07**

x	1	3	5	7	9
y	2.473	6.722	18.274	49.673	135.026

- Q.4** (a) Derive the formula for Simpson's 3/8 Rule. **03**
 (b) Establish Newton's forward interpolation formula. **04**

(c) Given the table of values as: 07

x	2.5	3.0	3.5	4.0	4.5
y(x)	9.75	12.45	15.70	19.52	23.75

Find $y(4.25)$, using Newton's backward difference interpolation formula.

OR

Q.4 (a) Write an algorithm for Trapezoidal Rule. **03**

(b) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Simpsons 3/8 rule taking $h = \frac{1}{6}$. **04**

(c) Evaluate $\int_1^2 e^{-0.5x} dx$ using four intervals for Simpson's 1/3 rule and Trapezoidal rule. **07**

Q.5 (a) Describe the method of finite difference approximations to partial derivatives. **03**

(b) Use second order Runge – Kutta method to solve $\frac{dy}{dx} = 3x + y$, given $y = 1.3$ when $x = 1$ to approximate y when $x = 1.2$ taking step size 0.1. **04**

(c) Determine the value of y at $x=0.3$, given that $\frac{dy}{dx} = x + y$ and $y(0) = 1$, using modified Euler's method. **07**

OR

Q.5 (a) Discuss in brief about Milne's Predictor-Corrector method. **03**

(b) Using Taylor's series method, obtain the solution of $\frac{dy}{dx} = 3x + y^2$, given that $y(0) = 1$. Find the value of y for $x = 0.1$. **04**

(c) Use fourth order Runge – Kutta method to find the value of y when $x = 0.2$, given that $y' = x + y^2$, and $y = 1$ when $x = 0$ taking step size 0.1. **07**

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