Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–IV (NEW) EXAMINATION – WINTER 2020

Subject Code:3140510 Date:15/02/2021

Subject Name:Numerical Methods in Chemical Engineering

Time:02:30 PM TO 04:30 PM Total Marks:56

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

MARKS

Q.1 **(a)** Discuss bracketing methods & open methods. **03**

(b) Fit the straight line that best fits to the following data: **04**

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

(c) Fit a second degree parabola to the following data **07**

x	1	2	3	4
y	1.7	1.8	2.3	3.2

Q.2 **(a)** Find the percentage error in the area of an ellipse when errors of 2% and 3% are made in measuring its major axes respectively. **03**

(b) Perform three iterations of the bisection method to obtain the root of the equation $2\,sinx - x = 0$, correct up to three decimal places. **04**

(c) Find the root of $x^3 - 2x - 1 = 0$ correct up to three decimal places using Secant method (starting from $x_0 = 1.5$ and $x_1 = 2$). **07**

Q.3 **(a)** Explain the Gauss Jordan method to solve the system of linear equations. **03**

(b) Solve the following system of equations by Gauss Elimination method: **04**

$$x + 3y + 2z = 5$$
$$2x + 4y - 6z = -4$$
$$x + 5y + 3z = 10$$

(c) Find a root of the equation $x^3 + x - 1 = 0$ correct up to four decimal places by using Newton-Raphson iteration formula. **07**

Q.4 **(a)** Find the largest eigen value of the matrix **03**

$$A = \begin{bmatrix} 3 & -5 \\ -2 & 4 \end{bmatrix}$$

(b) Solve the following system of equations by Gauss Jacobi method: **04**

$$6x + 2y - z = 4$$
$$x + 5y + z = 3$$
$$2x + y + 4z = 27$$

(c) Solve the following system of equations by Gauss Siedel method: **07**

$$x + 2y + z = 0$$
$$3x + y - z = 0$$
$$x - y + 4z = 3$$

Starting with (1,1,1)

Q.5 **(a)** Use the Euler's method to find y (0. 1), given that **03**

$\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$, Taking h = 0.2

(b) Apply 4th order Runge Kutta Method to compute y for $x = 0.1$, given that $\frac{dy}{dx} = 2x + y$, $y(0) = 1$, h=0.1 **04**

(c) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using (1) Trapezoidal rule (2) Simpson's 1/3 Rule (3) Simpson's 3/8 Rule **07**

Q.6 **(a)** Discuss in brief about boundary value problems. **03**

(b) Using Newton's divided difference formula, evaluate f(8) from the following data: **04**

x	4	5	7	10	11	13
f(x)	48	100	244	900	1210	2028

(c) Use the Taylor series method to find y (0.2), given that $\frac{dy}{dx} = 2y + 3e^x$, $y(0) = 1$. Taking h=0.1. **07**

Q.7 **(a)** Derive formula for Trapezoidal Rule of numerical integration. **03**

(b) By Simpson's 3/8 rule, evaluate $\int_0^1 \frac{sinx}{x}\, dx$ taking $h = \frac{1}{6}$. **04**

(c) Use Lagrange's interpolation formula to find the value of y when $x = 12$, if the values of x and y are given below: **07**

x	11	13	14	18	20	23
y	25	47	68	82	102	124

Q.8 **(a)** Derive formula for Simpson's 1/3 Rule of numerical integration. **03**

(b) Find cosh(0.56) from the following table using Newton's forward interpolation method. **04**

x	0.5	0.6	0.7	0.8
y	1.127626	1.185465	1.255169	1.337435

(c) Use Milne's predictor-corrector method to find y(0.4) for $y' = x + y^2$, y(0)=1 with h=0.1 **07**

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