Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV(New) EXAMINATION – SUMMER 2016

Subject Code:2140505 **Date:26/05/2016**

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.**

MARKS

Q.1 **Short Questions** **14**

1 Define Absolute Error

2 Name two interpolation methods that can be applied in which values of independent variable are not at equal intervals.

3 For solutions of linear algebraic equations simple iterative methods can be devised for systems in which the coefficient of the leading diagonal are _____ as compared to others.

(a) Large (b) Small (c) Equal (d) None of the above

4 Write formula to find the inverse of the matrix.

5 Find Relative Error of the number 8.6 if both of its digits are correct. Here absolute error is 0.05

6 If A = $\begin{bmatrix} 2 & 4 \\ 5 & 8 \end{bmatrix}$, Find the adj A.

7 Write Milne's formula to solve Ordinary differential equation.

8 Write Simpson's 3/8 rule.

9 Explain round off error

10 Define: Accuracy

11 Evaluate the sum S = $\sqrt{3} + \sqrt{5} + \sqrt{7}$ to four significant digits and find its absolute and relative errors.

12 Define: Precision

13 Find the value of 1st approximation for $x^3 - x - 1 = 0$ using bisection method.

14 Find the difference $\sqrt{6.37} - \sqrt{6.36}$ to three significant digits.

Q.2 **(a)** Find the root of the equation $2x - \log x - 7 = 0$ using False Position Method correct upto three decimal place. **03**

(b) It takes three different ingredients A, B, C to produce a certain chemical substance. A, B, C have to be dissolved in water separately before they interact to from the chemical. Suppose that the solution containing A at 1.5 combined with the solution containing B at 3.6 combined with the solution containing C at 5.3 makes 25.07g of the chemical. If the proportion for A, B, C in this solution are changed to 2.5, 4.3, 2.4 respectively then 22.36g of the chemical is produced. Finally if the proportions are 2.7, 5.5, 3.2 respectively, then 28.14g of **04**

the chemical is produced. What are the volume of the solutions containing A, B, C?

(c) Using multiple equation Newton Raphson method determine the roots of following equations. Initiate the computations with guesses of $x = 1.5 \; and \; y = 3.5$ **07**

$u_{(x,y)} = x^2 + xy - 10 = 0$

$v_{(x,y)} = y + 3xy^2 - 57 = 0$

OR

(c) Using Newton's divided difference interpolation evaluate f (9.2) for the following data. **07**

x	8	9	8.5	11
$f(x)$	2.079442	2.197225	2.251292	2.397595

Q.3 (a) Solve the system of equation by Gauss-Seidel Method upto three decimal place. **03**

$27x + 6y - z = 85$

$6x + 15y + 2z = 72$

$x + y + 54z = 110$

(b) Certain experimental values of x and y are given below: **04**

(0, -1), (2, 5), (5, 12), (7,20)

If a straight line Y = $a_0 + a_1 x$ is fitred to the data, find the approximate values of a_0 and a_1.

(c) Find numerically the largest Eigen value and corresponding Eigen Vector of the following matrix. **07**

$$A = \begin{bmatrix} 1 & -3 & 2 \\ 4 & 4 & -1 \\ 6 & 3 & 5 \end{bmatrix}$$

OR

Q.3 (a) Given the data below, find the isothermal work done on the gas as it is compressed from V1 = 22L to v2 = 2L use W $=-\int_{v1}^{v2} P dv$. Use trapezoidal rule. **03**

V,(L)	2	7	12	17	22
P (atm)	12.20	3.49	2.04	1.44	1.11

(b) Fit the polynomial of the second degree to the data points (x, y) given by, (0, 1), (1, 6), (2, 17). **04**

(c) From the following table, estimate the number of students who obtained marks between 40 and 45. **07**

Marks	30-40	40-50	50-60	60-70	70-80
No of Students	31	42	51	35	31

Q.4 (a) Find the cubic Polynomial which takes the following values: **03**

x	0	1	2	3
$f(x)$	1	2	1	10

(b) Find the solution, to three decimal, of the system by Matrix Inversion Method. **04**

$5x + y + 2z = 19$

$$x + 4y - 2z = -2$$
$$2x + 3y + 8z = 39$$

(c) Using Improved Euler's method, Solve $\frac{dy}{dx} + 2xy^2 = 0$ with the initial condition $y(0) = 1$ and compute $y(1)$ taking h = 0.2 **07**

OR

Q.4 **(a)** Use Descartes rule of sign to find numbers of positive, negative and imaginary roots of the function $x^6 - x^5 - 10x + 7 = 0$. **03**

(b) Calculate the approximate value of $\int_0^{\frac{\pi}{2}} \sin x \, dx$ by Simpson's 1/3 rule using 11 ordinates. **04**

(c) From the table below, for what value of x, y is minimum? Also find this value of y. **07**

x	3	4	5	6	7	8
y	0.205	0.240	0.259	0.262	0.250	0.224

Q.5 **(a)** A resistor is being used to dissipate energy from a variable d.c supply. A calculation is needed of how much energy has been dissipated over a period of time. Table below contains values of current I, through the resistor and voltage V, across the resistor for the first 100 seconds since electrical power was first applied. Calculate the energy dissipation during this time period using **Simpson's 1/3 rule** with a step interval of 10 seconds. **03**

Time(s)	0	10	20	30	40	50	60	70	80	90	100
Voltage(v)	50	99	67	80	92	96	78	82	90	107	86
Current(A)	10	20	13	16	18	22	14	15	18	19	17

(b) Solve the boundary value problem defined by, $y'' + y + 1 = 0$ with initial conditions $y(0) = 0, y(1) = 1$ by finite difference method, with h = 0.5 and determine the value of $y(0.5)$ **04**

(c) Apply Runge-Kutta Method of fourth order to calculate $y(0.2)$ given that $\frac{dy}{dx} = x + y$, $y(0) = 1$, taking h = 0.1 **07**

OR

Q.5 **(a)** Use Gauss forward formula to find y_{30}, given that, y_{21}=18.4780, $y_{25} = 17.8144$, $y_{29} = 17.1070$, $y_{33} = 16.3432$, $y_{37} = 15.5154$ **03**

(b) Derive formula for Trapezoidal rule of numerical integration **04**

(c) Find the values of $u(x,y)$ satisfying the parabolic equation $\frac{\partial u}{\partial t} = 4\frac{\partial^2 u}{\partial x^2}$ and the boundary conditions: **07**

$u(0,t) = 0 = u(8,t)$ *and* $u(x,0) = 4x - \frac{1}{2}x^2$ at the points $x = i$.

$i = 0,1,2,3 \ldots .7$ *and* $t = \frac{1}{8j}: j = 0,1,2 \ldots .5$

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