Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME SEMESTER – I EXAMINATION – SUMMER 2017

Subject Code: 2713007 **Date:08/05/2017**

Subject Name: Numerical Methods and Statistical Analysis for Chemical Engineering

Time:02:30 p.m. to 05:00 p.m. **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) Explain significance of '*Accuracy*' and '*Precision*' for numerical computation defining the terms. **07**

(b) Show that the Lagrangian interpolation formula for 2nd degree applied to equi-spaced data points gives the same result as Newton's forward difference formulae. **07**

Q.2 (a) Fit the under given vapor pressure temperature data to generate constants for three parameter Antoine equation **10**

T (°C)	P (mm Hg)
15.00	73.9062
18.98	92.1005
22.96	114.011
26.94	140.237
30.92	171.450
34.90	208.391
38.88	251.884
42.86	302.833
46.84	362.229
50.82	431.154
54.80	510.783
58.78	602.390
62.76	707.349

(b) Explain the Gauss Elimination technique for solution of simultaneous linear equations. **04**

OR

(b) Write a three step algorithm for Bisection method. **04**

Q.3 (a) Use composite trapezoidal rule with $\Delta x=0.1$ to evaluate integration of $x \ln x$ in the range 1.4 to 2. Compare your results with the analytical value. **07**

(b) Given the data (t y), estimate $\frac{d^2y}{dt^2}$ numerically at t=1.5 **07**

t	y
0	0
0.5	1.1875
1	5.0000
1.5	18.175
2.0	52.0000
2.5	122.1875
3.0	249.0000

OR

Q.3 **(a)** Fit a set of 2 cubic splines for three data points (-2.5, 0) (0 1.67) and (2.5, 0). **07**

(b) Consider the set of under given five data points and fit a third degree polynomial. Check if your polynomial replicates your data points. **07**

T(K)	P(bar)
259.2	0.04267
290.1	0.21525
350.9	2.01571
446.4	17.682
508.1	47.000

Q.4 **(a)** Obtain the roots of $F(x) = \ln(x^2 + 1) - e^{0.4x}\cos(\pi x) = 0$ using Newton-Raphson technique for $-5 \le x \le 5$. **07**

(b) Develop the third order explicit Adams's integration formula for Ordinary Differential Equations (ODE) with Initial Value Problems (IVP). What is the error term? **07**

OR

Q.4 **(a)** Solve $\begin{bmatrix} 2 & 1 & 0 \\ 1 & 2 & 1 \\ 0 & 1 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 3 \\ 2 \\ 1 \end{bmatrix}$ **07**

(b) Discuss Runge-Kutta Methods for solution of ODEs with working equations. **07**

Q.5 **(a)** Explain ODE with Boundary Value Problems (BVP) and explain any one method to solve them with example. **07**

(b) Differentiate Parabolic, Hyperbolic and Elliptic PDEs with examples. **07**

OR

Q.5 **(a)** Explain the finite difference method for solution of PDEs. **07**

(b) What information is expected from values of Standard Deviation and Variance for Stochastic Processes? Explain with example. **07**

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