Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER I (NEW) – • EXAMINATION – SUMMER 2016

Subject Code: 2713007 **Date: 16/05/2016**

Subject Name: Numerical Methods and Statistical Analysis for Chemical Engineering

Time:02:30 pm to 05:00 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) Explain the following terms with examples: **08**

a) Probability distribution

b) Sampling distribution

c) True Percentage Relative Error

d) Approximate Percentage Relative Error

(b) Explain method of false position and write algorithm for solution of non-linear algebraic equations using it. **06**

Q.2 (a) For heat capacity of a component, data is generated experimentally. Develop the linear regression expression for empirical model development. **07**

(b) Fit the data point to linear relationship and estimate the error at $x = 25$. **07**

x	y
5	0.530
10	0.716
15	0.806
20	0.869
25	0.943
30	1.013
35	1.096
40	1.160

OR

(b) Explain the Lagrangian interpolation formula. **07**

Q.3 (a) Use composite trapezoidal rule with $\Delta x = 0.1$ to evaluate integration of x^2 in the range 1 to 2. Compare your results with the analytical value. **07**

(b) 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) Derive working equations for the method of cubic spline approximation to a function. **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)** Explain the Gauss Seidel method for solution of simultaneous linear equations and highlight its strengths and limitations. **07**

(b) Explain ODE with Initial Value Problems (IVP) and explain any one method to solve them with example. **07**

OR

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

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

Q.5 **(a)** Differentiate Parabolic, Hyperbolic and Elliptic PDEs with examples. **08**

(b) Discuss importance of matrix inversion for solution of linear algebraic equations **06**

OR

Q.5 **(a)** Explain role of random variables for Stochastic Processes with example. **06**

(b) Explain the finite difference method with example for solution of PDEs. **08**

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