Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER–I(New course)• EXAMINATION – WINTER- 2015

Subject Code: 2713007 **Date: 31/12/2015**

Subject Name: Numerical Methods and Statistical Analysis for Chemical Engineering

Time:2:30 pm to 5:00 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)** Define following terms: **07**

a) Accuracy

b) Precision

c) Significant Digits

d) True Percentage Relative Error

e) Approximate Percentage Relative Error

f) Normalization of mantissa

g) Error Propagation

(b) Explain Bisection method and write a three step algorithm for it. **07**

Q.2 **(a)** Using three parameter Antoine equation for vapor pressure of any component, develop the linear regression expression for obtaining Antoine constants. **07**

(b) Curve fit the data points generated using $y = 2\sin(\pi x)$ for 0 Òx Ò1 by a 2nd degree polynomial. Estimate the error at $x = 0.25$. **07**

OR

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

Q.3 **(a)** Use composite trapezoidal rule with æx=0.2 to evaluate integration of $x \ln x$ in the range 1 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 using Newtonôs forward difference formula correct to $O(\Delta t)$. **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)** Explain the method of cubic spline approximation to a function with working equations. **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 Elimination technique for solution of simultaneous linear equations and highlight its strengths and limitations. **07**

(b) Differentiate ODE with Initial Value Problems and Boundary Value Problems. Explain Shooting method. **07**

OR

Q.4 **(a)** Compare Gauss-Jordan Method and Gauss-Seidel Iteration Method for solution of simultaneous linear equations. **07**

(b) Discuss modifications and Improvements in Eulerôs Method and compare with Runge-Kutta Methods. **07**

Q.5 **(a)** Discuss Sampling Distributions and Confidence Interval for statistical analysis. **08**

(b) Differentiate Parabolic, Hyperbolic and Elliptic PDEs with examples. **06**

OR

Q.5 **(a)** What information is expected from values of Standard Deviation and Variance for Stochastic Processes? Explain with example. **08**

(b) Explain the finite difference method for solution of PDEs. **06**

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