

[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 1532-D F-7 Your Roll No.....

Unique Paper Code : 2513703

Name of the Paper : Numerical Methods

Name of the Course : B.Tech. Instrumentation (Allied Course)

Semester : VII

Duration : 3 Hours

Maximum Marks : 75

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on the receipt of this question paper.
2. Attempt **five** questions in all.
3. Question No. 1 is compulsory.
4. Use of scientific calculator is allowed.

1. (a) Define “order of a numerical method”. (3)

(b) Explain the significance of interpolation. (3)

(c) Define local and global truncation errors in numerical analysis. (3)

(d) Find the root of the equation  $x^3 - x - 1 = 0$  using bisection method, correct up to three decimal places. (3)

(e) Solve  $\int_0^4 2^x dx$  using trapezoid rule. (3)

2. (a) Solve the following equation using Gauss-Jordan method.

P.T.O.

$$x + y + z = 9$$

$$2x - 3y + 4z = 13$$

$$3x + 4y + 5z = 40 \quad (7)$$

(b) Solve following equation using Jacobi iterative method.

$$4x + y = 3$$

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

$$-y + 4z = 5 \quad (5)$$

(c) Find the cube root of 2 using Regula-Falsi method. (3)

3. (a) Find the real root of the equation  $\cos x - 3x + 1 = 0$  using Newton-Raphson method, correct to four decimal places. (5)

(b) Find the polynomial  $f(x)$  using Lagrange's interpolation formula and hence find  $f(10)$  for : (5)

x	5	6	9	11
y	12	13	14	16

(c) Compute  $\int_0^1 \frac{1}{1+x^2} dx$  using Romberg's method correct to four decimal places. (5)

4. (a) Find  $y(0.4)$  using modified Euler's method correct to three decimal places. Given :

$$\frac{dy}{dx} = x - y^2; y(0.2) = 0.2, \text{ taking } h = 0.2. \quad (6)$$

(b) Compute  $\int_0^2 e^{-x^2} dx$  using Simpson's 1/3<sup>rd</sup> rule. (5)

- (c) Using the formula  $f'(x_1) = \frac{f(x_2) - f(x_0)}{2h}$  and the Richardson extrapolation, find  $f'(3)$ , the following table of values is given :

x	-1	1	2	3	4	5	7
f(x)	1	1	16	81	256	625	2401

(4)

5. (a) Using Runge-Kutta method of fourth order, solve the following differential equation for y at x = 1.2 and 1.4

$$\frac{dy}{dx} = \frac{2xy + e^x}{x^2 + xe^x} \text{ given } x_0 = 1, y_0 = 0. \quad (7)$$

- (b) Solve following system of equations using Gauss-Thomas method.

$$2x_1 + 2x_2 = 4$$

$$2x_1 + 4x_2 + 4x_3 = 6$$

$$x_2 + 3x_3 + 3x_4 = 7$$

$$2x_3 + 5x_4 = 10 \quad (5)$$

- (c) Find a real root of the equation  $x^2 - 2x - 5 = 0$  using secant method.

(3)

6. (a) Solve the differential equation  $\frac{d^2y}{dx^2} = y + x(x - 4)$ ,  $0 \leq x \leq 4$  using finite difference method with  $y(0) = y(4) = 0$  and  $n = 4$  subintervals. (5)

- (b) A curve passes through the points (0, 18), (1, 10), (3, -18) and (6, 90). Find the slope of the curve using Lagrange's formula at  $x = 2$ . (6)

- (c) Find the value of  $\cos(1.74)$  from the following table : (4)

x	1.7	1.74	1.78	1.82	1.86
sin(x)	0.9916	0.9857	0.9781	0.9691	0.9584

7. Write short notes on :

- (a) Efficient computations and convergence. (5)
- (b) Cubic spline interpolation. (5)
- (c) Ralston's method. (5)