Time: 3 Hrs **Marks: 80**

Note :

- **Question No.1 is compulsory.**
- Solve **ANY THREE** questions from the **remaining** five questions.
- Figure to the right indicates full marks.
- Assume suitable data wherever required, but justify the same.

Q. 1 Solve **ANY FOUR** questions from the following. (Each question carries 5 marks) **20**

a) Define Accuracy, Precision and Error. (05)

b) What is scaling and how it affects the solution to linear algebraic equations using Gauss Elimination Method (05)

c) Write the steps to convert a binary number into decimal number with an example. (05)

d) Explain fuzzy logic and its architecture. (05)

e) Using the graphical method, determine x and y for the following equations: (05)

$2x - y = -1$

$x - 2y = -8$

Q. 2 **a)** Determine x, y and z using Gauss Elimination method. (10)

$2x - 7y - 10z = -17$

$5x + y + 3z = 14$

$x + 10y + 9z = 7$

b) Determine x, y and z using Gauss Seidal method. (10)

$5x + 3y + 7z = 4$

$3x + 26y + 2z = 9$

$4x + y + 2z = 16$

Q.3 **a)** Using Bisection method, determine the root of an equation (10)
$f(x) = \sin x - 5x + 2 = 0$ if initial approximations are $x_o=0.4$ and $x_1=0.6$.

b) Using Regula Falsi method, determine the root of an equation (10)
$f(x) = x^3 + 3x - 5 = 0$ if initial approximations are $x_o=1$ and $x_1=2$ upto 3 iterations. (x is in radians)

Q. 4 **a)** Determine a polynomial regression equation for the given dataset. (10)

x	3	4	5	6	7
y	7.5	3.2	3.8	6.5	11.5

b) Determine the polynomial using Lagrange's formula, which satisfies $p(1) = 1$, $p(3) = 27$ and $p(4) = 64$. Also, determine $p(1.5)$. (10)

Q.5 **a)** Use Euler's method to solve $\frac{dy}{dx} = 2x + y \quad at\ x = 1$ when y(0) = 1 with h=0.5. (10)

b) Solve the integral $\int_1^2 (4x - 1)\, dx$ by using Simpson's 1/3rd rule with n = 6. (10)

Q.6 **a)** For a steady state heat conduction through a plate of 0.3 m x 0.3 m, $\frac{d^2T}{dx^2} + \frac{d^2T}{dy^2} = 0$ (10)

The boundary temperatures are as follows:
Left Boundary = 500 K
Right Boundary = 1000 K
Top Boundary = 300 K
Bottom Boundary = 400 K
Determine the temperatures at inner nodes by dividing the plate in 3x3 grid.

b) For a transient heat conduction through a beam of 1.2 m, $\frac{du}{dt} = \frac{d^2u}{dx^2}$; (10)

The boundary conditions are as follows:
u(0,t) = 0; u(1,t) = 4t; u(x,0) = 0; h = 0.2;
Determine 'u' for two-time steps using Crank Nicholson method.

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