**Bachelor of Science (B.Sc. I.T.) Semester—IV (C.B.S.) Examination**

**NUMERICAL METHODS**

**Paper—VI**

Time : Three Hours] [Maximum Marks : 50

**N.B. :—** (1) **ALL** questions are compulsory and carry equal marks.

(2) Assume the data wherever necessary.

**EITHER**

1. (a) Use the bisection method to find a real root of the equation $f(x) = x^3 - x - 1 = 0$. 5

(b) Use the false position method to find a root of the function $f(x) = x^3 - 5x + 1 = 0$. 5

**OR**

(c) Find the roots of the equation

$f(x) = x^2 - 5x + 6 = 0$ in the vicinity of $x = 5$ using Newton-Raphson method. 5

(d) Use the Scant method to estimate the root of the equation $x^2 - 4x - 10 = 0$ with the initial estimates of $x_1 = 4$ and $x_2 = 2$. 5

**EITHER**

2. (a) Solve the following system of linear equations by using the Basic Gauss elimination method :

$$x_1 + 2x_2 + 3x_3 = 8$$
$$2x_1 + 4x_2 + 9x_3 = 8$$
$$4x_1 + 3x_2 + 2x_3 = 2$$ 5

(b) Using Gauss elimination with partial pivoting. Solve the following system of equation :

$$x_1 + 2x_2 + 3x_3 = 8$$
$$2x_1 + 4x_2 + 9x_3 = 8$$
$$4x_1 + 3x_2 + 2x_3 = 2$$ 5

**OR**

(c) Solve the following using Gauss-Jordan method :

$$2x_1 + x_2 + x_3 = 7$$
$$4x_1 + 2x_2 + 3x_3 = 4$$
$$x_1 - x_2 + x_3 = 0$$ 5

(d) What is ill-conditional system ? Describe the problem of ill-condition for two equation system. 5

**EITHER**

3. (a) What is spline interpolation ? Discuss with linear splines. 5

(b) Table below gives values of square of integers :

| x | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| $x^2$ | 1 | 4 | 9 | 16 | 25 |

using the linear interpolation formula estimate the square of 3.25

(a) Using the points 3 and 4

(b) Using the points 2 and 4.

Compare and comment on the results. 5

**OR**

(c) Given the table of data

| | | | | |
|---|---|---|---|---|
| x | 1 | 2 | 3 | 4 |
| z | 0 | 1 | 2 | 3 |
| y | 12 | 18 | 24 | 30 |

obtain a regression plane to fit the data. 5

(d) Use the least square regression to fit a straight line to the data

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| x | 0 | 2 | 4 | 6 | 8 | 12 | 16 | 20 |
| y | 10 | 12 | 18 | 22 | 20 | 30 | 26 | 30 |

5

**EITHER**

4. (a) Use Trapezoidal Rule to compute

$$I = \int_0^1 \frac{1}{1+x}\,dx$$

correct to three decimal places.

Assume h = 0.125. 5

(b) Derive Simpson's 1/3rd rule of numerical integration. 5

**OR**

(c) Given the equation

$$y'(x) = \frac{2y}{x} \text{ with } y(1) = 2$$

Estimate y(2) using the Milne-Simpson predictor-corrector method.

Assume h = 0.25. 5

(d) Use Runge-Kutta second order method to solve

$$\frac{dy}{dx} = \frac{y+x}{y-x},\ y(0) = 1 \text{ at } x = 0.4$$

Assume h = 0.2. 5

5. Attempt **ALL** :

(a) What is bisection method ? Explain. 2½

(b) Evaluate $\int_0^1 \frac{1}{1+x^2}\,dx$ by using Trapezoidal Rule taking n = 4. 2½

(c) How is the Secant Method compared with Newton-Raphson method ? 2½

(d) Write a short note on Round off errors and refinement. 2½