

Instruction to Candidates :

Attempt any five questions, selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)

Unit-I

1. (a) Explain the various types of errors. [8]
 (b) Find the real roots of the equation $x^3 + x + 1 = 0$. [8]

OR

1. (a) Find the number of roots of the equation $f(x) = 3x^6 - 4x^5 + 5x^2 - 6x - 7 = 0$ [8]
 (b) Determine the stepsize that can be used in the tabulation of $f(x) = \sin x$ in the interval $[0, \pi/4]$ at equally spaced nodal points so that the truncation error of the quadratic interpolation is less than 5×10^{-8} . [8]

Unit-II

2. (a) Find a root, correct to three decimal places and lying between 0 and 0.5 of the equation $4e^{-x} \sin x - 1 = 0$. [8]
 (b) Given that the equation $x^{2.2} = 69$ has a root between 5 and 8. Use the method of regula-falsi to determine it. [8]

OR

2. (a) Find the real root of the equation : $x^3 - 3x - 5 = 0$ correct to four places of decimal by Newton Raphson method. [8]
 (b) Find the root of the equation $x^3 + x - 1 = 0$ by Newton-Raphson method. [8]

Unit-III

3. (a) Solve the following system by using the Gauss-Jordan elimination method
 $x + 2y - 3z = 2$
 $6x + 3y - 9z = 6$
 $7x + 14y - 21z = 13$ [8]

- (b) Use Gaussian elimination to solve the system of linear equations

$$\begin{aligned} x_1 + 5x_2 &= 7 \\ -2x_1 - 7x_2 &= -5 \end{aligned} \quad [8]$$

OR

3. (a) Use crammer's rule to solve
 $3x_1 + 4x_2 - 3x_3 = 5$

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

$$3x_1 + 2x_2 - x_3 = 3$$

- (b) Solve the system [8]

$$0.0003120x_1 + 0.006032x_2 = 0.003328$$

$$0.5000x_1 + 0.8942x_2 = 0.9471 \quad [8]$$

Unit-IV

4. (a) Solve the system

$$2x + y = 2$$

$$2x + 1.01y = 2.01$$

- (b) Solve the equations [8]

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

$$x + 2y + 3z = 6$$

$$3x + y + 2z = 8$$

- by the method of LU - Decomposition. [8]

OR

4. Use power method to find the largest eigen value and corresponding eigen vector of the matrix.

$$A = \begin{bmatrix} 1 & 2 & 0 \\ 2 & 1 & 0 \\ 0 & 0 & -1 \end{bmatrix} \quad [16]$$

Unit-V

5. (a) Using Newton's forward difference formula, find the sum

$$S_n = 1^3 + 2^3 + 3^3 + \dots + n^3 + (n+1)^3 \quad [8]$$

- (b) Use Lagrange's interpolation formula to find y when $x = 1$ given that : [8]

x	0	1	3	4
y	5	6	50	105

OR

5. (a) Prove by Lagrange's formula :

$$y_1 = y_3(0.3)(y_3 - y_{-3}) + 0.2(y_{-3} - y_{-5}) \text{ approx.} \quad [8]$$

- (b) By means of Lagrange's formula, prove that

$$y_0 = \frac{1}{2}(y_1 + y_{-1}) - \frac{1}{8} \left[\frac{1}{2}(y_3 - y_1) \right] + \frac{1}{8} \left[\frac{1}{2}(y_{-1} - y_{-3}) \right] \quad [8]$$