

1019
B.E. (Electrical and Electronics Engineering)
Fourth Semester
AS-401: Numerical Analysis

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Part. Use of non-programmable calculator is allowed.

x-x-x

1. (a) Calculate the value of $\sqrt{3} + \sqrt{5} + \sqrt{7}$ correct to four significant figures and find its absolute and relative errors.
- (b) Define Simpson's 1/3 and 1/8 rule.
- (c) State Gerschgorin and Brauer theorems. What are the applications of these theorems?
- (d) Define eigen value and eigen vector using an example.
- (e) Define Chebyshev polynomials? (5 × 2 = 10)

PART A

2. (a) The function $f(x) = \tan^{-1} x$ can be expressed as (5)

$$\tan^{-1} x = x - \frac{x^3}{3} + \frac{x^5}{5} - \dots + (-1)^{n-1} \frac{x^{2n-1}}{2n-1} + \dots$$

Find n such that the series determines $\tan^{-1} 1$ correct to 6 significant digits.

- (b) Using iterative method find a real root of the equation (5)

$$x^3 + x^2 - 1 = 0$$

on the interval $[0,1]$ with an accuracy of 10^{-4} .

3. (a) Using Bairstow's method, obtain the quadratic factors of the following polynomial equation: (5)

$$x^4 - 6x^3 + 18x^2 - 24x + 16 = 0$$

- (b) Find a real root of the equation $x = e^{-x}$ using Newton-Raphson method. (5)

4. (a) Using Lagrange's interpolation formula, find the form of the function $y(x)$ from the following table: (4)

x	0	1	3	4
y	-12	0	12	24

- (b) Find the Hermite polynomial of degree 5 which fits the following data and hence find an approximate value of $\ln 2.7$. (6)

x	2.0	2.5	3.0
$y = \ln x$	0.69315	0.91629	1.09861
$y' = 1/x$	0.5	0.4	0.33333

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PART B

5. (a) Using the Householder's transformation reduce the matrix A into a tridiagonal matrix. (5)

$$A = \begin{bmatrix} 1 & 3 & 4 \\ 3 & 1 & 2 \\ 4 & 2 & 1 \end{bmatrix}$$

- (b) Find the solution to three decimal places, of the system using Gauss-Seidel method: (5)

$$\begin{aligned} 83x + 11y - 4z &= 95 \\ 7x + 52y + 13z &= 104 \\ 3x + 8y + 29z &= 71 \end{aligned}$$

6. (a) Using Newton-Coates method (method of undetermined coefficients) to derive the formula (5)

$$\int_0^{2\pi} f(x) \sin x \, dx = f(0) - f(2\pi)$$

- (b) Given that $\frac{dy}{dx} - \sqrt{xy} = 2$, $y(1) = 1$, find the value of $y(2)$ in steps of 0.1 using Euler method. (5)

7. (a) Use the method of least squares to fit the straight line $Y = a + bX$ to the data (5)

x	0	1	2	3
y	3	6	9	12

- (b) Solve the boundary value problem (5)

$$y'' - 64y + 10 = 0, \quad y(0) = y(1) = 0$$

by the finite difference method. Compute the value of $y(0.5)$.