

1058

B.E. (Electrical and Electronics Engineering)

Fourth Semester

As-401: Numerical Analysis

(2016)

Max. Marks: 50

Time allowed: 3 Hours

*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  $\sqrt{102} - \sqrt{101}$  correct to four significant figures and find its absolute and relative errors.
- (b) Define Chebyshev polynomial of degree 'n' over the interval  $[-1,1]$  in terms of  $T_i(x)$  and show that  $x^2 = \frac{1}{2}[T_0(x) + T_2(x)]$ .
- (c) State Gerschgorin and Brauer theorems. What are the applications of these theorems?
- (d) What are transcendental and polynomials equations? Give examples.
- (e) What is the difference between Newton interpolation and Hermite interpolation? (5 × 2 = 10)

## PART A

2. (a) Find the number of terms of the exponential series such that their sum gives the value  $e^x$  correct to five decimal places for all values of  $x$  in the range  $0 \leq x \leq 1$ . (4)
- (b) Using bisection method find a real root of the equation (6)

$$x^3 - 2x - 5 = 0$$

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

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

- (b) Find a root of the equation  $x^3 - 2x^2 + 3x - 5 = 0$  between 1 and 2, correct to three decimal places by Regula Falsi and Newton-Raphson method. (5)
4. (a) Find the unique polynomial of degree 2 or less, such that (4)  
 $f(0) = 1, f(1) = 3, f(3) = 55$ , using  
 (i) The iterated interpolation  
 (ii) The Newton divided difference interpolation.
- (b) Given the following values of  $f(x)$  and  $f'(x)$  estimate the values of  $f(-0.5)$  and  $f(0.5)$  using the Hermite interpolation. The exact values are  $f(-0.5) = 33/64$  and  $f(0.5) = 97/64$  (6)

$x$	$f(x)$	$f'(x)$
-1	1	-5
0	1	1
1	3	7

PART B

5. (a) Solve the following system of equations using Cholesky method: (5)

$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & 8 & 22 \\ 3 & 22 & 82 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 5 \\ 6 \\ -10 \end{bmatrix}$$

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

$$A = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$$

6. (a) Evaluate the following integral (correct to three decimal places) by both trapezoidal and Simpson's rule with  $h = 0.5, 0.25$  (5)

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

- (b) Given  $\frac{dy}{dx} = y - x$  where  $y(0) = 2$ , find  $y(0.1)$  and  $y(0.2)$  correct to four decimal places using Runge-Kutta method. (5)

7. (a) For  $x$  nearer 1, the sum (5)

$$S = 1 - x + \frac{x^2}{2} - \frac{x^3}{6} + \frac{x^4}{24} - \frac{x^5}{120} + \frac{x^6}{720} - \frac{x^7}{5040}$$

gives a result which is correct to five decimal places. Economize the above series if the fourth decimal place is not to be affected.

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

$x$	0	1	2	3
$y$	2	5	8	11