

This question paper contains 4 printed pages]

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S. No. of Question Paper : 6472

Unique Paper Code : 251401

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Name of the Paper : Numerical Techniques (ELHT-401)

Name of the Course : B.Sc. (H) Electronics

Semester : IV

Duration : 3 Hours

Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Answer five questions in all including Q. No. 1 which is compulsory.

Only non-programmable scientific calculator is to be used.

1. (a) Find the relative error if the number  $x = 0.00646819$  is :

(i) chopped off up to 3 decimal places

(ii) rounded off up to 3 decimal places.

3

(b) If  $a = 0.5555e1$ ,  $b = 0.4545e1$ ,  $c = 0.4535e1$ , find  $(a \times b) - c$  using 4 digit mantissa in computer arithmetic.

3

(c) Give the formula for  $dy/dx$  at  $x = x_n$  using Newton's backward difference formula.

3

P.T.O.

- (d) What is the error formula for order of the error in the Runge-Kutta IVth order method for solution of first order differential equation ? 3
- (e) Find the root of the equation  $x^3 - 4x - 9 = 0$  using bisection method at the end of 3 iterations using four significant figures in each step. 3
2. (a) Explain graphically the Newton-Raphson's method to solve an algebraic and transcendental equation. 5
- (b) Discuss and derive the rate of convergence for Newton-Raphson's method. 5
- (c) Find a real root of the equation  $x \log_{10} x = 1.2$  by Regula-Falsi method correct up to 4 decimal places. 5
3. (a) Derive the formula for Lagrange's interpolation formula for non-uniform intervals. 8
- (b) Find the cubic polynomial which takes the following values using Newton's forward interpolation formula :

$x$	$y$
0	1
1	2
2	1
3	10

Hence evaluate  $f(1.5)$ .

4. (a) Derive the trapezoidal rule of integration for  $n$  intervals and estimate the error involved in it. 9

- (b) Evaluate the integral :

$$\int_0^1 (x dx / 1 + x)$$

using Simpson's 1/3 rule for  $h = 0.25$ . 6

5. (a) Derive the Heun's method for the solution of first order differential equation graphically. 5

- (b) Find the solution in the interval  $(0, .5)$  of the following differential equation using Euler's Cauchy method :

$$dy/dx = x + y$$

Given  $h = 0.25$ , and  $y = 0$  at  $x = 0$ . 4

- (c) Apply Runge-Kutta's IVth order method to find approximate value of  $y$  for  $x = 0.2$  in single step, if  $dy/dx = x + y^2$ , Given that  $y = 1$  at  $x = 0$ . 6

6. (a) Apply Gauss Elimination method to solve the set of equations with partial pivoting :

$$x + 4y - z = -5$$

$$x + y - 6z = -12$$

$$3x - y - z = 4$$

8

- (b) Apply Jacobi method to solve the following set of equations using at least 5 steps :

$$x + y + z = 9$$

$$2x - 3y + 4z = 13$$

$$3x + 4y + 5z = 40$$

7

P.T.O.

7. (a) Find the largest eigen value and the corresponding eigen vector in the following matrix using power method (at least 5 iterations) : 7

$$\begin{bmatrix} 10 & 4 & -1 \\ 4 & 2 & 3 \\ -1 & 3 & 1 \end{bmatrix}$$

- (b) Fit a parabola :

8

$$p(x) = b_0 + b_1x + b_2x^2$$

to the given points by the method of least squares :

$$(-1, 3), (1, 1), (2, 2), (3, 6)$$