[Total No. of Questions - 8] [Total No. of Printed Pages - 2] (2064)

14755

M. Tech 2nd Semester Examination

Computational Techniques

EC-203

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt any five questions.

1. (a) Using Newton Raphson method, compute the real roots of $x \log_{10} x - 1.2 = 0$, correct to three decimal places. (10)

   (b) State Lagrange's interpolation formula. Use this formula to find the value of y, when x=5, if the following values of x and y are given:

x	1	2	3	4	7
y	2	4	8	16	128

(10)

2. Determine the largest eigen value and the corresponding eigen vector using iteration scheme to three correct decimal places for the matrix $\begin{bmatrix} 4 & 1 & 0 \\ 1 & 20 & 1 \\ 0 & 1 & 4 \end{bmatrix}$ (20)

3. (a) Using Runge – Kutta method of fourth order to solve for y(0.1), y(0.2) and y(0.3) given that $\frac{dy}{dx} = xy + y^2$, y(0)=1. (10)

(b) Using Milne's predictor - corrector method, obtain the solution of the equation $\frac{dy}{dx} = \frac{1}{x+y}$ at x = 0.8. given that y(0) = 2, y(0.2) = 2.0933, y(0.4) = 2.1755, y(0.6) = 2.2493. (10)

4. Find the solution of the boundary value problem $\frac{d^2y}{dx^2} = y + x$, $x \in [0, 1]$, y(0) = 0, y(1) = 0 with the shooting method. Use the Runge Kutta method of second order to solve the initial value problems with h = 0.2. (20)

5. Define Chebyshev polynomials. Develop the function $f(x) = \frac{1}{2}\ln\left(\frac{1+x}{1-x}\right)$ in a series of Chebyshev polynomials. (20)

6. Use Jacobi method to find all Eigen values of real symmetric matrix A given by $A = \begin{bmatrix} 3 & 1 & 0 \\ 1 & 4 & 2 \\ 0 & 2 & 1 \end{bmatrix}$ (20)

7. Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ in 0 < x < 2, t > 0 with conditions u(0, t) = u(2, t) = 0, t > 0, and u(x, 0) = $\sin\left(\frac{\pi x}{2}\right)$, 0 ≤ x ≤ 2, using Δx=0.5, Δt = 0.25 for one time step by Crank - Nicholson method. (20)

8. Solve the boundary value problem $u'' + u = x$, 0 < x < 1; u(0) = 0, u(1) = 0 using the Ritz finite element method with linear piecewise polynomials for two and three elements of equal lengths. (20)