[Total No. of Questions - 9] [Total No. of Printed Pages - 4]
(2063)

822

B.Tech 4th Semester Examination

Numerical Methods and Computer Programming

ID-4001

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 five questions in all selecting one question from each of section A, B, C and D. Section E is compulsory attempt all the subparts of section.

SECTION - A

1. (a) Using Newton's divided difference formula, find f(8) given f(1) = 3, f(3) = 31, f(6) = 223, f(10) = 1011, f(11) = 1343. **(10)**

   (b) Applying Lagrange's interpolation formula find a cubic polynomial which approximate the following data:

x :	3	2	1	–1
f(x) :	3	12	15	–21

   (10)

2. (a) Apply Gauss forward Interpolation formula to obtain f(x) at x=32 given that

x:	25	30	35	40
f(x):	0.2707	0.3027	0.3386	0.3794

   (10)

   (b) write a computer program in C for Newton's backward Interpolation Method. **(10)**

SECTION - B

3. (a) Obtain $\sqrt{12}$ to four decimal places by Newton's Raphson method. **(10)**

   (b) Find the real root of the equation $x^{ex} = 2$ by Regular Falsi Method is four stages. **(10)**

4. (a) Solve by Gauss-Seidal method, the following system of equations **(10)**

   $6x + y + z = 105$; $4x + 8y + 3z = 155$; $5x + 4y - 10z = 65$

   (b) Solve the equations

   $10 - 2y - 2z = 6$; $x + 10y - 2z = 7$;
   $x - y + 10z = 8$ by Relaxation Method. **(10)**

SECTION - C

5. (a) Find first and second order derivatives at x = 0.75, from the table

x:	0.50	0.75	1.00	1.25	1.50
y:	0.13	0.42	1.00	1.95	2.35

   (10)

   (b) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ using Trapezoidal rule considering seven ordinates. Compare it with exact value. **(10)**

6. (a) Write a computer program in C to perform integration using Simpson's 1/3 rule. **(10)**

   (b) Evaluate $\int_4^{5.2} \log x \, dx$ using Weddle's and Simpson's 3/8 rules. **(10)**

SECTION - D

7. (a) By Cranck-Nicholson method solve the equation $\frac{\partial^2 4}{\partial x^2} = \frac{\partial u}{\partial t}$ subject to u(x, 0) = 0, u(0, t) = 0 and u(1, t) = t for two time steps. **(10)**

(b) Define elliptic, parabolic and hyperbolic type of partial differential equations and derive standard 5-point formula to solve

$$\frac{\partial^2 4}{\partial x^2} = \frac{\partial^2 4}{\partial y^2} = 0$$ **(10)**

8. (a) Solve the Laplace equation over the square mesh of side 4 units satisfying the boundary conditions:

$u(0, y) = 0, 0 \le y \le 4$

$u(4, y) = 12 + y, 0 \le y \le 4$

$u(x, 0) = 3x, 0 \le y \le 4$

$u(x, 4) = x^2, 0 \le x \le 4$ **(10)**

(b) Using Schmidt's process solve $24\, u_{xx} = u_t$ where $0 < x < 1$, $t > 0$ with boundary conditions u (0, t) = 0 = u (10, t)

$u(x, 0) = \frac{x(10 - x)}{25}$ and choosing h=1 and $k^2 s^5$ suitably. Find u_{iN} for i = 1, 2, 3.....9 and j=1, 2, 3, 4. **(10)**

SECTION - E

9. (a) Obtain the divided difference table for the following data:

x:	–1	0	2	3
f(x):	–8	3	1	12

(2)

(b) Using Lagrenge's interpolation, find the polynomial through (0, 0), (1, 1) and (2, 2). **(2)**

(c) Define algebraic and transcendental equation with examples. **(2)**

(d) Show that the iterative formula for finding the reciprocal of N is

$$x_{n+1} = x_n\left[2 - Nx_n\right]$$ **(2)**

(e) What do you mean by

"Diagonally dominant"? **(2)**

(f) In numerical integration, what should be the number of intervals to apply Sivapson's 1/3 and Simpson's 3/8 rule? **(2)**

(g) Write a computer program in C for bisection method to find root of f(x)=0. **(2)**

(h) State Crank-Nicholson's Scheme to solve $\frac{\partial^2 4}{\partial x^2} = a\frac{\partial 4}{\partial t}$, when $k = ah^2$. **(2)**

(i) Write formula for $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = x_0$ using forward differences. **(2)**

(j) Prove that $\nabla = 1 - E^{-1}$. **(2)**