

Seat  
No.

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CBI1325

## Numerical Analysis & Computational Methods (New) (1030)

P. Pages : 3

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All questions are compulsory and attempt **any two** bits out of a, b, c from each question.
5. Use of Non programmable calculator is allowed.
6. Assume suitable data, if necessary.

### UNIT - I

1. a) Describe the concept of mathematical modeling of engineering problems. Solve the equation  $x \tan x = -1$  by Regula falsi method in between 2.5 and 3, correct to four decimal places. 10  
b) What are the steps required to produced quality software ? Find the positive root between 1 and 2 which satisfies  $x^3 - 3x + 1 = 0$  to 3 decimal places, by using Horner's method. 10  
c) Write note on rate of convergence. Find a positive root of  $2x = 3 + \cos x$  by using bisection method. 10

### UNIT - II

2. a) Explain Improved and modified Euler's method. Find the values of  $y(0.1)$  and  $y(0.2)$  by using Taylor series method, given that  $\frac{dy}{dx} = 3x + \frac{1}{2}y$  &  $y(0) = 1$ . 10  
b) Calculate  $\int_0^{\pi/2} \sin x \, dx$  by dividing the interval into ten equal parts, using Trapezoidal, Simpson's  $\frac{1}{3}$ rd & Simpson's  $\frac{3}{8}$ th rules. 10

- c) Using Runge Kutta method of fourth order, solve  $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$  given  $y(0) = 1$  at  $x = 0.2, 0.4$ .

10

## UNIT - III

3. a) What is principle of least square method ? Fit a curve of the form  $y = ab^x$  to the following data.

10

x	1	2	3	4	5	6
y	151	100	61	50	20	8

- b) Write short notes on lagrangel's interpolation. Using stirling formula, estimate  $f(32)$  from the following table.

10

x	20	25	30	35	40
y	49225	48316	47236	45926	44306

- c) Explain the possible sources of error in interpolation. Using Newton's divided difference formula, find the values of  $f(2)$  and  $f(15)$  given the following table.

10

x	4	5	7	10	11	13
f(x)	48	100	294	900	1210	2028

## UNIT - IV

4. a) Solve by LU - decomposition the following system.

10

$$x + 5y + z = 14$$

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

$$3x + y + 4z = 17$$

- b) Solve the following system by using Gauss Jacobi method.

10

$$8x - 3y + 2z = 20$$

$$6x + 3y + 12z = 35$$

$$4x + 11y - z = 33$$

- c) Solve by using Gauss Jordan method.

10

$$10x + y + z = 12$$

$$2x + 10y + z = 13$$

$$x + y + 5z = 7$$

### UNIT - V

5. a) Write note on basic steps of finite Element Analysis for any machine component.

10

- b) Solve  $\nabla_u^2 = 8x^2y^2$  for square mesh given  $u = 0$  on the four boundaries dividing the square into 16 sub squares of length 1 unit.

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- c) Using Crank Nicolson method, solve

10

$$U_{xx} = ut \text{ subject to}$$

$$u(x, 0) = 0 \quad u(0, t) = 0, \quad u(1, t) = t$$

$$\text{taking } h = \frac{1}{4} \text{ and } k = \frac{1}{8}$$

compute  $u$  for one time step only.

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