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मठ - 039

Numerical Analysis & Computational Methods (1030)

P. Pages : 2

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. Black figures to right indicate full marks.
6. Use of non programmable calculator is allowed.
7. Assume suitable data, if necessary.

1. a) Explain Newton-Raphson method. Give geometrical meaning of Newton's method. Also explain criterion for the convergence. 10
b) Explain Bisection method and find the positive root of $x^4 - x^3 - 2x^2 - 6x - 4 = 0$ by bisection method. 10
c) By Horner's method, find the root of $x^3 - 3x^2 + 2.5 = 0$ that lies between 2 and 3. 10
2. a) Using Taylor series method, find $y(1.1)$ and $y(1.2)$ correct to four decimal places given $\frac{dy}{dx} = xy^{1/3}$ and $y(1) = 1$. 10
b) Explain Gauss quadrature technique and solve $\int_0^1 \frac{dx}{1+x^2}$ by using Gauss quadrature technique. 10
c) Compute $y(0.3)$ given $\frac{dy}{dx} + y + xy^2 = 0$, $y(0) = 1$ by taking $h = 0.1$ using R. K. method of fourth order correct to 4 decimals. 10
3. a) Explain stirling's interpolation. The following table gives the values of the probability integral $f(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-x^2} dx$ for certain values of x . Find the value of this integral when $x = 0.5437$ using stirling's formula. 10

x	0.51	0.52	0.53	0.54	0.55	0.56	0.57
y = f(x)	0.5292437	0.5378987	0.5464641	0.5549392	0.5633233	0.5716157	0.5798158

- b) Using Newton's divided difference formula, find the values of $f(2)$, $f(8)$ and $f(15)$ given the following table 10

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

- c) Explain ill-conditioning in least square method. Also explain logarithmic curve fitting. 10

4. a) Solve the system of equations by Gauss Jordan method. 10

$$x + y + z + w = 2$$

$$2x - y + 2z - w = -5$$

$$3x + 2y + 3z + 4w = 7$$

$$x - 2y - 3z + 2w = 5$$

- b) Solve the following system by LU decomposition method
 $x + y + z = 1$, $4x + 3y - z = 6$, $3x + 5y + 3z = 4$ 10

- c) Solve by Gauss-seidal method, the following system. 10

$$28x + 4y - z = 32$$

$$x + 3y + 10z = 24$$

$$2x + 17y + 4z = 35$$

5. a) Explain finite element method. Write basic steps of finite element analysis. 10

- b) Explain Bender schmidt method and solve $\frac{\partial^2 u}{\partial x^2} - 2 \frac{\partial u}{\partial t} = 0$ Given $u(0, t) = 0$,
 $u(4, t) = 0$, $u(x, 0) = x(4 - x)$. Assume $h = 1$. Find the values of u upto $t = 5$. 10

- c) Using crank - Nicholson method, solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to $u(x, 0) = 0$,
 $u(0, t) = 0$ and $u(1, t) = t$

- i) Taking $h = 0.5$ and $k = \frac{1}{8}$ and ii) $h = \frac{1}{4}$ and $k = \frac{1}{8}$ 10
