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MME-101

(Following Paper ID and Roll No. to be filled in your Answer Book)

Paper ID : 240101

Roll No.

M.Tech.

(SEM. I) THEORY EXAMINATION, 2015-16

NUMERICAL METHODS & COMPUTER PROGRAMMING

[Time : 3 hours]

[Total Marks : 100]

1. Attempt **all** parts. All parts carry equal marks. Write answer of each part in short. (2×10=20)

- Write the iteration formula to find a root of the equation by Newton-Raphson method.
- State the condition for convergence of the root of the equation $f(x) = 0$.
- Define forward, backward and shift operators.
- Find (i) $\Delta \log x$ (ii) $\Delta \tan^{-1}x$
- Define numerical differentiation.
- Evaluate $\int_1^{5-2} \log x dx$ Weddle's rule.
- Evaluate $\int_0^1 \frac{dx}{1+x}$ by Boole's rule.

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(1)

(h) Using modified Euler's method find $y(0.1)$ from

$$\frac{dy}{dx} = x + y + xy \text{ taking } h = 0.025.$$

(i) Find the second degree polynomial passes through the point (0, 1), (1, 3), (2, 7) and (3, 6, 13)

(j) Find the polynomial $f(x)$ from the following table

x	0	1	2	3	4
$f(x)$	3	6	11	18	27

Section-B

Attempt **any five** questions from this section. (10×5=50)

- Evaluate $\Delta^2 \left(\frac{5x+12}{x^2+5x+16} \right)$.
- If $y_{10}=3, y_{11}=6, y_{12}=11, y_{13}=18, y_{14}=27$ find y_4 .
- Apply Bessel's formula to find $f(27.5)$ from the table:

x	25	26	27	28	29	30
$f(x)$	4.000	3.846	3.704	3.571	3.448	3.333

5. Using modified Euler's method, find an approximate value of y when $x = 0.3$ given that

$$dy * dx = x + y \text{ and } y = 1 \text{ when } x = 0.$$

(2)

6. Solve the following equations by Crout's method:

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

$$2x - 3y - z = -3$$

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

7. Use iteration method to find a root of the equation to four decimal places of $x^3 - 9x + 1 = 0$ and also find algorithm using Newton-Raphson method and also write algorithm.

8. Solve $x^3 - 5x^2 - 17x + 20 = 0$ by Graeff's method.

9. Use Bolle's five point formula to compute $\int_0^{\pi} \sqrt{\sin x} dx$.

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Section-C

Attempt **any two** questions from this section. (15×2=30)

10. (a) Fit a curve of the form $y = \frac{a}{x} + bx$, by the method of least squares to the following data of x and $f(x)$:

(1, 5.43), (2, 6.28), (4, 10.32), (6, 14.86), (8, 19.51)

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(3)

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(b) Compute the value of $\int_{0.2}^{1.4} (\sin x - \log x + e^x) dx$ using Simpson's $\frac{3}{8}$ th rule.

11. (a) Apply Rung-Kutta fourth order method to find an approximate value of y when $x = 0.2$ given that

$$\frac{dy}{dx} = x + y \text{ and } y = 1 \text{ when } x = 0.$$

(b) Apply Bessel's formula to obtain y_{25} , given $y_{20} = 2854$, $y_{24} = 3162$, $y_{28} = 3544$, $y_{32} = 3992$.

12. (a) Using Lagrange's formula, estimate the value of $y(10)$ from the following data (x, y) :

(5,12), (6,13), (9,14), (11,16)

(b) Compute the value of $\sqrt{10}$ correct to 2 decimal places.

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