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(b) Solve $\frac{\partial u}{\partial t} = \frac{1}{2} \frac{\partial^2 u}{\partial x^2}$, $0 \leq x \leq 12$, $0 \leq t \leq 12$ with initial and boundary conditions

(i) $u(x, 0) = \frac{1}{4} x(15 - x)$; $0 \leq x \leq 12$

(ii) $u(0, t) = 0$

(iii) $u(12, t) = 9$, $0 \leq t \leq 12$

using Schmidt relation by taking $h = k = 3$.

(16)

Reg. No. :



Question Paper Code : 23772

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Fourth Semester

Civil Engineering

MA 2264 — NUMERICAL METHODS

(Common to Sixth Semester — Electronics and Communication Engineering, Computer Science and Engineering, Industrial Engineering, Information Technology and Fifth Semester — Polymer Technology, Chemical Engineering, Polymer Technology, Aeronautical Engineering, Mechanical Engineering, Electrical and Electronics Engineering and Mechatronics Engineering)

(Regulations 2008)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write down the condition for the convergence of fixed point iteration method.
2. Derive the iterative formula for finding the value of $\frac{1}{N}$ where N is a real number using Newton's method.
3. Find the divided differences of $f(x) = x^3 + x + 2$ for the arguments 1, 3, 6 and 11.
4. Write down the Newton's backward interpolation formula.
5. Write down the Newton-Cote's quadrature formula for equidistant ordinates.
6. Write down the first two derivatives at $x = x_n$ using Newton's backward interpolation formula.
7. Under which condition the fourth order Runge-Kutta method reduces to Simpson's rule?

8. How many values are needed to use Milne's Predictor-Corrector formula prior to the required value?
9. Write down the diagonal five point formula in solving elliptic equations.
10. Write down the Bender-Schmidt explicit formula in solving parabolic equation.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Using Newton's method solve $x \log_{10} x = 12.34$ by starting with $x_0 = 10$ upto 4 decimal places. (8)

- (ii) Find the inverse of the matrix $A = \begin{bmatrix} 8 & -4 & 0 \\ -4 & 8 & -4 \\ 0 & -4 & 8 \end{bmatrix}$ by using Gauss-Jordan method. (8)

Or

- (b) (i) Solve the system of equations by Gauss elimination method. (8)
 $2 + 3y - z = 5$; $4x + 4y - 3z = 3$; $2x - 3y + 2z = 2$.

- (ii) Find the numerically largest eigenvalue of $A = \begin{bmatrix} 1 & -3 & 2 \\ 4 & 4 & -1 \\ 6 & 3 & 5 \end{bmatrix}$ by Power method. (8)

12. (a) (i) Find $f(8)$ for the following data using Newton's divided difference formula. (8)

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

- (ii) Using Lagrange's interpolation formula, find $y(10)$ given that $y(5) = 12$, $y(6) = 13$, $y(9) = 14$, $y(11) = 16$. (8)

Or

- (b) Find the cubic spline approximation for the function given below. (16)

x	0	1	2	3
$y = f(x)$	1	2	33	244

Assume $M_0 = 0$, $M_3 = 0$. Also find $y(2.5)$.

13. (a) (i) Find $y'(10)$ from the following table. (8)

x	3	5	11	27	34
$y(x)$	-13	23	899	17315	35606

- (ii) Evaluate $\int_0^{\pi/2} \sqrt{\sin x} dx$ using Simpson's 1/3 rule. (8)

Or

- (b) (i) Evaluate $\int_{0.5}^{0.7} e^{-x} \sqrt{x} dx$ taking 5 ordinates by using Trapezoidal rule. (8)

- (ii) Evaluate $\int_0^1 \int_0^1 \frac{1}{(1+x+y)} dx dy$ by using Trapezoidal rule, with step sizes $h = k = 0.5$. (8)

14. (a) Using Runge-Kutta method of fourth order solve $\frac{dy}{dx} = \frac{2xy + e^x}{x^2 + xe^x}$ for $x = 1.2$ and 1.4 by using $y_0 = 0$ at $x_0 = 1$. (16)

Or

- (b) Given $\frac{dy}{dx} = (x^3 + xy^2)e^{-x}$, $y(0) = 1$, find y at $x = 0.1, 0.2$ and 0.3 by Taylor's series method and compute $y(0.4)$ by Milne's method. (16)

15. (a) Solve $u_{xx} + u_{yy} = 0$ over the square mesh of side 4 units, satisfying the following boundary conditions: (16)

- (i) $u(0, y) = 0$, for $0 \leq y \leq 4$
 (ii) $u(4, y) = 12 + y$, for $0 \leq y \leq 4$
 (iii) $u(x, 0) = 3x$, for $0 \leq x \leq 4$
 (iv) $u(x, 4) = x^2$, for $0 \leq x \leq 4$

Or