Reg. No. : | | | | | | | | | | |

Question Paper Code: 52114

M.E. DEGREE EXAMINATION, NOV 2016

First Semester

CAD / CAM

15PMA124 - ADVANCED NUMERICAL METHODS

(Regulation 2015)

Duration: Three hours | Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. The root of the equation $x^3 - 2x - 5 = 0$ lies between

   (a) 0 and 1 (b) 1 and 2 (c) 2 and 3 (d) 3 and 4

2. The Error of Runge kutta fourth order is

   (a) O (h^3) (b) O (h^2) (c) O (h^5) (d) O (h^4)

3. Hyperbolic equation is

   (a) $4u_{xx} - 3u_{xy} + 2u_{yy} = 0$ (b) $4u_{xx} - 6u_{xy} + 2u_{yy} = 0$

   (c) $u_{xx} - 3u_{xy} + 12u_{yy} = 0$ (d) $u_{xx} - 2u_{xy} + u_{yy} = 0$

4. The Laplace equation is

   (a) Hyperbolic (b) elliptic (c) parabolic (d) none of these

5. Which method is called "Weighted residual method"?

   (a) Least square method (b) Collocation method

   (c) Galerkin method (d) Rayleigh-Ritz method

PART - B (5 x 3 = 15 Marks)

6. Define partial pivoting.

7. What is meant by orthogonal collocation?

8. State the explicit scheme formula for the solution of the wave equation.

9. Write down the finite difference scheme to solve Poisson's equation.

10. Define a difference quotient.

PART - C (5 x 16 = 80 Marks)

11. (a) Use Faddeev's method to find the eigen values of the matrix $A = \begin{pmatrix} 2 & -1 & 1 \\ -1 & 2 & 1 \\ 1 & -1 & 2 \end{pmatrix}$ and hence find its inverse. (16)

Or

(b) Solve the following system of equations by Gauss-Jacobi's method:
$27x + 6y - z = 85,\ x + y + 54z = 110,\ 6x + 15y + 2z = 72$ (16)

12. (a) Find y (0.1), y (0.2) and y (0.3) using R-K method of fourth order given $\frac{dy}{dx} = \frac{1}{2}(1+x)y^2$, y (0) = 1. Continue your calculation to find y (0.4) using Adams method. (16)

Or

(b) Solve the boundary value problem xy'' + y = 0, y (1) = 1 and y (1.25) = 1.3513 by shooting method. Take h = 0.25 and assume the initial guesses for y' (1) as 1.2 and 1.5. (16)

13. (a) Solve $u_{tt} = u_{xx}$ up to t = 0.5 with a spacing of 0.1 subject to y (0, t) = 0, y(1, t) = 0, yt(x, 0) = 0 and y(x, 0) = 10 + x(1-x). (16)

Or

(b) Solve $u_{tt} = 4\, u_{xx}$ with boundary conditions $u(0, t) = 0 = u(4, t)$, $t > 0$ and the initial conditions $(x,0) = 0,\ u(x,0) = x(4-x)$. (16)

14. (a) Solve the Poisson equation $\nabla^2 u = -10(x^2 + y^2 + 10)$ subject to the condition $u = 0$ at $x = 0$ and $x = 3$, $u = 3$, $u = 0$ at $y = 0$ and $u = 1$ at $y = 3$ for $0 < x < 3$. Find the solution taking $h = 1$ with a square. (16)

Or

(b) By iteration method, solve the Laplace equation $u_{xx} + u_{yy} = 0$, over the square region, satisfying the boundary conditions:
$u(0, y) = 0, 0 \leq y \leq 3, u(3, y) = 9 + y, 0 \leq y \leq 3, u(x, 0) = 3x, 0 \leq x \leq 3,$
$u(x, 3) = 4x, 0 \leq x \leq 3.$ (16)

15. (a) Solve the Poisson $u_{xx} + u_{yy} = -2$, $0 \leq x, y \leq 1$ with the condition $u=0$ on the boundary of the square $0 \leq x \leq 1, 0 \leq y \leq 1$ using finite element method. (16)

Or

(b) Using Galerkin technique, solve the Poisson's equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = k$, $0 < x, y < 1$, with $u = 0$ on the boundary C of the region R. (16)

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