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

Question Paper Code: 41211

M.E. DEGREE EXAMINATION, DECEMBER 2014.

First Semester

CAD / CAM

14PMA124 - ADVANCED NUMERICAL METHODS

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (5 x 1 = 5 Marks)

1. "As soon as a new value for a variable is found by iteration, it is used immediately in the following equations". This method is called
   (a) Gauss-seidel (b) Thomos algorithm
   (c) Gauss-Jacobi (d)Gauss Elimination

2. The truncation error of Adams-Bashforth method is
   (a) O(h^3) (b) O(h^4) (c) O(h^2) (d) O(h^5)

3. The PDE $xf_{xx} + yf_{yy} = 0$ is elliptic when
   (a) x > 0 and y > 0 (b) x > 0 and y < 0
   (c) x < 0 and y < 0 (d) x < 0 and y > 0

4. The Laplace equation is
   (a) hyperbolic (b) elliptic
   (c) parabolic (d) None of these

5. If R(x) is orthogonal, then
   (a) $\int_0^1 R(x)F_i(x)dx = 0$ (b) $\int_{-1}^1 R(x)F_i(x)dx = 0$
   (c) $\int_0^1 F_i(x)dx = 0$ (d) $\int_0^1 R(x)dx = 0$

PART - B (5 x 3 = 15 Marks)

6. Distinguish Power method and Faddeev – Leverrier method.

7. What is the technique commonly used for stiff system?

8. Write the implicit and explicit formula for solving parabolic equations.

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

10. Define Orthogonal collocation method.

PART - C (5 x 16 = 80 Marks)

11. (a) (i) Solve by Gauss Elimination Method, the equations $3x + 2y + 7z = 4$; $2x + 3y + z = 5$; $3x + 4y + z = 7$. (8)

(ii) By using Gauss seidel method, Solve the system of equations $6x + 3y + 12z = 35$; $8x - 3y + 2z = 20$; $4x + 11y - z = 33$. (8)

Or

(b) Using Faddeev-Laverrier method, find all the eigen values of the matrix

$$A = \begin{bmatrix} 3 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 3 \end{bmatrix}$$ and hence find its inverse. (16)

12. (a) (i) Given $\frac{dy}{dx} = y - x$ where $y(0) = 2$, find $y(0.1)$ and $y(0.2)$ by Runge-Kutta method of fourth order. (8)

(ii) Given $y' = x^2 - y$, $y(0) = 1$ and the starting values $y(0.1) = 0.0052$, $y(0.2) = 0.8213$, $y(0.3) = 0.7492$. Obtain the value of $y(0.4)$ using Adam's predictor corrector method. (8)

Or

(b) Solve the boundary value problem $y'' + y = 0$, $y(0) = 0$ and $y(1) = 1$ by shooting method. (16)

13. (a) (i) Solve by Crank-Nicholson method $u_t = \frac{1}{16} u_{xx}$, $0 < x < 1, t > 0$; $u(x, 0) = 0$, $u(0, t) = 0$, $u(1,t) = 100t$. Compute u for one time with $h = {}^1/_4$. (8)

(ii) Discuss ADI method to solve the two dimensional parabolic equations. (8)

Or

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

14. (a) Solve the equation $u_{xx} + u_{yy} = 0$ in the square region of side 4 units satisfying the following boundary conditions:

$u(0, y) = 0$ for $0 \le y \le 4$, $u(4, y) = 12 + y$ for $0 \le y \le 4$

$u(x,0) = 3x$ for $0 \le x \le 4$, $u(x, 4) = x^2$ for $0 \le x \le 4$. (16)

Or

(b) Solve the PDE $\nabla^2 u = -10(x^2 + y^2 + 10)$ over the square mesh with sides $x = 0$, $y = 0$, $x = 3$, $y = 3$ with $u = 0$ on the boundary and mesh length = 1. (16)

15. (a) Solve the Poisson's equation $u_{xx} + u_{yy} = -1$ where u = 0 on the boundary of the square formed by the nodes (0,0), (1,0), (1,1) and (0,1). (16)

Or

(b) Solve the boundary value problem $u_{xx} + u_{yy} = -2$, $|x| \le 2, |y| \le 2$ and u = 0 on the boundary. Use the Galerkin finite element method to determine u at the nodes (0, 0), (1, 0) and (1, 1). (16)
