C **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 51024

M.E. DEGREE EXAMINATION, APRIL 2019

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. If the Eigen values are -3, 4, 1 then the dominant Eigen value of A is CO1- R

   (a) -3 (b) 4 (c)1 (d) None of the above

2. The Error term in Adam – Bash forth Predictor formula is CO2 -R

   (a) $\frac{14\,h}{45}\Delta^4 y_0$ (b) $\frac{14\,h}{45}\Delta^4 y_0$ (c) $\frac{14\,h}{45}\Delta^4 y_0$ (d) None of the above

3. In solving equation $u_t = \alpha^2\, u_{xx}$ by crank- Nicholson method, to simplify method we take $\frac{(\Delta x)^2}{\alpha^2 k}$ as CO3- R

   (a) $\frac{1}{2}$ (b) 2 (c) 1 (d) 0

4. The PDE $xf_{xx} + y\, f_{yy} = 0$ is elliptic when CO4 -R

   (a) x > 0 and y < 0 (b) x < 0 and y < 0

   (c) x < 0 and y > 0 (d) None of the above

5. R(x) is orthogonal then CO5- R

   (a) $\int_0^1$ R(x) F_i(x)dx = 0 (b) $\int_{-1}^1$ R(x) F_i(x)dx = 0 (c) $\int_0^1$ R(x) dx = 0 (d) $\int_0^1$ F_i(x)dx = 0

PART – B (5 x 3= 15 Marks)

6. Solve the system of equations by Gauss elimination method CO1-U

$11x + 3y = 17$, $2x + 7y = 16$.

7. Write down Adam Bashforth's predictor formulae. CO2-U

8. Give an example of parabolic equation. CO3-U

9. Write down the finite difference form of the equation $\nabla^2 u = f(x, y)$ CO4-U

10. Define orthogonal collocation in Galerkin method? CO5-U

PART – C (5 x 16= 80Marks)

11. (a) (i) Solve the equations using Thomas algorithm CO1- App (8)

$3x + y = 9$
$x + 2y + 3z = 14$
$y - z = 1$

(ii) Solve by Gauss elimination method, the equations CO1- App (8)

$2x + 3y - z = 5$
$4x + 4y - 3z = 3$
$-2x + 3y - z = 1$

Or

(b) Using power method find the largest Eigen value and corresponding Eigen vector, find the matrix. CO1- App (16)

$$\begin{pmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$$

12. (a) Find y (0.2) by Runge kutta method of fourth order if CO2- App (16)

$y'' - x\,y' = 0$,
$y(0) = 1$,
$y'(0) = 0$

Or

(b) (i) Solve the equation CO2- App (8)

$y''(x) - xy(x) = 0$ for $y(x_i)$, $x_i = 0, 1/3, 2/3$, given that
$y(0) + y'(0) = 1$ and $y(1) = 1$.

(ii) Using Adam's Bash forth method find y (4.4) given CO2- App (8)

$5xy' + y^2 = 2$, $y(4) = 1$, $y(4.1) = 1.0049$,
$y(4.2) = 1.0097$ and $y(4.3) = 1.0143$.

13. (a) (i) Solve by Crank-Nicholson method , CO3-App (8)

$u_t = \frac{1}{16} u_{xx}$ *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*.

(ii) Explain implicit method CO3-U (8)

Or

(b) (i) Discuss ADI method to solve the two dimensional parabolic equations. CO3-U (8)

(ii) Discuss the stability of two dimensional heat equation $u_t = \alpha (u_{xx} + u_{yy})$. CO3-U (8)

14. (a) Solve the Poisson's equation CO4 -App (16)

$u_{xx} + u_{yy} = -81xy$, $0 < x < 1, 0 < y < 1$ given that

u(0,y) = 0, u(x,0) = 0, u(1,y) = 100, u(x,1) =100 and h = 1/3.

Or

(b) Solve $u_{xx} + u_{yy} = 0$, $0 \le x, y \le 1$, with $u(0, y) = 10 = u(1, y)$ and $u(x, 0) = 20 = u(x, 1)$. Take h = 0.25 and apply Liebmann's method to 3 decimal accuracy**.** CO4 -App (16)

15. (a) Solve the boundary value problem CO5-App (16)

$u_{xx} + u_{yy} = -1$, $|x| \le 1$, $|y| \le 1$ and u=0 on $|x| = 1$, $|y| = 1$.

Use the Galerkin finite element method to determine the solution values at the nodes $(0,0)$, $\left(\frac{1}{2},0\right)$ and $\left(\frac{1}{2},\frac{1}{2}\right)$.

(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 $(1,1)$. CO5-App (16)

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