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

Question Paper Code: 51Z24

M.E. DEGREE EXAMINATION, NOV 2018

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. " As soon as a new value for a variable is formed by iteration, it is used immediately in the following equations." CO1- R

   (a) Gauss – Seidel method (b) Thomas algorithm

   (c) Gauss – Jacobi method (d) Gauss elimination method

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. When explicit method is stable only if? CO3- R

   (a) $\lambda > 1$ (b) $\lambda > 1/2$ (c) $\lambda < 1/2$ (d) $\lambda < 1$

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. Write down formula for the Faddeev – Leverrier method? CO1-U

7. Write down the Runge-Kutta formula of fourth order. CO2-U

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

9. Write down the five point finite difference scheme to solve Laplace equations. CO4-U

10. Write formula for Galerkin Finite element method. CO5-U

PART – C (5 x 16= 80Marks)

11. (a) (i) Evaluate $\sqrt{12}$ to four decimal places by Newton's – Raphson method. CO1- App (8)

(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) (i) Solve the system of equations using pivot techniques CO1- App (8)

$x+y+z = 7$
$3x+3y+4z = 24$
$2x+y+3z = 16$

(ii) Using Gauss-Seidel iterative method, solve the following system of equations: CO1- App (8)

$8x-3y+2z = 30$; $4x+11y-z = 33$; $6x+3y+12z = 35$.

12. (a) Find y (0.2) by Runge kutta method of fourth order if $y'' – x\,y' = 0$, $y(0) = 1$, $y'(0) = 0$ CO2- App (16)

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)

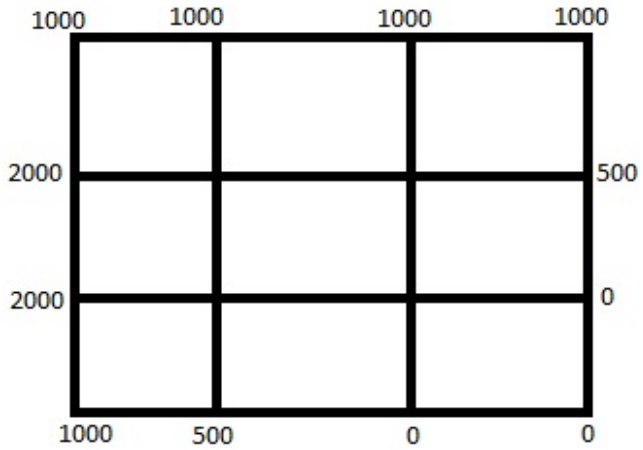
Or

(b) (i) Discuss the stability of two dimensional heat equation CO3-U (8)

$u_t = \alpha (u_{xx} + u_{yy})$.

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

14. (a) Obtain a finite difference scheme to solve the Laplace equation. Solve $\nabla^2 u = 0$ at the pivotal points in the square shown fitted with square mesh. Use Leibmamm's iteration procedure. (5 iteration only) CO4 -App (16)



Or

(b) 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.

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 CO5-App (16)

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