A **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 54022

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2021

Fourth Semester

Civil Engineering

15UMA422 - NUMERICAL METHODS

(Common to EEE, EIE and Chemical Engineering)

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. What is the order of convergence of Newton-Raphson method CO1-R

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

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

   (a) -4 (b) 3 (c) 1 (d) 0

3. Newton's forward interpolation formula used only for _____ intervals CO2-R

   (a) unequal (b) equal (c) both (d) None

4. The parabola which passes through the points (0, 0), (1, 1), and (2, 20) CO2-R

   (a) $8x^2$-$9x$ (b) $9x^2$-$8x$ (c) $3x^2$-$2x$ (d) $2x^2$-$3x$

5. What is the restriction on the number of intervals for Simpson's 1/3 rule? CO3-R

   (a) Odd number (b) Even number (c) multiple of 3 (d) any

6. Gaussian three point formula is exact for polynomials upto degree CO3-R

   (a) 1 (b) 3 (c) 5 (d) 6

7. From the following which one is single step method CO4-R

   (a) Milne's (b) Taylor (c) Adam Bashforth (d) None

8. How many prior values are required to predict the next value in Adam's method CO4-R

   (a) 2 (b) 3 (c) 4 (d) 5

9. A partial differential equation is classified as a Parabolic if B^2-4AC CO5-R

(a) < 0 (b) = 0 (c) > 0 (d) None

10. What type of equations can be solved by Crank-Nickolson's difference formula. CO5-R

(a) Parabolic (b) Elliptic (c) Hyperbolic (d) None

PART – B (5 x 2= 10Marks)

11. Find the iterative formula to find $\sqrt{N}$ where N is a positive number. CO1-R

12. Form the Newton's divided difference table for the following data CO2-R

x	5	15	22
y	7	36	160

13. Apply two point formula to evaluate $\int_{-1}^{1} \frac{dx}{1+x^2}$. CO3-R

14. Using Euler's method compute y for $x = 0.2$ from $y' = y - \frac{2x}{y}$, $y(0)=1$. CO4-R

15. Write the difference scheme for solving the Laplace equation. CO5-R

PART – C (5 x 16= 80Marks)

16. (a) (i) By Newton- Raphson method find a non zero root of $x^2 + 4\sin x = 0$. CO1-Ana (8)

(ii) Solve the system of equations by Gauss elimination method CO1-Ana (8)

$x + 2y + z = 3;\quad 2x + 3y + 3z = 10;\quad 3x - y + 2z = 13$

Or

(b) (i) Using Gauss-Seidel method, solve the following system. CO1-App (8)

$x + 3y + 52z = 173.61;\ x - 27y + 2z = 71.31;\ 41x - 2y + 3z = 65.46$

Start with $x = 1, y = -2, z = 3$.

(ii) Determine the largest eigen value and the corresponding eigen vector of the Matrix $\begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$ by power method CO1-Ana (8)

17. (a) (i) Using Newtons divided difference formula find u (3) given u (1) = - 26, u (2) = 12, u (4) = 256 and u (6) = 844. CO2-App (8)

(ii) From the following table find the value of $tan45°15$ by Newton's forward Interpolation formula. CO2-Ana (8)

$x°$	45	46	47	48	49	50
tan $x°$	1	1.03553	1.07237	1.11061	1.15037	1.19175

Or

(b) Obtain the cubic Spline approximation for the function $y = f(x)$ from the following data given that $y_0'' = y_3'' = 0$. CO2-U (16)

x	-1	0	1	2
y	-1	1	3	35

18. (a) (i) Compute $f'(0) and f''(4)$ from the data. CO3-Ana (8)

x	0	1	2	3	4
y	1	2.718	7.381	20.086	54.598

(ii) Find $\int_{1.6}^{2.8} f(x)\,dx$ by Simpsons $(1/3)^{rd}$ rule from the following table. CO3-App (8)

x	1.6	1.8	2.0	2.2	2.4	2.6	2.8
f(x)	4.95	6.05	7.39	9.02	11.02	13.46	16.44

Or

(b) (i) Evaluate $\int_0^2 \frac{x^2 + 2x + 1}{1 + (x+1)^4} dx$ by Gaussian three point formula CO3-Ana (8)

(ii) Evaluate $\int_0^1 \int_0^1 e^{x+y}\,dxdy$ using trapezoidal rule and Simpson's rule. CO3-U (8)

19. (a) (i) Find by Taylor's series method, the values of y at x = 0.1 and x = 0.2 to four decimal places from $\frac{dy}{dx} = x^2 y - 1, y(0) = 1$ CO4-U (8)

(ii) Using Modified Euler's methods find CO4-App (8)

$y(0.2)$ *if* $\frac{dy}{dx} = y - x^2 + 1, y(0) = 0.5$

Or

(b) Apply Runge-Kutta method of fourth order to find approximate values of y for $x = 0.2$, 0.4 and 0.6 if $\frac{dy}{dx} = x^3 + y, y(0) = 2$. Hence find y (0.8) by Milne's predictor- corrector method. CO4-Ana (16)

20. (a) Solve CO5-App (16)

$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$, subject to

(i) u(0,y) = 0, $0 \le y \le 4$

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

(iii) u(x,0) = 3x, $0 \le x \le 4$

(iv) $u(x,4) = x^2$, $0 \le x \le 4$ by dividing the square into 16 square meshes of side 1.

Or

(b) Solve the Poisson equation $\nabla^2 u = -10(x^2 + y^2 + 10)$, $0 \le x \le 3; 0 \le y \le 3; u = 0$ on the boundary. CO5-U (16)