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

Question Paper Code:U4M23

B.E./B.Tech. DEGREE EXAMINATION, APRIL 2025

Fourth Semester

Civil Engineering

21UMA423 - NUMERICAL METHODS

(Regulations 2021)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Order of convergence of Newton's method is ________ CO1-U

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

2. When Gauss Elimination method is used to solve AX=B, A is transferred in a _______ matrix CO1- U

   (a) lower triangular (b) upper triangular (c) square (d) zero

3. In Cubic Spline, $M_0=M_n=$ ________ CO2- U

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

4. In Cubic Spline, $M_0=M_n=$ ________ CO2- U

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

5. Trapezoidal rule is so called, because it approximates the integral by the sum of _______trapezoids CO3- U

   (a) n (b)n+1 (c)n-1 (d) 2n

6. Gaussian three point quadrature formula is exact for polynomials upto degree _______ CO3- U

   (a) 1 (b)2 (c)3 (d) 5

7. Predictor-Corrector methods are ________ starting methods CO4- U

   (a) self (b)not self (c)identity (d) None of these

8. _____ prior values are required to predict the next value in Milne's method CO4- U

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

9. PDE of second order, if B^2-4AC= 0 then CO6- U

(a) parabolic (b)elliptic (c)hyperbolic (d) None of these

10. $u_{xx}+u_{yy}=0$ is a _________ equation CO5- U

(a) Laplace (b)Poisson (c)heat (d) wave

PART – B (5 x 2= 10Marks)

11. Compare Gauss Elimination and Gauss Jordan Methods CO1- U

12. Form the divided difference table for the following data CO2- App

x	2	5	10
y	5	29	109

13. Using two –point Gaussian quadrature formula find $\int_{-1}^{1} \frac{1}{1+x^2} dx$ CO3- App

14. Using Euler's method find y(0.1) given $\frac{dy}{dx}$ =1+ y^2, y(0) =0 CO4- App

15. Classify $u_{xx} - 2u_{xy} + u_{yy} = 0$ CO6- U

PART – C (5 x 16= 80Marks)

16. (a) (i) Solve the equation e^x -3x = 0 by iteration method CO1-App (8)

(ii) Solve x + 2y +z = 8, 2x + 3y +4z = 20, 4x + y + 2z =12 using Gauss Elimination method CO1-App (8)

Or

(b) (i) Using Power method find numerically largest Eigen value and the corresponding Eigen vector of the matrix $\begin{pmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$ CO1 -App (8)

(ii) Solve 27x + 6y – z = 85, 6x + 15y +2z = 72, x + y + 54z =110 using Gauss Seidel method CO1-App (8)

17. (a) Using Lagrange's interpolation formula calculate f(10) for the following data CO2-App (8)

X	5	6	9	11
Y	12	13	14	16

(ii) Using Newton's divided difference formula calculate f(3) satisfying the following data: CO2- App (8)

x	0	1	2	5
y	2	3	12	147

Or

(b) (i) Using Newton's forward interpolation formula calculate f(5) for the following data CO2- App (8)

X	4	6	8	10
Y	1	3	8	10

(ii) Using Cubic Spline calculate f(1.5) for the following data CO2- App (8)

x	1	2	3
f(x)	-8	-1	18

18. (a) (i) Compute the first and second derivatives of y at x = 1 from CO3- App (8)

x	1	2	3	4
y	1	8	27	64

(ii) Evaluate $\int_0^6 \frac{1}{1+x^2}dx$ with 6 equal intervals by CO3- App (8)

(a) Trapezoidal rule

(b) Simpson's $\frac{1}{3}$ rule.

Or

(b) (i) Evaluate $\int_0^1 \frac{1}{1+x^2}dx$ using Romberg's method correct to 4 decimal places. CO3- App (8)

(ii) Evaluate $\int_0^1\int_0^1 e^{(x+y)}dxdy$ using Trapezoidal rule by taking CO3- App (8) h=k=0.5

19.	(a)	(i) Using Taylor's series method find $y(1.1)$ given $y' = x + y$ with $y(1) = 0$	CO4- App	(8)
		(ii) Given $\frac{dy}{dx} = x^3 + y$, $y(0) = 2$, $y(0.2) = 2.443$, $y(0.4) = 2.99$, $y(0.6) = 3.68$. Find $y(0.8)$ by Milne's Predictor & Corrector method.	CO4- App	(8)
		Or		
	(b)	(i) Using R.K Method of 4th order, solve $\frac{dy}{dx} = y - x^2$ with $y(0) = 1$ at $x = 0.2$	CO4- App	(8)
		(ii) Using Adam's Bash forth Predictor-Corrector method, find y(4.4) given that $5xy' + y^2 = 2$, $y(4) = 1$, $y(4.1) = 1.0049$, $y(4.2) = 1.0097$ and $y(4.3) = 1.0143$	CO4- App	(8)
20.	(a)	(i) Solve $\frac{\partial^2 u}{\partial x^2} = 2\frac{\partial u}{\partial t}$, u(0,t) = 0 , u(4,t) = 0 , u(x,0) = x(4 - x) . Take h = 1 and find the values of u up to t = 5 using Bender-Schmidt's difference equation	CO5- App	(8)
		(ii) Using Crank-Nicholson's difference equation to solve $\frac{\partial^2 u}{\partial x^2} = 16\frac{\partial u}{\partial t}$ u(0,t) = 0 , u(1,t) = 100t , u(x,0) = 0 compute u for one time step function with h=0.25	CO5- App	(8)
		Or		
	(b)	Solve $\nabla^2 \mathbf{u} = -10(\mathbf{x}^2 + \mathbf{y}^2 + 10)$ over the square mesh with sides $\mathbf{x} = 0, \mathbf{x} = 3, \mathbf{y} = 0, \mathbf{y} = 3$ with u=0 on the boundary and mesh length 1 unit.	CO5- App	(16)