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

Question Paper Code:U4M23

B.E./B.Tech. DEGREE EXAMINATION, NOV 2024

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 iteration method is — CO1-U

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

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 Newton's forward formula, u=. — CO2- U

   (a) $\frac{x-x_0}{h}$ (b) $\frac{x-x_1}{h}$ (c) $\frac{x-x_2}{h}$ (d) $\frac{x-x_n}{h}$

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

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

5. Truncation error in Trapezoidal rule is of the order ___. — CO3- U

   (a) h^3 (b)h^2 (c)h^4 (d) 0

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

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

7. In Euler's method, if h is small, the method is too _______ — CO4- U

   (a) fast (b)slow (c)average (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. Crank Nicholson's difference equation is _________ method — CO5- U

(a) Explicit (b) Implicit (c) single step (d) multi step

PART – B (5 x 2= 10Marks)

11. State the principle used in Gauss Jordan Method — 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 $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ — CO6- U

PART – C (5 x 16= 80Marks)

16. (a) (i) Solve for a positive root of 3x – cos x - 1 =0 using Newton's Raphson method correct to 6 decimal places. — CO1-App (8)

(ii) Solve x + 3y +3z = 16, x + 4y +3z = 18, x + 3y + 4z =19 using Gauss Jordan method — CO1-App (8)

Or

(b) (i) Using Power method find numerically largest Eigen value and the corresponding Eigen vector of the matrix $\begin{pmatrix} 9 & 1 & 8 \\ 7 & 4 & 1 \\ 1 & 7 & 9 \end{pmatrix}$ — CO1 -App (8)

(ii) Solve 20x+y-2z = 17: 3x+20y-z = -18 ; 2x-3y+20z = 25 using Gauss Seidal method . — CO1-App (8)

17. (a) (i) Using Lagrange's interpolation formula calculate f(3) for the following data CO2-App (8)

X	0	1	2	5
Y	2	3	12	147

(ii) Using Newton's divided difference formula calculate f(8) for the data CO2- App (8)

X	4	5	7	10	11	13
Y	48	100	294	900	1210	2028

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 h=k=0.5 CO3- App (8)

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 $\frac{\partial^2 u}{\partial x^2} = 32\frac{\partial u}{\partial t}$, u(0,t) = 0 , u(1,t) = t , u(x,0) = 0 . Take h = 0.25 and find the values of u up to t = 1 using Bender-Schmidt's difference equation CO5- App (8)

(ii) Using Crank-Nicholson's difference equation to solve CO5- App (8)

$$\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$$

u(0,t) = 0 , u(1,t) = t , u(x,0) = 0. compute u for one time step function with h=0.25 .

Or

(b) Solve the Poisson equation $u_{xx} + u_{yy} = -81xy$, 0<x<1, 0<y<1 , u(0,y)=0, u(x,0) = 0, u(1,y)=100, u(x,1)=100 and h=1/3 CO5- App (16)