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

Question Paper Code: 94021

B.E./B.Tech. DEGREE EXAMINATION, NOV 2023

Fourth Semester

Civil Engineering

19UMA423 - Numerical Methods

(Common to Chemical Engineering)

(Regulations 2019)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Iteration method converges if $|g^1(x)|$ ___________ CO1-U

   (a) >1 (b) <1 (c) =0 (d) >0

2. Newton's method is also called method of _________ CO1-U

   (a) tangents (b) slope (c) secants (d) false

3. Lagrange's interpolation formula can be used for ____ interval CO2-U

   (a) equal (b)unequal (c)equal and unequal (d) none of these

4. In Newton's forward formula, n=. CO2-U

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

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

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

6. The Simpson's one third rule is approximated by ______ CO3- U

   (a) parabola (b)trapezoid (c)hyperbola (d) elliptic

7. Taylor Series method will be very useful to give some _____ values for RK, Milne's and Adam's methods CO4-U

   (a) initial (b)final (c)intermediate (d) two

8. In Euler's method, if h is large then it gives _______value CO4-U

(a) accurate (b) inaccurate (c) average (d) None of these

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

(a) parabolic (b) elliptic (c) hyperbolic (d) Non homogeneous

10. The equation $u_{xx}+u_{yy=0}$ CO5-App

(a) elliptic (b) parabolic (c) hyperbolic (d) Non homogeneous

PART – B (5 x 2= 10Marks)

11. State the principle used in Gauss Elimination Method CO1-U

12. State Newtons divided difference formula CO2-U

13. Evaluate $\int_1^2 \frac{dx}{1+x^2}$ with 2 equal intervals using trapezoidal rule CO3-App

14. Using Taylor's series method find $y(0.1)$ given $y' = 1 + y$ with $y(0) = 1$ CO4-App

15. Classify $u_{xx} - 2u_{xy} + u_{yy} = 0$ 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 $\begin{pmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{pmatrix}$ 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 find 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 find 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 find f(5) for the following data CO2 -App (8)

X	4	6	8	10
Y	1	3	8	10

(ii) Given the following table, find f(1.5) using cubic spline function 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. $\int_{-2}^{2} e^{\frac{-x}{2}}$ using two point Gaussian quadrature formula CO3-App (8)

(ii) Evaluate $\int_1^{1.4}\int_2^{2.4} \frac{1}{xy}dxdy$ using Trapezoidal Rule with h = 0. 1 & k = 0. 1 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 $\frac{dy}{dx} = 1 + y^2$, y(0) =0 , y(0.2) = 0.2027 , y(0.4) =0.4228, y(0.6) = 0.6841 evaluate y(0.8) by Adams – Bash forth Method.	CO4-App	(8)
		Or		
	(b)	(i) Using R-K method of fourth order, solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$ at $x = 0.2$	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)
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 $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$ u(0,t) = 0 , u(1,t) = t , u(x,0) = 0. compute u for one time step function with h=0.25 .	CO5-App	(8)
		Or		
	(b)	Solve $\nabla^2 \mathbf{u} = -10(\mathbf{x}^2 + \mathbf{y}^2 + 10)$ over the square mesh with sides $\mathbf{x = 0, x = 3, y = 0, y = 3}$ with u=0 on the boundary and mesh length 1 unit.	CO5- App	(16)