b. Using Newton's forward interpolation, find the value of y at $x=43$. 12 3 2 2

x	40	50	60	70	80	90
y	184	204	226	250	276	304

30. a. Find the first, second and third derivatives of the function tabulated below at the point $x=1.5$ 12 4 3 2

x	1.5	2	2.5	3	3.5	4
y	3.375	7.0	13.625	24.0	38.875	59.0

(OR)

b. The velocity V of a particle at distances from a point on its path is given by the table. 12 6 3 2

S (feet)	0	10	20	30	40	50	60
V (feet/sec)	47	58	64	65	61	52	38

Estimate the time taken to travel 60 feet by using Simpson's $1/3^{rd}$ rule. Compare the result with Simpson's $3/8^{th}$ rule.

31. a. Given $\frac{dy}{dx}=x^2y-1$ *and* $y(0)=1$ find the value of *y(0.1)* using Taylor series method. 12 4 4 2

(OR)

b. Given $y''+xy'+y=0, y(0)=1, y'(0)=0$ find the value of *y(0.1)* by using Runge-Kutta method of fourth order where h=0.1. 12 4 4 2

32. a. Solve the equation $\frac{\partial u}{\partial t}=\frac{1}{2}\frac{\partial^2 u}{\partial x^2}, 0\le x\le 12, 0\le t\le 12$ with boundary and initial conditions. 12 3 5 2

$u(x,0)=\frac{1}{4}x(15-x), 0\le x\le 12$

$u(0,t)=0, u(12,t)=9, 0\le t\le 12$

Using Schmidt relation.

(OR)

b. Solve by Crank Nicholson's method 12 3 5 2

$\frac{\partial u}{\partial t}=\frac{1}{16}\frac{\partial^2 u}{\partial x^2}, 0<x<1, t>0, u(x,0)=0, u(0,t)=0, u(1,t)=100t$

Compute u for one step with h=1/4.

* * * * *

Reg. No.														

B.Tech. DEGREE EXAMINATION, MAY 2023

Fourth Semester

18MAB206T – NUMERICAL METHODS AND ANALYSIS

(For the candidates admitted from the academic year 2018-2019 to 2021-2022)

Note:

(i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.

(ii) **Part - B & Part - C** should be answered in answer booklet.

Time: 3 hours Max. Marks: 100

PART – A (20 × 1 = 20 Marks)

Answer **ALL** Questions

	Marks	BL	CO	PO
1. Newton – Raphson method is also known as the method of (A) Tangents (B) Chords (C) Diameter (D) Trapezoid	1	1	1	1
2. The condition of convergence for iterative methods of solving a system of simultaneous linear equations is stated that the coefficient matrix should be (A) Upper triangular (B) Diagonally dominant (C) Conditionally convergent (D) Lower triangular	1	1	1	1
3. The convergence in the Gauss-Seidel method is roughly _____as faster as in Jacobi method. (A) 3 times (B) 6 times (C) 4 times (D) 2 times	1	1	1	1
4. To find the inverse of matrix A, we use (A) Gauss – elimination method (B) Gauss – Seidel method (C) Gauss – Jacobi method (D) Newton – Raphson method	1	1	1	1
5. The forward difference operator Δ is defined by (A) $\Delta y_x = y_{x+1}$ (B) $\Delta y_x = y_{x+1} - y_{2x-1}$ (C) $\Delta y_x = y_{x+1} - y_x$ (D) $\Delta y_x = 2y_{x+1}$	1	1	2	1
6. The first divided difference of f(x) for the arguments x_0 and x_1 is defined as (A) $f(x_0,x_1)=\frac{x_1-x_0}{f(x_1)}$ (B) $f(x_0,x_1)=x_1-f(x_0)-x_2$ (C) $f(x_0,x_1)=\frac{f(x_1)-f(x_0)}{x_1-x_0}$ (D) $f(x_0,x_1)=\frac{f(x_1)-f'(x_0)}{x_1-x_0}$	1	1	2	1
7. The differences $\Delta y_0, \Delta^2 y_0, \Delta^3 y_0 \ldots$ are called the _____differences. (A) Leading (B) Diagonal (C) Numerical (D) Differential	1	1	2	1

8. Lagrange's interpolation formula is used for _____intervals. 1 1 2 1
   (A) Equal (B) Unequal
   (C) Both equal and unequal (D) Neither equal nor unequal

9. Close approximation in Simpson's one-third rule is obtained when h is 1 1 3 1
   (A) Small (B) Large
   (C) Infinity (D) Greater

10. Trapezoidal rule approximates the integral by sum of n 1 1 3 1
   (A) Rhombus (B) Circle
   (C) Triangle (D) Trapezoids

11. Simpson's one-third rule is also called 1 1 3 1
   (A) Hyperbolic rule (B) Elliptic rule
   (C) Parabolic rule (D) Trapezoid rule

12. Simpson's three-eight rule can be applied only when n is 1 1 3 1
   (A) Odd (B) Even
   (C) Prime (D) Multiple of 3

13. Taylor's series method is 1 1 4 1
   (A) Single step method (B) Multi step method
   (C) Iterative method (D) Error method

14. The improved Euler method is based on the average of 1 1 4 1
   (A) Points (B) Slopes
   (C) Curves (D) Errors

15. Consider the function $y=f(x)$ such that $f(1)=5$ and $f(3)=11$. The estimated value of $\int_1^3 f(x)dx$ with h=2 using Trapezoidal rule is 1 2 3 1
   (A) 4 (B) 8
   (C) 12 (D) 16

16. Which of the following is a method for finding a numerical integration? 1 1 3 2
   (A) Euler's method (B) Tangent method
   (C) Simpson's one-third rule (D) Jacobi method

17. If $B^2-4AC<0$, then the second order PDE is known as 1 1 5 1
   (A) Elliptic (B) Parabolic
   (C) Hyperbolic (D) Wave equation

18. The equation $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=f(x,y)$ is known as 1 1 5 1
   (A) Elliptic (B) Laplace equation
   (C) Poisson equation (D) Wave equation

19. The error in the diagonal formula is _____times the error in the standard formula. 1 1 5 1
   (A) One (B) Two
   (C) Three (D) Four

20. The nature of the partial differential equation $f_{xy}-f_x=0$ is 1 1 5 1
   (A) Elliptic (B) Parabolic
   (C) Hyperbolic (D) Laplace equation

PART – B (5 × 4 = 20 Marks)

Answer **ANY FIVE** Questions

	Marks	BL	CO	PO

21. Evaluate $\sqrt{12}$ to four decimal places by Newton's-Raphson's method. 4 6 1 2

22. Solve the system of equations by Gauss elimination method: 4 3 1 2
   $x+2y+z=3, 2x+3y+3z=10, 3x-y+2z=13$.

23. Express x^3+x^2+x+1 in factorial polynomial and get their successive forward differences taking h=1. 4 2 2 2

24. Find the missing term in the following table. 4 4 2 2

x	1	2	3	4	5	6	7
y	2	4	8	-	32	64	128

25. Evaluate the integral $I=\int_4^{5.2} \log_e^x\, dx$ using Trapezoidal rule. 4 6 3 2

26. Compute y at $x=0.25$ by Modified-Euler method given $y'=2xy, y(0)=1$. 4 3 4 2

27. Classify the following partial differential equation 4 4 5 2
   (i) $xf_{xx}+yf_{yy}=0, x>0, y>0$
   (ii) $f_{xx}-2f_{xy}=0, x>0, y>0$

PART – C (5 × 12 = 60 Marks)

Answer **ALL** Questions

	Marks	BL	CO	PO

28. a. Solve the following system of equations by using Gauss-Jacobi method correct to 3 decimal places 12 3 1 2
   $8x-3y+2z=20$
   $4x+11y-z=33$
   $6x+3y+12z=35$

   (OR)

   b. Solve by Gauss Seidel method the following system 12 3 1 2
   $28x+4y-z=32$
   $x+3y+10z=24$
   $2x+17y+4z=35$

29. a. Using Lagrange's formula, fit a polynomial to the data. Also find y at $x=2$. 12 3 2 2

x	0	1	3	4
y	–12	0	6	12

   (OR)