23. a. Find the values of $f'(4)$ *and* $f''(4)$ from the following data. | 8 | 3 | 3 | 2 |

x:	0	1	2	3
y:	1	2	9	28

(OR)

b. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Trapezoidal rule with h=0.2. Hence find the value of π. Can you use Simpson's formula in this case? | 8 | 3 | 3 | 3 |

24. a. Use Taylor's series method to find y(1.1) correct to 4 decimal places given $y' = xy^{1/3}$ *and* $y(1) = 1$. | 8 | 3 | 4 | 2 |

(OR)

b. Solve $y' = x^2 + y^2;\ y(0) = 1$ by modified Euler's method and find $y(0.2)$. | 8 | 3 | 4 | 2 |

25. a. Solve $u_{xx} = 2u_t,\ u(0,t) = 0,\ u(4,t) = 0$ *and* $u(x,0) = x(4-x)$ choosing $h=k=1$ and using Bender Schmidt formula, find values upto $t=5$. | 8 | 4 | 5 | 2 |

(OR)

b. Solve by Crank Nicholson method, $16u_t = u_{xx};\ 0 < x < 1,\ t > 0$ given that $u(x,0) = 0, u(0,t) = 0, u(1,t) = 100t$. | 8 | 4 | 5 | 2 |

PART – C (1 × 15 = 15 Marks)

Answer **ANY ONE** Question

	Marks	BL	CO	PO

26. Given $y'' + xy' + y = 0; y(0) = 1\ y'(0) = 0$ find the value of $y(0.1)$ by R.K method of fourth order. | 15 | 4 | 4 | 3 |

27. If $f(0) = 0, f(1) = 0, f(2) = -12, f(4) = 0, f(5) = 600, f(7) = 7308$, find a polynomial that satisfies this data using Newton's divided difference formula, hence find $f(6)$. | 15 | 4 | 3 | 3 |

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Reg. No.														

B.Tech. / M.Tech (Integrated) DEGREE EXAMINATION, MAY 2023

Third Semester

21MAB206T – NUMERICAL METHODS AND ANALYSIS

(For the candidates admitted from the academic year 2021 - 2022 & 2022 - 2023)

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** and **Part - C** should be answered in answer booklet.

Time: 3 Hours Max. Marks: 75

PART – A (20 × 1 = 20Marks)

Answer **ALL** Questions

	Marks	BL	CO	PO

1. The negative root of the equation $e^x = 2 + x$ lies between | 1 | 1 | 1 | 1 |

(A) –1.6 and –1.7 (B) –1.7 and –1.8

(C) –1.8 and –1.9 (D) –1.9 and –2.0

2. The iteration formula for finding the reciprocal of N by N-R method is | 1 | 1 | 1 | 1 |

(A) $x_{n+1} = x_n(2 - Nx_n)$ (B) $x_{n+1} = x_n(1 - Nx_n)$

(C) $x_{n+1} = x_n(1 + Nx_n)$ (D) $x_{n+1} = x_n(2 + Nx_n)$

3. If the nth differences of a tabulated function are constants, then the function is a polynomial of degree | 1 | 1 | 1 | 1 |

(A) 1 (B) 2

(C) n–1 (D) n

4. $\Delta \log f(x) =$ | 1 | 1 | 1 | 2 |

(A) $\log f(x) - \log f(x+h)$ (B) $\log f(x+h) + \log f(x)$

(C) $\log f(x) + \log f(x-h)$ (D) $\log f(x+h) - \log f(x)$

5. What is $\Delta^2 f(x)$, *if* $f(x) = x^2 - 3x + 1$ taking $h=1$ | 1 | 2 | 2 | 1 |

(A) $2x+1$ (B) $2x$

(C) 2 (D) 0

6. The first divided difference of f(x) for the arguments x_0, x_1 is defined as | 1 | 2 | 2 | 2 |

(A) $\frac{f(x_1) - f(x_0)}{x_1 - x_0}$ (B) $\frac{f(x_1) - f(x_0)}{x_0 - x_1}$

(C) $\frac{f(x_1) - f(x_0)}{x_0 + x_1}$ (D) $\frac{f(x_0) - f(x_1)}{x_0 - x_1}$

7. The relation between E and μ is | 1 | 2 | 2 | 1 |

(A) $\mu = E^{1/2} + E^{-1/2}$ (B) $\mu = E^{-1/2} - E^{1/2}$

(C) $\mu = \frac{1}{2}\left[E^{1/2} + E^{-1/2}\right]$ (D) $\mu = \frac{1}{2}\left[E^{-1/2} - E^{1/2}\right]$

8. The central difference operator δ is given by 1 1 2 1

(A) $\delta f(x)=f\left(x+\frac{h}{2}\right)+f\left(x-\frac{h}{2}\right)$ (B) $\delta f(x)=f(x)-f\left(x+\frac{h}{2}\right)$

(C) $\delta f(x)=f(x)+f\left(x-\frac{h}{2}\right)$ (D) $\delta f(x)=f\left(x+\frac{h}{2}\right)-f\left(x-\frac{h}{2}\right)$

9. The error in the trapezoidal rule is of order 1 1 3 2

(A) $\frac{h^2}{12}$ (B) $\frac{h^3}{6}$

(C) $\frac{3h^2}{8}$ (D) h^2

10. Numerical differentiation is the process of computing the value of 1 1 3 1

(A) Δy_0 (B) ∇y_0

(C) $\frac{\Delta y}{\Delta x}$ (D) $\frac{dy}{dx}$

11. Simpson's 1/3 rule is also called 1 1 3 1

(A) Parabolic rule (B) Hyperbolic rule

(C) Elliptic rule (D) Trapezoidal rule

12. 1 1 3 2

Simpson's 1/3 rule is $\int_{x_0}^{x_n} f(x)dx =$

(A) $\frac{h}{3}\left[(y_0+y_n)+2(y_2+y_4+...)+4(y_1+y_3+...)\right]$

(B) $\frac{h}{2}\left[(y_0+y_n)+2(y_1+y_2+...)\right]$

(C) $\frac{3h}{8}\left[(y_0+y_n)+2(y_2+y_4+...)+4(y_1+y_3+...)\right]$

(D) $\frac{h}{3}\left[(y_0+y_n)+2(y_1+y_3+...)+4(y_2+y_4+...)\right]$

13. Which of the following method is better method? 1 2 4 1

(A) Taylor's series method (B) Euler's method

(C) R-K method (D) Modified Euler's method

14. How many prior values required to predict the next value in Adam's predictor corrector method? 1 1 4 1

(A) 2 (B) 1

(C) 3 (D) 4

15. Improved Euler's algorithm to find solution of a first order differential equation for n=0,1,2,…. 1 1 4 1

(A) $y_{n+1}=y_n+h\left[f\left(x_n+\frac{h}{2},y_n\right)+\frac{h}{2}f(x_n,y_n)\right]$

(B) $y_{n+1}=y_n+hf(x_n,y_n)$

(C) $y_{n+1}=y_n+\frac{h}{2}\left[f(x_n,y_n)+f(x_n+h,y_n)+hf(x_n,y_n)\right]$

(D) $y_{n+1}=y_n+\left[f\left(x_n+\frac{h}{2},y_n+\frac{h}{2}f(x_n,y_n)\right)\right]$

16. Adam's corrector formula is 1 1 4 1

(A) $y_{n+1}=y_n+\frac{h}{24}\left[55y'_n-58y'_{n-1}+37y'_{n-2}-9y'_{n-3}\right]$

(B) $y_{n+1}=y_n+\frac{h}{24}\left[55y'_n+59y'_{n-1}-37y'_{n-2}+9y'_{n-3}\right]$

(C) $y_{n+1}=y_n+\frac{h}{24}\left[9y'_{n+1}+19y'_n-5y'_{n-1}+y'_{n-2}\right]$

(D) $y_{n+1}=y_n+\frac{h}{24}\left[9y'_{n+1}-19y'_n+5y'_{n-1}+y'_{n-2}\right]$

17. If $B^2-4AC=0$ then second order PDE is known as 1 1 5 1

(A) Elliptic (B) Parabolic

(C) Hyperbolic (D) Laplace equation

18. $\nabla^2 u=0$ is called 1 1 5 1

(A) Elliptic (B) Parabolic

(C) Hyperbolic (D) Laplace equation

19. Bender Schmidt recurrence equation is valid only if 1 1 5 1

(A) $k=\frac{h^2}{2}$ (B) $k=\frac{ah^2}{2}$

(C) $k=\frac{2}{ah^2}$ (D) $k=\frac{2}{h^2}$

20. The error in the diagonal five point formula is _____ times the error in standard five point formula. 1 1 5 1

(A) 1 (B) 2

(C) 3 (D) 4

PART – B (5 × 8 = 40 Marks)

Answer **ALL** Questions

		Marks	BL	CO	PO
21. a.	Find a negative root of the equation $x^3-2x+5=0$ by the iteration method correct to 4 decimal places.	8	3	1	2
	(OR)				
b.	Find the positive root of the equation $3x-\cos x-1=0$ by Newton's method correct to 4 decimal places.	8	3	1	2
22. a.	Estimate the value of *f(22)* from the following table:	8	3	2	2

x:	20	25	30	35	40	45
f(x):	354	332	291	260	231	204

(OR)

b. Find *f(x)* as a polynomial in x from the given data. 8 3 2 2

x:	3	7	9	10
f(x):	168	120	72	63