Reg. No.															

B.Tech. / M.Tech. (Integrated) DEGREE EXAMINATION, MAY 2024
Fourth Semester

21MAB202T – NUMERICAL METHODS
(For the candidates admitted during the academic year 2021-2022 , 2022-2023 & 2023-2024)

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

	Question	Marks	BL	CO	PO
1.	In solving simultaneous equations by Gauss elimination method, the coefficient matrix is reduced to (A) Upper triangular matrix (B) Diagonal matrix (C) Lower triangular matrix (D) Identity matrix	1	1	1	1
2.	Gauss-Seidel method converges roughly twice faster than (A) Newton's method (B) Gauss elimination method (C) Gauss Jacobi method (D) Regula Falsi method	1	1	1	1
3.	Newton Raphson method is also called (A) Method of tangents (B) Method of chords (C) Method of secant (D) Method of successive approximation	1	1	1	1
4.	To determine numerically largest eigen value and the corresponding eigen vector of a square matrix A we use (A) Gauss Jacobi method (B) Gauss Seidel method (C) Regula Falsi method (D) Power method	1	1	1	1
5.	The second order divided difference for the following data is x: 1, 2, 4 y: 4, 5, 13 (A) 1 (B) 3 (C) 4 (D) 7	1	2	2	1
6.	The first divided difference of f(x) for the arguments x_0, x_1 is defined as (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) $\frac{f(x_0)-f(x_1)}{x_0+x_1}$ (D) $\frac{f(x_0)+f(x_1)}{x_0+x_1}$	1	1	2	1

7. When the values of the independent variables are not equally spaced, then we use 1 1 2 1
(A) Newton's forward interpolation formula
(B) Newton's backward interpolation formula
(C) Lagrange's interpolation formula
(D) Central difference interpolation formula

8. The principle of least squares states that the best representative curve to the set of points is that for which E, the sum of squares of the residuals is a 1 1 2 1
(A) Maximum
(B) Minimum
(C) Either minimum or maximum
(D) Neither minimum nor maximum

9. Newton's forward difference formula to compute $\frac{dy}{dx}$ $at\ x = x_0$ is 1 1 3 1
(A) $\frac{dy}{dx} = \frac{1}{h}\left[\Delta y_0 - \frac{1}{2}\Delta^2 y_0 + \frac{1}{3}\Delta^3 y_0 - ...\right]$
(B) $\frac{dy}{dx} = \frac{1}{h}\left[\Delta y_0 + \frac{1}{2}\Delta^2 y_0 + \frac{1}{3}\Delta^3 y_0 + ...\right]$
(C) $\frac{dy}{dx} = \frac{1}{h}\left[\nabla y_0 + \frac{1}{2}\nabla^2 y_0 + \frac{1}{3}\nabla^3 y_0 + ...\right]$
(D) $\frac{dy}{dx} = \frac{1}{h}\left[\nabla y_0 - \frac{1}{2}\nabla^2 y_0 + \frac{1}{3}\nabla^3 y_0 - ...\right]$

10. Find $\frac{dy}{dx}$ $at\ x = 1$ from the following table. 1 1 3 1

x	1	2	4
y	1	8	27

(A) 8
(B) 4
(C) 3
(D) 1

11. Simpson's one third rule can be applied only when the number of intervals is 1 1 4 1
(A) Odd
(B) Even
(C) Prime
(D) Multiple of 3

12. The error in the trapezoidal formula is of the order 1 1 4 1
(A) h^2
(B) h^3
(C) h^4
(D) h^5

13. How many prior values are required to predict the next value in Milne's method? 1 1 4 1
(A) 3
(B) 4
(C) 5
(D) 2

14. Use Runge-Kutta method of fourth order, if $k_1 = 0.2, k_2 = 0.1967, k_3 = 0.1967, k_4 = 0.1891$ then Δy is 1 2 4 1
(A) 0.1921
(B) 0.19598
(C) 0.2010
(D) 0.2110

15. Which of the following is a multi step method? 1 1 4 1
(A) Taylor series method
(B) Euler's method
(C) R-K method
(D) Milne's method

16. Milne's predictor formula is 1 1 4 1

(A) $y_{n+1,p} = y_{n-3} + \frac{4h}{3}\left(2y'_{n-2} - y'_{n-1} + 2y'_n\right)$

(B) $y_{n+1,p} = y_{n-1} + \frac{h}{3}\left(y'_{n-1} + 4y'_n + y'_{n+1}\right)$

(C) $y_{n+1,p} = y_{n-3} + \frac{h}{3}\left(2y'_{n-2} + y'_{n-1} + 2y'_n\right)$

(D) $y_{n+1,p} = y_{n-1} + \frac{4h}{3}\left(4y'_{n-1} + 4y'_n + y'_{n+1}\right)$

17. If $B^2 - 4AC = 0$, the second order PDE $Af_{xx} + Bf_{xy} + Cf_{yy} + \phi\left(x, y, f_x, f_y\right) = 0$ is 1 1 5 1

(A) Elliptic
(B) Parabolic
(C) Hyperbolic
(D) Laplace equation

18. In Crank Nicholson scheme, if λ=1, then the choice of the value of k is 1 1 5 1

(A) $k = ah^2$
(B) $k = \frac{ah^2}{2}$
(C) $k = ah$
(D) $k = 1$

19. To solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ we use 1 1 5 1

(A) Crank-Nicholson scheme
(B) Bender Schmidt scheme
(C) Leibmann's method
(D) Poisson's difference scheme

20. To use Bender Schmidt recurrence equation, with explicit formula $u_{i,j+1} = \lambda u_{i+1,j} + \left(1 - 2\lambda\right)u_{i,j} + \lambda u_{i-1,j}$ the choice of the λ should be 1 1 5 1

(A) λ=1
(B) λ=1/2
(C) λ=0
(D) λ=2

PART – B (5 × 8 = 40 Marks)
Answer **ALL** Questions

Marks BL CO PO

21. a. Find a positive root of $x^3 - 4x + 1 = 0$ by Regula Falsi method correct to 3 decimal places. 8 3 1 2

(OR)

b. Solve by Gauss elimination method the equations $2x + y + 4z = 12$, $8x - 3y + 2z = 20$, $4x + 11y - z = 33$. 8 3 1 2

22. a. Calculate the sum of squares of residuals in the case of straight line fit for the following data. 8 4 2 2

x	0	1	2	3	4
y	1	5	10	22	38

(OR)

b. Using Lagrange's interpolation formula, find the value of y when x=8. 8 3 2 2

x	3	7	9	10
y	168	120	72	63

23. a. Find the value of $f'(4)$ and $f''(4)$ from the following table.	8	3	3	2

x	0	1	2	3
f(x)	1	2	9	28

(OR)

b. Evaluate $\int_0^6 \frac{1}{1+x}dx$ using Trapezoidal rule and Simpson's one third rule, taking h=1.	8	4	3	2
24. a. Using Taylor method, compute y(0.2) and y(0.4) correct to 3 decimal places given $\frac{dy}{dx}=1-2xy \text{ and } y(0)=0$.	8	3	4	2

(OR)

b. Using improved Euler method find the value of y at x=0.1, given $y'=x^2-y, y(0)=1$.	8	3	4	2
25. a. Solve $\frac{\partial^2 u}{\partial x^2}=2\frac{\partial u}{\partial t}, u(0,t)=0, u(4,t)=0 \text{ and } u(x,0)=x(4-x)$ choosing h=k=1 and using Bender Schmidt formula find the values upto t=5.	8	3	5	2

(OR)

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

PART – C (1 × 15 = 15 Marks)
Answer **ANY ONE** Questions

	Marks	BL	CO	PO
26.i. Solve the following equations by Gauss-Seidel method. $27x+6y-z=85$, $6x+15y+2z=72$, $x+y+54z=110$	8	3	1	2
ii. Estimate the value of f(42) from the following table.	7	4	2	2

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

27. Apply fourth order Runge-Kutta method to find an approximate value of y when x=0.2 given that $y'=x+y, y(0)=1$, taking $h=0.1$.	15	4	4	2

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