Reg. No.															

B.Tech. DEGREE EXAMINATION, DECEMBER 2023
Fourth Semester

18MAB206T – NUMERICAL METHODS AND ANALYSIS
(For the candidates admitted from the academic year 2020-2021 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) Secant (C) Co-secant (D) Squares	1	1	1	2
2.	The order of convergence of Newton's method is (A) 2 (B) 3 (C) 4 (D) 1	1	1	1	2
3.	One of the direct method to save system of simultaneous linear equation is (A) Gauss-Jacobi (B) Gauss-Elimination (C) Gauss-Seidel (D) Newton's method	1	1	1	2
4.	The convergence in the Gauss-Seidel method is roughly _______ as faster as in Jacobi's method. (A) Three times (B) Five times (C) Ten times (D) Two times	1	1	1	2
5.	The translation operator E is defined by (A) $Ef(x)=f(x+h)$ (B) $Ef(x)=f(x)$ (C) $Ef(x+h)=f(x)$ (D) $Ef(x)=f(x-h)$	1	1	2	2
6.	The relation between E and ∇ is (A) $\nabla - E^{-1} = 1$ (B) $1+\nabla = E^{-1}$ (C) $\nabla = 1-E^{-1}$ (D) $\nabla = 1+E^{-1}$	1	2	2	2.
7.	The $(n+1)^{th}$ and higher differences of a polynomial of degree 'n' are (A) Quadratic (B) Parabolic (C) Linear (D) Zeros	1	1	2	2
8.	$\delta E^{1/2} =$ (A) Δ (B) ∇ (C) δ (D) E	1	2	2	2

9. The trapezoidal rule is (A) h/2[sum of the first and last ordinates + 2(sum of remaining ordinates)] (B) $h/2\left[y_0+y_1+2\left(y_2+\ldots y_n\right)\right]$ (C) h/2 [sum of y_0 and y_{n-1} + 2 (sum of remaining ordinates)] (D) $h/2\left[y_0+y_n+2\left(y_2+y_4+\ldots\right)+4\left(y_1+y_3+\ldots\right)\right]$	1	1	3	2
10. The error in Trapezoidal rule is (A) $\lvert E \rvert < \frac{(b-a)h^2}{12}$ (B) $\lvert E \rvert < \frac{(b-a)h^3}{12}$ (C) $\lvert E \rvert < \frac{(b-a)h^3}{180}$ (D) $\lvert E \rvert < \frac{(b+a)h^3}{60}$	1	1	3	2
11. Simpson's Three-eight rule can be applied only when n is (A) Odd (B) Even (C) Prime (D) Multiple of 3	1	1	3	2
12. Simpson's one-third rule is also called (A) Parabolic rule (B) Hyperbolic rule (C) Elliptic rule (D) Trapezoidal rule	1	1	3	2
13. The improved Euler method is based on the averages of (A) Points (B) Slopes (C) Curves (D) Both points and slopes	1	1	4	2
14. Which of the following is a better method? (A) Taylor series method (B) R-K method (C) Euler's method (D) Modified Euler method	1	1	4	2
15. The error term in Milne's corrector formula is (A) $\frac{-h}{90}\Delta^4 y_0'$ (B) $\frac{h}{90}\Delta^4 y_0'$ (C) $\frac{-h}{90}\Delta^3 y_0$ (D) $\frac{h}{90}\Delta^4 y_0$	1	1	4	2
16. Which of the following is Modified Euler's formula for $\frac{dy}{dx}=f(x,y), y(x_0)=y_0$ (A) $y_1=y_0+h^2 f(x_0,y_0)$ (B) $y_1=y_0-h^2 f(x_0,y_0)$ (C) $y_1=y_0+hf\left(x_0+\frac{1}{2}h, y_0+\frac{1}{2}hf(x_0,y_0)\right)$ (D) $y_1=y_0+h$	1	1	4	1
17. $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$ is called (A) Elliptic (B) Parabolic (C) Hyperbolic (D) Laplace equation	1	1	5	2

18. Bender-Schmidt recurrence equation is valid only if 1 1 5 2

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

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

19. The equation $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=f(x,y)$ is also called 1 1 5 2

(A) Laplace equation (B) Poisson equation

(C) One dimensional heat equation (D) Two dimensional heat equation

20. Bender-Schmidt scheme converges for 1 1 5 2

(A) $\lambda=1$ (B) $\lambda=1/2$

(C) $\lambda=3$ (D) $\lambda=3/2$

PART – B (5 × 4 = 20 Marks)

Answer **ANY FIVE** Questions

	Marks	BL	CO	PO
21. Find the real positive roof of $3x-\cos x-1=0$ by Newton's method correct to 4 decimal places.	4	3	1	2
22. Find the 7th term of the sequence 1, 4, 10, 20, 35, 56…	4	3	2	2
23. Evaluate $\int_1^2 \frac{dx}{1+x^2}$ taking h=0.2 using trapezoidal rule.	4	3	3	2
24. Solve $\frac{dy}{dx}=x+y, y(1)=0$ to obtain y(1.1) by Taylor's method taking h=0.1.	4	3	4	2
25. Using Euler's method, solve numerically the equation $y'=x+y, y(0)=1,$ *for* $x=0.2$ *and* 0.4.	4	3	4	2
26. Classify the partial differential equation $(x+1)u_{xx}-2(x+2)u_{xy}+(x+3)u_{yy}=0$.	4	3	5	2
27. State modified Euler formula and improved Euler formula.	4	3	4	2

PART – C (5 × 12 = 60 Marks)

Answer **ALL** Questions

	Marks	BL	CO	PO
28. a. Solve the following system of equation of using Gauss-Seidel method correct to three decimal places $8x-3y+2z=20$ $4x+11y-z=33$ $6x+3y+12z=35$	12	3	1	2
(OR)				
b. Solve the system of equations by Gauss-Jordan method. $x+2y+z=3$ $2x+3y+3z=10$ $3x-y+2z=13$	12	3	1	2

29. a. The population of a town is as follows. 12 3 2 2

x	1941	1951	1961	1971	1981	1991
y	20	24	29	36	46	51

Estimate the population increase during the period 1946 to 1976.

(OR)

b. Use Lagrange's interpolation formula to fit a polynomial to the data. 12 3 2 2

x	0	1	3	4
y	-12	0	6	12

And hence find the value of y when x=2.

30. a. Find the first two derivative of $(x)^{1/3}$ *at* $x=50$ *and* $x=56$ given the table below. 12 3 5 2

x	50	51	52	53	54	55
$y=x^{1/3}$	3.6840	3.7084	3.7325	3.7563	3.7798	3.8030

(OR)

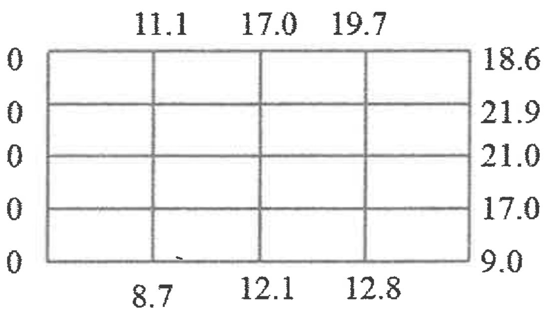
b. Evaluate $\int_0^6 \frac{dx}{1+x^2}$ using trapezoidal and Simpson's $\frac{1}{3}$ and $\frac{3}{8}$ rules, taking h=1. 12 3 5 2

31. a. Using R-K method of fourth order compute y(0.1), y(0.2) given $\frac{dy}{dx}+y+xy^2=0, y(0)=1$, correct to 4 decimals. 12 3 4 2

(OR)

b. Using modified Euler's method, find *y(0.1)* and *y(0.2)* for the differential equation, $\frac{dy}{dx}=x^2+y^2, y(0)=1$. 12 4 4 2

32. a. Find the Liebmann's method the values at the interior lattice points of the square region of the harmonic function u whose boundary values are as shows below. 12 3 5 1



(OR)

b. Solve $u_t=4u_{xx}, u(0,t)=0, u(8,t)=0$ *and* $u(x,0)=4x-\frac{1}{2}x^2$, taking h=1, k=1/8 using Bender-Schmidt formula upto t=5. 12 3 5 2

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