Reg. No.															

B.Tech. DEGREE EXAMINATION, DECEMBER 2023

Fourth Semester

18MAB202T – NUMERICAL METHODS FOR ENGINEERS

(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. By method of least squares, the error committed in fitting a straight line is — 1 | 1 | 1 | 1

(A) $E = \sum y - a\sum xy - b\sum y^2$ (B) $E = \sum y^2 - a\sum xy - b\sum y$

(C) $E = \sum y - a\sum xy^2 - b\sum y$ (D) $E = \sum y^2 - a\sum x^2 y - b\sum y$

2. The order of convergence in Newton Raphson method is — 1 | 2 | 1 | 1

(A) 1 (B) 2

(C) 3 (D) 0

3. "As soon as a new value for a variable is found by iteration, it is used immediately in the following equation" this method is called — 1 | 1 | 1 | 1

(A) Gauss-Seidel method (B) Gauss-Jacobi method

(C) Gauss-Jordan method (D) Gauss-Elimination method

4. In Regula Falsi method, the first approximation is given by — 1 | 1 | 1 | 1

(A) $\frac{af(b)-bf(a)}{f(b)-f(a)}$ (B) $\frac{af(a)-bf(b)}{f(b)-f(a)}$

(C) $\frac{af(b)-bf(a)}{f(a)-f(b)}$ (D) $\frac{bf(a)-af(a)}{f(a)-f(b)}$

5. Choose the correct answer : If $f(x)=x^2+x+1$, then the value of $\Delta f(x)$; taking h=1, is — 1 | 2 | 2 | 1

(A) $2x+3$ (B) $2x+2$

(C) 2 (D) x^2+1

6. Pick out the correct answer : The n^{th} order difference of a polynomial of n^{th} degree is — 1 | 1 | 2 | 1

(A) Zero (B) Polynomial of $(n-1)^{th}$ degree

(C) Constant (D) Polynomial in first degree

7. Which of the following options correctly describes the applicability of Lagrange's interpolation formula? — 1 | 1 | 2 | 1

(A) Only for equal intervals (B) Only for unequal intervals

(C) Both equal and unequal intervals (D) Not applicable for either equal or unequal intervals

8. Name the interpolation which is used to interpolate the value of y at the beginning of the table if the arguments are equally spaced 1 1 2 1

(A) Newton forward interpolation (B) Newton backward interpolation
(C) Lagrange's interpolation (D) Newton divided difference formula

9. If a set of numerical values of the integral $f(x)$, a single valued function, is applied to $\int_a^b f(x)dx$, then that process is called 1 2 3 1

(A) A numerical integration (B) Quadrature
(C) Interpolation (D) Extrapolation

10. The error in Simpson's one-third rule is of order 1 1 3 1

(A) h^2 (B) h^4
(C) h^5 (D) h^6

11. Simpson's three-eighth rule can be applied if 1 2 3 1

(A) The number of ordinates is odd (B) The number of ordinates is even
(C) The number of interval is multiple of 3 (D) The number of interval is even

12. In deriving Trapezoidal rule, the arc of the curve $y=f(x)$ over each sub interval is replaced by its 1 1 3 1

(A) Chord (B) Tangent
(C) Diameter (D) Radius

13. Which of the following formula is a particular case of Runge-Kutta formula of second order? 1 1 4 1

(A) Taylor formula (B) Euler's modified formula
(C) Milne's predictor formula (D) Adam's predictor formula

14. Improved Euler method is based on the averages of 1 2 4 1

(A) Points (B) Slopes
(C) Curves (D) Both points and slopes

15. Which of the following method is a multi-step method? 1 1 4 1

(A) Taylor series method (B) Runge-Kutta method
(C) Euler method (D) Milne's predictor – corrector method

16. In Runge-Kutta method of fourth order, Δy stands for 1 2 4 1

(A) $\frac{1}{6}[k_1+k_2+k_3+k_4]$ (B) $\frac{1}{6}[k_1-2k_2+2k_3-k_4]$
(C) $\frac{1}{6}[k_1+2k_2+2k_3+k_4]$ (D) $\frac{1}{6}[2k_1+k_2+k_3+2k_4]$

17. Classify the PDE : $xf_{xx}+yf_{yy}=0, x<0, y>0$ 1 2 5 1

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

18. 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) $k=\frac{2}{h^2}$

19. The solution of hyperbolic equation $u_{tt}=a^2u_{xx}$ is unstable if

				1	1	5	1

(A) λ=a (B) λ=1/a

(C) λ<1/a (D) λ>1/a

20. To solve $\frac{\partial^2u}{\partial x^2}+\frac{\partial^2u}{\partial y^2}=0$, we use

				1	1	5	1

(A) Crank-Nicholson scheme (B) Bender-Schmidt scheme

(C) Liebmann's method (D) Poisson method

PART – B (5 × 4 = 20 Marks)

Answer **ANY FIVE** Questions

	Marks	BL	CO	PO
21. Explain how Newton's method can be used to find the iterative formula for $\sqrt{N}$ where N is a positive integer.	4	2	1	2
22. Expression $f(x)=x^3-3x^2+5x+7$ interms of factorial polynomial taking h=2 and find its differences.	4	2	2	2
23. Construct the divided difference table for the data (0,1), (1,4), (3,40) and (4,85).	4	3	2	2
24. Compute $\frac{dy}{dx}$ at $x=64$ from the following table.	4	3	3	2

x	1	2	3	4
y	1	8	27	64

25. Calculate y at x=0.1, if $\frac{dy}{dx}=1+xy, y(0)=2$ using Euler's method.	4	3	4	2
26. Test the nature of PDE $(x+1)u_{xx}-2(x+2)u_{xy}+(x+3)u_{yy}=0$.	4	4	5	2
27. Evaluate $\int_{1/2}^{1}\frac{1}{x}dx$ by Trapezoidal rule, by dividing the range into 4 equal parts.	4	4	3	2

PART – C (5 × 12 = 60 Marks)

Answer **ALL** Questions

	Marks	BL	CO	PO
28. a. Given the following data.	12	3	1	2

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

Find the straight line and the parabola fit and calculate the sum of squares of the residuals in both cases.

(OR)

b.i. Compute the real root of $x\log_{10}x-1.2=0$ correct to 4 decimal places using Regula false position method. 6 3 1 2

ii. Solve by Gauss-Jordan method the equations $x+y+z=9, 2x-3y+4z=13, 3x+4y+5z=40$. 6 3 1 2

29. a. From the data given below, calculate the number of students whose weight is between 60 to 70. 12 3 2 2

Weight in (*lbs*)	0-40	40-60	60-80	80-100	100-120
No. of students	250	120	100	70	50

(OR)

b. Deduce the polynomial f(x) by using Lagrange's formula and hence find *f(3)* for the following values of x and y. 12 4 2 2

x	0	1	2	5
y	2	3	12	147

30. a. From the following table, compute $\frac{dy}{dx}$ *at* $x=500$ and x=550 using appropriate interpolation formula. 12 3 3 2

x	500	510	520	530	*540*	550
$y=\log_e x$	6.2146	6.2344	6.2538	6.2729	*6.2916*	6.3099

(OR)

b. The following table gives the velocity v of a particle at time t. 12 3 3 2

t (secs)	0	2	4	6	*8*	10	12
V (m/sec)	4	6	16	34	*60*	94	136

Calculate the distance moved by the particle in 12 secs and also the acceleration at t=2 secs.

31. a. Consider $\frac{dy}{dx}=y-x^2+1, y(0)=0.5$, taking $h=0.2$. 2 4 2

(i) using the modified Euler method find y(0.2) 4

(ii) using R-K method of fourth order find y(0.4) 8

(OR)

b. Given 12 3 4 2

$5xy'+y^2=2, y(4)=1, y(4.1)=1.0049, y(4.1)=1.0097, y(4.3)=1.0143$

compute y(4.4) using Milne's method.

32. a. Solve by Crank-Nicolson method, $\frac{\partial^2 u}{\partial x^2}=\frac{\partial u}{\partial t}$ for 0<x<1, t > 0 given that *u(0,t)=0, u(1,t)=0* and *u(x,0)=100x(1–x)* compute u for one time step with h=1/4. 12 3 5 2

(OR)

b. Solve $16u_{xx}=u_{tt}, u(0,t)=0, u(5,t)=0, u(x,0)=x^2(5-x), u_t(x,0)=0$ taking h=1 and upto one half of the period of vibration. 12 3 5 2

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