b. Analyze the following system of equations and solve it by Gauss-Seidel method. 10 4 1 1,2

$4x+2y+z=14$

$x+5y-z=10$

$x+y+8z=20$

27. a. The population of a town in the census is given below. Applying the interpolation technique, estimate the population in the year 1895 and 1925. 10 4 2 1,2

Year (*x*):	1891	1901	1911	1921	1931
Population *(y):* (in 1000's)	46	66	81	93	101

(OR)

b. Determine the polynomial y(x) for the following data using Lagrange's interpolation formula. 10 3 2 1,2

x	0	1	4	5
y(x):	4	3	24	39

28. a. In a machine, a slider moves along a fixed straight rod. Its distance x cms. along the rod is given below for various values of time t sec. 10 4 3 ,12

t:	0.1	0.2	0.3	0.4	0.5
x:	31.62	32.87	33.64	33.95	33.81

Analyse the technique of numerical differentiation and determine the velocity of the slider when t=0.1 and t=0.5.

(OR)

b. The velocity of the train at various times are given by the following table, 10 3 3 1,2

Minutes:	0	2	4	6	*8*	10	12	14	16	*18*	20
Miles/hr:	0	10	18	25	*29*	32	20	11	5	*2*	0

Apply numerical integration to calculate the total distance covered in 20 minutes.

29. a.i. Given $y'=xy+y^2, y(0)=1$, use Taylor series method to estimate the value of y at $x=0.1$, taking $h=0.1$. 5 3 4 1,2

ii. Use Modified Euler method to calculate $y(0.2)$, given $y'=y-x^2, y(0)=1$ by taking h=0.2. 5 3 4 1,2

(OR)

b. Apply Milne's predictor-corrector method to estimate the value of y(0.4), given $y'=2e^x-y, y(0)=2, y(0.1)=2.010, y(0.2)=2.040, y(0.3)=2.090$, by analyzing the predictor and corrector formula. 10 4 4 1,2

30. a. Solve $\nabla^2 u=-10\left(x^2+y^2+10\right)$ over the square mesh with sides $x=0$, $y=0$, $x=3$, $y=3$ with $u=0$ on the boundary and mesh length 1 unit, by using suitable numerical technique. 10 3 5 1,2

(OR)

b. Analyse the one half period of vibration and evaluate the pivotal values of the following equations taking $h=1$ for one half period of vibration, given $u(0,t)=0$, $u(5,t)=0$, $u_t(x,0)=0$ and $u(x,0)=\begin{cases}2x, & 0\le x\le 2.5\\ 10-2x, & 2.5\le x\le 5\end{cases}$. 10 4 5 1,2

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Reg. No.														

B.Tech. DEGREE EXAMINATION, MAY 2022

Fourth Semester

18MAB202T – NUMERICAL METHODS FOR ENGINEERS

(For the candidates admitted from the academic year 2018-2019 to 2019-2020)

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** should be answered in answer booklet.

Time: 2½ Hours Max. Marks: 75

PART – A (25 × 1 = 25 Marks)

Answer **ALL** Questions

Marks BL CO PO

1. When we fit a parabola by the method of least squares, which of the following is the formula to calculate the error? 1 1 1 1

(A) $\sum y^2+a\sum x^2y+b\sum xy+c\sum y$ (B) $\sum y^2-a\sum x^2y-b\sum xy-c\sum y$

(C) $\sum y^2-a\sum xy^2-b\sum xy-c\sum x$ (D) $\sum y^2-a\sum x^2y+b\sum xy-c\sum x$

2. In solving simultaneous equations by Gauss Jordan method, the co-efficient matrix is reduced to 1 1 1 1

(A) Null matrix (B) Diagonal matrix

(C) Upper triangular matrix (D) Lower triangular matrix

3. Which of the following is one of the normal equation to fit a straight line $y=ax+b$? 1 1 1 1

(A) $\sum y=a\sum x+nb$ (B) $\sum xy=a\sum x-nb$

(C) $\sum y^2=a\sum y+nb$ (D) $\sum y=a\sum xy+b\sum x$

4. Find the range, in which the negative root lies while solving $x^3-2x+5=0$ 1 2 1 2

(A) 0 and 1 (B) –1 and –2

(C) –2 and –3 (D) 1 and 2

5. Write the first iteration values of x and y, by Gauss-Seidel method for the system of equations $4x+y=2; 2x+3y=5$

(A) $x=4, y=3$ (B) $x=1, y=2$

(C) $x=0.5, y=1.67$ (D) $x=0.5, y=1.33$

6. The operator E is equivalent to 1 1 2 1

(A) $(1+\Delta)^{-1}$ (B) $(1-\Delta)^{-1}$

(C) $(1+\nabla)^{-1}$ (D) $(1-\nabla)^{-1}$

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

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

8. If $3x^{(3)}+7x^{(2)}+8x^{(1)}-6$ is the factorial, polynomial, then find the second forward difference, by taking h=1. 1 2 2 2

(A) $9x^{(2)}-14x^{(1)}+8$ (B) $18x^{(1)}-14$

(C) $18x^{(1)}+14$ (D) $9x^{(2)}+14x^{(1)}+8$

9. The polynomial that suits the given data $f(0)=4, f(1)=3$ and $f(4)=24$, by suitable interpolation technique is 1 2 2 2

(A) x^2-2x+4 (B) $-3x^2+2x+4$

(C) $2x^2-3x+4$ (D) $-2x^2+x+4$

10. The third differences of *f(x)* for the following data is 1 2 2 2

x	0	1	2	3	4
f(x)	1	3	7	13	21

(A) 0,0 (B) 0,1

(C) 1,1 (D) 1,0

11. Which of the following is the forward difference formula to get the first derivative at $x=x_0$? 1 1 3 1

(A) $\frac{1}{h}\left(\Delta y_0-\frac{1}{2}\Delta^2 y_0+\frac{1}{3}\Delta^3 y_0-....\right)$ (B) $\frac{1}{h^2}\left(\Delta^2 y_0-\frac{1}{2}\Delta^3 y_0+....\right)$

(C) $\frac{1}{h}\left(\Delta y_0+\frac{1}{2}\Delta^2 y_0+....\right)$ (D) $\frac{1}{h^2}\left(\Delta^2 y_0+\frac{1}{2}\Delta^3 y_0+....\right)$

12. The accuracy in the trapezoidal rule can be improved by 1 1 3 1

(A) Increasing the number of intervals (B) Increasing the value of h

(C) Decreasing the number of intervals (D) Without changing the value of h

13. Simpson's three-eight rule can be applied only when the number of intervals is 1 1 3 1

(A) Odd (B) even

(C) Multiple of 3 (D) Multiple of 2

14. Using the following table, find the value of $f'(1)$ 1 2 3 2

x	1	2	3
f(x)	4	26	48

(A) –7 (B) 22

(C) 11 (D) 7

15. Find the value of $\int_{1/2}^{1}\frac{1}{x}dx$ by trapezoidal rule by dividing the range into 4 equal parts. 1 2 3 2

(A) 0.527 (B) 0.321

(C) 0.490 (D) 0.697

16. Taylor's series method is known as 1 1 4 1

(A) Single step method (B) Multi step method

(C) Iterative method (D) Trial and error method

17. The improved Euler method is based on the averages of 1 1 4 1

(A) Points (B) Slopes

(C) Curves (D) Both points and slopes

18. How many prior values are required to predict the next value in predictor-corrector methods? 1 1 4 1

(A) 1 (B) 2

(C) 3 (D) 4

19. Given $y'=x+y, y(0)=1$, find the value of y(0.1) by Euler's method. 1 2 4 2

(A) 1 (B) 0.2

(C) 1.1 (D) 0.1

20. Using Runge-Kutta method of fourth order, if $k_1=0.2$, $k_2=0.205$, $k_3=0.2052$, $k_4=0.2105$ then the value of Δy will be 1 2 4 2

(A) 0.2052 (B) 0.3053

(C) 0.1038 (D) 1.2052

21. If $B^2-4AC=0$, then the second order linear PDE is classified as 1 1 5 1

(A) Cyclic (B) Hyperbolic

(C) Parabolic (D) Elliptic

22. The PDE $xf_{xx}+yf_{yy}=0, x<0, y>0$ is classified as 1 2 5 2

(A) Parabolic (B) Cyclic

(C) Elliptic (D) Hyperbolic

23. The term $u_{ij}=\frac{1}{4}\left[u_{i-1,j-1}+u_{i-1,j+1}+u_{i+1,j-1}+u_{i+1,j+1}\right]$ is known as 1 2 5 2

(A) Diagonal five point formula (B) Standard five point formula

(C) Explicit formula (D) Implicit formula

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

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

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

25. Crank-Nicholson recurrence scheme is used to solve 1 1 5 1

(A) One dimensional Wave equation (B) One dimensional Heat equation

(C) Laplace equation (D) Poisson equation

PART – B (5 × 10 = 50 Marks)

Answer **ALL** Questions

Marks BL CO PO

26. a.i. Using the method of least squares, fit a straight line to the following data. 5 3 1 1,2

x	3	4	5	6
y	6	9	10	11

ii. Determine the root of $f(x)=\cos x-xe^x$, using Newton-Raphson method, correct to 4 decimal places. 5 3 1 1,2

(OR)