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(FOR THE CANDIDATES ADMITTED DURING THE ACADEMIC YEAR 2024 ONLY)

24UMS306

REG.NO. :

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI
END-OF-SEMESTER EXAMINATIONS : NOVEMBER-2025
B.Sc.-MATHEMATICS **MAXIMUM MARKS: 75**
SEMESTER: III **TIME : 3 HOURS**

PART - III

NUMERICAL TECHNIQUES

SECTION – A (10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS.
MULTIPLE CHOICE QUESTIONS. (K1)

1. If X is the inverse of the matrix A, then which of the following is correct ?
   a) AX = B b) AX = I c) AI = X d) AB = X

2. Newton's forward interpolation is used only for _____intervals.
   a) equal b) unequal c) Infinite d) finite

3. Which of the following formulas is used for estimating the first derivative near the beginning of a data table?
   a) Newton's forward difference formula.
   b) Newton backward difference formula.
   c) Stirling's formula.
   d) Lagrange interpolation formula.

4. If $\frac{dy}{dx} = 1 - y; y(0) = 0$, than value of y(0.1)=_____, by using Euler's method.
   a) 0.9 b) -0.1 c) 0.1 d) 0.01

5. Which of the following is a Laplace's equation?
   a) $u_x + u_y = 0$ b) $u_x - u_y = 0$ c) $u_{xx} - u_{yy} = 0$ d) $u_{xx} + u_{yy} = 0$

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES. (K2)

6. Calculate the augmented matrix for the system of the equation $2x + 3y = 5; 3x - 2y = 2$.
7. Write down the formula for Gregory Newton's forward interpolation.
8. What is the order of the error in the Trapezoidal rule?
9. State the formula for the fourth order of Runge kutta method.
10. Write down the formula for the diagonal five-point formula.

SECTION – B (5 X 5 = 25 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. (K3)

11. a) Solve by Gauss-elimination method 2x+y+4z=12, 8x-3y+2z=20, 4x+11y-z=33.

(OR)

b) Find by Gaussian elimination, the inverse of the matrix

$$\begin{bmatrix} 4 & 1 & 2 \\ 2 & 3 & -1 \\ 1 & -2 & 2 \end{bmatrix}$$

(CONTD……2)

12.a) The following are data from the Steam table :

Temperature	140	150	160	170	180
Pressure	3.685	4.854	6.302	8.076	10.225

Using Newton's formula find the pressure of the steam for a temperature of 142?

(OR)

b) Construct Newton's forward interpolation polynomial for the following data:

x:	4	6	8	10
y:	1	3	8	16

use it to find the value of y for x=5.

13.a) From the following table of values of x and y, Calculate $\frac{dy}{dx}$ for x=1.25.

x:	1.00	1.05	1.10	1.15	1.20	1.25
y:	1.00000	1.02470	1.04991	1.07238	1.09544	1.11803
x:	1.30					
y:	1.14017					

(OR)

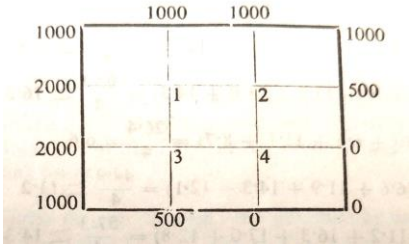
b) Dividing the range into 10 equal parts, Calculate the approximate value of $\int_0^{\pi} \sin x \, dx$ by Trapezoidal rule.

14. a) Compute the value of y for x=0.1 by Picard's method, given that $\frac{dy}{dx} = \frac{y-x}{y+x}$ y(0)=1.

(OR)

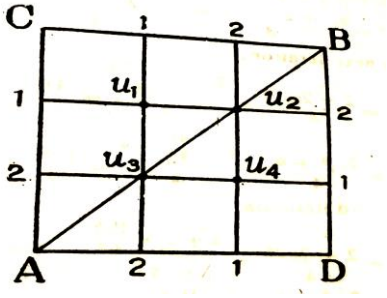
b) Solve the equation $\frac{dy}{dx} = 1 - y$ with the initial condition x=0, y=0, using Euler's algorithm and tabulate the solutions at x=0.1, 0.2, 0.3, 0.4

15.a) Given the values of u(x, y) on the boundary of the square given in the figure, evaluate the function u(x, y) satisfying Laplace's equation $\nabla^2 u = 0$ at the pivotal points of this figure.



(OR)

b) Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as shown, using Liebmann method. Iterate until the maximum difference between successive values at any point is less than 0.005.



SECTION – C (5 X 8 = 40 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

(K4 (Or) K5)

16. a) Solve, by Gauss-Jacobi method of iteration, the equations are 27x+6y-z=85, 6x+15y+2z=72, x+y+54z=110.

(OR)

b) Solve, 8x-3y+2z=20, 4x+11y-z=33, 6x+3y+12z=35 by using Gauss – Seidal method.

17.a) Derive Geogory-Newton Backward interpolation formula.

(OR)

b) Given the data

x:	0	1	2	5
f(x):	2	3	12	147

find the cubic function of x.

18. a) Use Romberg's method to compute $\int_0^1 \frac{1}{1+x^2}dx$ correct to 4 decimal places. Hence deduce an approximate value of π.

(OR)

b) From the following table of values of x and y, Calculate $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ for x=1.05,

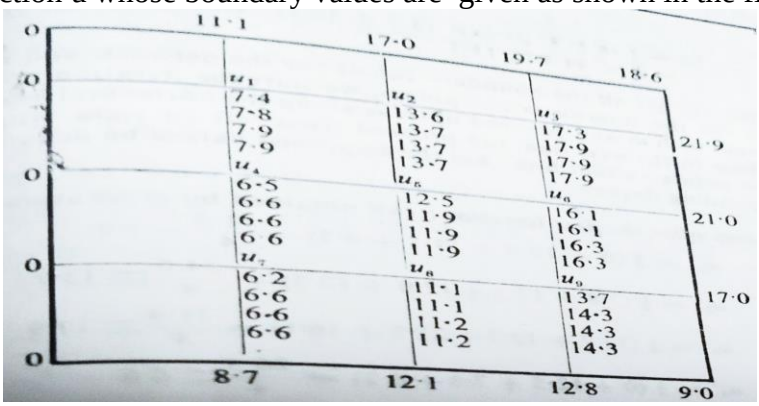
x:	1.00	1.05	1.10	1.15	1.20	1.25
y:	1.00000	1.02470	1.04991	1.07238	1.09544	1.11803
x:	1.30					
y:	1.14017					

19. a) Apply the fourth order Runge-kutta method, to compute an approximate value of y when x=0.2, given that $y' = x + y$, y(0)=1 .

(OR)

b) Using Taylor series method, obtain the values of y at to four significant figures, if y satisfies the equation $\frac{d^2y}{dx^2} = -xy$ given that $\frac{dy}{dx} = 0.5$ and y=1 when x=0.

20.a) Determine by iteration method the values at the interior lattice points of a square region of the harmonic function u whose boundary values are given as shown in the figure below.



(OR)

b) Solve the partial differential equation $\nabla^2 u = -10(x^2 + y^2 + 10)$ over the square with sides x=0=y, x=3=y, with u=0 on the boundary and mesh length = 1.

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