

D 130233

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Name.....

Reg. No.....

**FIFTH SEMESTER (CBCSS—UG) / INTEGRATED PG DEGREE
EXAMINATION, NOVEMBER 2025**

Mathematics/Mathematics and Physics (Double Main)

MTS 5D 03—LINEAR MATHEMATICAL MODELS

(2020 Syllabus)

Time : Two Hours

Maximum : 60 Marks

Section A (Short Answer Type)

All questions can be answered.

Each question carries 2 marks.

(Ceiling 20 marks)

- Find an equation of the line through $(8, -4)$ and $(-2, -4)$.
- Graph the equation $y - x + 1 = 0$.
- Let $f(x) = 7 - 5x$ and $g(x) = 2x - 3$. Find $f(-3)$ and $g(2.5)$.
- Write down the equation for the least square line.
- Use Gauss-Jordan method to solve the system :

$$3x - 4y = 1$$

$$5x + 2y = 19.$$

6. Find $\begin{bmatrix} 2 & 3 \\ -2 & 4 \end{bmatrix} + \begin{bmatrix} 4 & 3 \\ 7 & 8 \end{bmatrix} - \begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}$.

7. Let $A = \begin{bmatrix} 1 & -3 \\ 7 & 2 \\ -2 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 & -1 \\ 3 & 1 & 4 \end{bmatrix}$, find AB and BA .

8. Find the inverse of $\begin{bmatrix} 2 & -4 \\ 1 & -2 \end{bmatrix}$.

Turn over

9. Graph the feasible region for the system

$$y \leq -2x + 8$$

$$-2 \leq x \leq 1.$$

10. State Corner Point Theorem.

11. What is a slack variable ?

12. Write the dual of the linear programming problem :

$$\text{Minimize } w = 7y_1 + 5y_2 + 8y_3$$

$$\text{subject to: } 3y_1 + 2y_2 + y_3 \geq 10$$

$$4y_1 + 5y_2 \geq 25$$

$$\text{with } y_1 \geq 0, y_2 \geq 0, y_3 \geq 0.$$

Section B (Paragraph/Problem Type)

All questions can be answered.

Each question carries 5 marks.

(Ceiling 30 marks)

13. Find the equation of the line that passes through the point $(3, 5)$ and is parallel to the line $2x + 5y = 4$.

14. A firm producing poultry feed finds that the total cost $C(x)$ in dollars of producing and selling x units is given by $C(x) = 20x + 100$. Management plans to charge 24 dollars per unit for the feed.

(a) How many units must be sold for the firm to break even ?

(b) What is the profit if 100 units of feed are sold ?

15. Consider the following table of data ;

x	:	1	1	2	2	9
y	:	1	2	1	2	9

Find the least squares line and the correlation co-efficient.

16. Use the Gauss-Jordan method to solve the system :

$$x + 2y - z = 0$$

$$3x - y + z = 6$$

$$-2x - 4y + 2z = 0.$$

17. Solve each system of equations by using the inverse of the co-efficient matrix if it exists :

$$x + 3y - 2z = 4$$

$$2x + 7y - 3z = 8$$

$$3x + 8y - 5z = -4.$$

18. Introduce slack variables as necessary and write the initial simplex tableau for the linear programming problem :

Find $x_1 \geq 0$ and $x_2 \geq 0$ such that

$$x_1 + x_2 \leq 10$$

$$5x_1 + 2x_2 \leq 20$$

$$x_1 + 2x_2 \leq 30$$

and $z = x_1 + 3x_2$ is maximized.

19. Happy Ice Cream Cone Company makes cake cones and sugar cones, both of which must be processed in the mixing department and the baking department. Manufacturing one batch of cake cones requires 1 hour in the mixing department and 2 hours in the baking department, and producing one batch of sugar cones requires 2 hours in the mixing department and 1 hour in the baking department. Each department is operated for at most 12 hours per day. Write a system of inequalities that expresses these restrictions.

Section C (Essay Type)

Answer any one of the following question.

The question carries 10 marks.

20. Use graphical method to solve the linear programming problem :

$$\text{Maximize } z = 2x + 4y$$

$$\text{subject to: } 3x + 2y \leq 12$$

$$5x + y \geq 5$$

$$\text{with } x \geq 0, y \geq 0.$$

21. Use simplex method to solve the linear programming problem :

$$\text{Maximize } z = 25x + 30y$$

$$\text{subject to: } x + y \leq 65$$

$$4x + 5y \leq 300$$

$$\text{with } x \geq 0, y \geq 0.$$

(1 × 10 = 10 marks)