**D 110211** **(Pages : 3)** **Name.....**

**Reg. No.....**

**FIFTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION**
**NOVEMBER 2024**

Mathematics

MTS 5B 08—LINEAR PROGRAMMING

(2020 Admission onwards)

Time : Two Hours Maximum : 60 Marks

**Section A ((Short Answer Type)**

*All questions can be answered.*
*Each question carries* 2 *marks.*
*Ceiling* 20 *Marks.*

1. Draw the set of points $(x, y)$ satisfying the constraints

   $2x + y \leq 8,\ x + 2y \leq 10,\ x \geq 0, y \geq 0.$

2. Write the canonical maximization linear programming problem.

3. Define a convex subset of $\mathbb{R}^2$. Also draw a convex set and a non-convex set in $\mathbb{R}^2$.

4. Let S be a convex set in $\mathbb{R}^2$. Define an extreme point of S.

5. Consider the canonical maximum tableau below :

| $x$ | $y$ | $-1$ | |
|---|---|---|---|
| 1 | 2 | 3 | $= -t_1$ |
| 4 | 5 | 6 | $= -t_2$ |
| 7 | 8 | 9 | $= f$ |

   State the canonical maximization linear programming problem represented by the tableau above.

6. Write the canonical slack maximization linear programming problem.

7. State Von-Neumann Minimax Theorem.

8. What is complementary slackness of a dual canonical linear programming problem ?

**Turn over**

9. What is the basic feasible solution of a balanced transportation problem ?

10. Define hyper plane and closed half-space of $\mathbb{R}^n$.

11. What is the mixed strategy of a matrix game ?

12. What is the general balanced assignment problem ?

**Section B (Paragraph/Problem Type)**

*All questions can be answered.*
*Each question carries* 5 *marks.*
*Ceiling* 30 *marks.*

13. Solve graphically : Maximize $f(x, y) = 30x + 50y$ subject to

$2x + y \leq 8,\ x + 2y \leq 10, x \geq 0, y \geq 0.$

14. State Duality Theorem.

15. Solve the transportation problem given below :

| | | | |
|---|---|---|---|
| 7 | 2 | 4 | 10 |
| 10 | 5 | 9 | 20 |
| 7 | 3 | 5 | 30 |
| 20 | 10 | 30 | |

16. Solve the assignment problem given below :

| | | |
|---|---|---|
| 38 | 21 | 34 |
| 41 | 14 | 36 |
| 28 | 20 | 25 |

17. Write the simplex algorithm for Maximum Tableau's.

18. Find the von Neumann value and the optimal strategy for each player in the matrix games below :

$$\begin{bmatrix} -1 & 1 & -1 & 2 \\ -1 & -1 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$$

19. What is a two-person zero-sum matrix game ?

## Section C (Essay Type)

*Answer any* **one** *of the following questions.*
*The question carries* 10 *marks.*

20. Solve the canonical linear programming problem using simplex algorithm to the minimum tableau given below :

| | | | |
|---|---|---|---|
| $x_1$ | 20 | 25 | 300 |
| $x_2$ | 40 | 20 | 500 |
| $-1$ | 1000 | 800 | 0 |
| | $= t_1$ | $= t_2$ | $= g$ |

21. Solve the following maximization problem :

Maximize $f(x, y) = x + 3y$ subject to
$x + 2y \leq 10,\ 3x + y \leq 15,\ x \geq 0,\ y$ is unconstrained.

(1 × 10 = 10 marks)