Roll No…….. **Total No. of Printed Pages: [02]**

Total No. of Questions: [09]

B.Sc. (Hons.) Math (Semester –6th)

LINEAR PROGRAMMING PROBLEM

SUBJECT CODE: -BMATS1-601

Paper ID: [19131226]

Time: 03 Hours **Maximum Marks: 60**

Instruction for candidates:

1. Section A is Compulsory.
2. Attempt any FOUR questions from Section B.
3. Attempt any TWO questions from Section C.

Section – A **(2 marks each)**

Q1. Explain the followings:

a. Define linear independence and dependence of vectors.
b. Define Basic feasible solution.
c. What is standard form of L.P.P.?
d. Define slack and surplus variables.
e. Formulate the dual of the L.P.P.
   Maximize $z = 5x_1+3x_2$ subject to constraints
   $3x_1+5x_2 \leq 15$, $5x_1+2x_2 \leq 10$, $x_1 \geq 0$, $x_2 \geq 0$.
f. State Fundamental Theorem of duality.
g. State Complementary slackness theorem.
h. Consider the 2x2 game $\begin{bmatrix} 4 & 7 \\ 6 & 5 \end{bmatrix}$. Does it have a saddle point?
i. Define pure strategy and mixed strategy in a game.
j. What is Two-person zero sum game and why it is called so?

Section – B **(5 marks each)**

Q2. Use graphical method to solve the L.P.P.

Maximize $z = 50x_1+60x_2$ subject to constraints

$2x_1+3x_2 \leq 1500$, $3x_1+2x_2 \leq 1500$, $0 \leq x_1 \leq 400$, $0 \leq x_2 \leq 400$.

Q3. What is optimal solution of L.P.P. and reduce the following L.P.P. into standard form:

Maximize $z = x_1-3x_2$ subject to constraints

$-x_1+2x_2 \leq 15$, $x_1+3x_2 \geq 10$, x_1 and x_2 are unrestricted in sign.

Q4. Define the following terms:
Unbounded solution, alternate solution and degenerate solution.

Q5. Prove that dual of the dual is the primal.

Q6. Solve the following 3x3 game:

$$\begin{array}{c} \\ \text{Player A} \end{array} \begin{array}{c} \text{Player B} \\ \begin{bmatrix} 3 & -1 & -3 \\ -3 & 3 & -1 \\ -4 & -3 & 3 \end{bmatrix} \end{array}.$$

Section – C **(10 marks each)**

Q7. Anita electric company produces two products X and Y. Products are produced and sold on a weekly basis. The weekly production cannot exceed 25 for product X and 35 for product Y because of limited available facilities. The company employs total of 60 workers. Product X requires 2 man-weeks of labour, while Y requires one man-week of labour. Profit margin on X is Rs. 60 and on Y is Rs. 40. Formulate it as a linear programming problem and solve for maximum profit.

Q8. Explain the procedure of dual simplex method and use it to solve the following L.P.P.:

Maximize $z = 3x_1+x_2$ subject to constraints

$x_1+x_2 \geq 1,\ 2x_1+3x_2 \geq 2,\ x_1,\ x_2 \geq 0.$

Q9. Solve the following game graphically:

Player B

Player A $\begin{bmatrix} 2 & 1 & 0 & -2 \\ 1 & 0 & 3 & 2 \end{bmatrix}$.