WEIGHTAGE TO FORMS OF QUESTIONS
PAPER: GMA-103

UNIT	Name of Units	LA marks	SA1 marks	SA2 marks	VSA marks	Objective type marks	Total marks
No. of questions		3/4/6	5	5	6	3	
Marks alloted		6/12	4	3	1	1	
UNIT-I	Introduction to Linear Programming	6x2=12	4x2=8	3x1=3	1x2=2	1x1=1	26
UNIT-II	Methods of solving Linear Programming Problems	12x1=12	4x2=8	3x2=6	1x1=1	1x1=1	28
UNIT-III	Game Theory	6x2-12	4x1=4	3x2=6	1x3=3	1x1=1	26
Estimated Time	Whole paper	81	45	33	14	7	

Sample question

MATHEMATICS

PAPER-GMA-103

Linear Programming and its Applications

Full marks: 80 Pass mark: 32 Time: 3 hours

The figures in the margin indicate full marks for the questions.

1. Choose and rewrite the correct answer for the following questions: 1x3=3

(a) The number of basic feasible solutions in a system of two linear equations in five variables will be

(i) 10 (ii) at most 10 (iii) at least 10 (iv) 5

(b) The main objective of Linear programming problem (LPP) is to provide a --------------------- to the decision makers

(i) Scientific basis (ii) Maximum number of alternatives

(iii) Minimum number of alternatives (iv) an optimum solution

(c) If a game does not have a saddle point then the solution offers

(i) a mixed strategy (ii) a pure strategy (iii) a pure game

(iv) non optimum

2. Answer the following questions: 1x6=6

   (a) Define Basic solution.
   (b) Define a slack variable.
   (c) Define an extreme points.
   (d) Define two persons zero sum game.
   (e) When a game is said to be a pure game?
   (f) Define Dominance in a rectangular game.

3. Answer the following questions: 3x5=15

(a) A two-person zero-sum game has the following pay-off matrix. Solve the game $\begin{bmatrix} 8 & -1 \\ 3 & 0 \\ 0 & -2 \\ -7 & -4 \end{bmatrix}$

(b) Solve the following game using dominance property

	B_1	B_2	B_3	B_4
A_1	20	15	12	35
A_2	25	14	8	10
A_3	-5	4	11	0

(c) Write the general form of LPP and its Canonical forms.

(d) Write any three applications of LPP.

(e) what is an artificial variable and why is it necessary to introduce it?

4. Answer the following questions: ` 4x5=20

(a) An oil company has two units A and B which produces three different grades of oil super fine, medium and low grade oil. The company has to supply 12,8,24 barrels of super fine, medium and low grade oils respectively per week. It costs the company Rs. 1,000 and Rs. 800 per day to run the units A and B respectively. On a day Unit A produces 6, 2 and 4 barrels and the unit B produces 2,2 and 12 barrels of super fine, medium and low grade oil per day. The manager has to decide on how many days per week should each unit be operated in order to meet the requirement at minimum cost. Formulate the LPP model.

(b) Write the dual of the following linear programming problem

Minimise Z=$3x_1 - 2x_2 + 4x_3$

Subject to

$$3x_1 + 5x_2 + 4x_3 \geq 7$$
$$6x_1 + x_2 + 3x_3 \geq 4$$
$$7x_1 - 2x_2 - x_3 \leq 10$$
$$x_1 - 2x_2 + 5x_3 \geq 3$$
$$4x_1 + 7x_2 - 2x_3 \geq 2$$
$$x_1, x_2, x_3 \geq 0$$

(c) Prove that the intersection of the members of any family of convex sets is again a convex set.

(d) Show that S=$\{(x_1, x_2, x_3) | 2x_1 - x_2 + x_3 \leq 4\} \subseteq R^3$ is a convex set.

(e) Solve the game whose payoff matrix is $\begin{bmatrix} 8 & -3 \\ -3 & 1 \end{bmatrix}$

5. Answer the following questions: (Choose any two) 6x2=12

(a) Find all the basic solutions to the system of linear equations

$$x_1 + 2x_2 + x_3 = 4$$

$$2x_1 + x_2 + 5x_3 = 5$$

Are the solutions degenerate?

(b) Prove that the dual of the dual is the primal.

(c)Solve the following linear programming problem by graphical method

Minimise Z=$2x_1 + x_2$

Subject to the constraints

$$5x_1 + x_2 \leq 50$$
$$x_1 + x_2 \geq 1$$
$$x_2 \leq 4$$
$$x_1, x_2 \geq 0$$

6. Answer the following question: (Choose any one) 12x1=12

(a) Use Simplex method to solve the following LPP.

$$Maximise\ Z = x_1 + 9x_2 + x_3$$
$$Subject\ to \quad x_1 + 2x_2 + 3x_3 \leq 9$$
$$3\,x_1 + 2x_2 + 2x_3 \leq 15$$
$$x_1, x_2, x_3 \geq 0$$

(b) Use big M method to solve the following LPP

$$Maximise\ Z = 3x_1 + 2x_2$$
$$Subject\ to \quad 3\,x_1 + 4x_2 \geq 4$$
$$2x_1 + x_2 \leq 1$$
$$x_1, x_2 \geq 0$$

(c) Use two phase method to solve the following LPP

$$Maximise\ Z = 3x_1 - x_2$$
$$Subject\ to \quad 2\,x_1 + x_2 \geq 2$$
$$x_1 + 3x_2 \leq 3$$
$$x_2 \leq 4 \qquad x_1, x_2 \geq 0$$

7. Answer the following question: (Choose any two) 6x2=12

(a) Explain maximin and minimax Principle for solving a two person zero sum game.

(b) Derive the formula for solving any 2x2 two person zero sum game without any saddle point, payoff matrix for player A be

Player A		Player B	
		B_1	B_2
	A_1	a_{11}	a_{12}
	A_2	a_{21}	a_{22}

© Solve graphically the game whose payoff matrix is $\begin{bmatrix} 2 & 3 & 11 \\ 7 & 5 & 2 \end{bmatrix}$