Bachelor of Science (B.Sc.-III) Fifth Semester

B.Sc. 3530 / MAT-303 - Mathematics Paper-II (Optional)
(Linear Programming and Transportation Problem)

P. Pages : 3 **GUG/W/18/1317**

Time : Three Hours Max. Marks : 60

Notes : 1. Solve all **five** questions.
2. All questions carry equal marks.

UNIT - I

1. a) Solve the following linear programming problem graphically. **6**

Max. $z = x_1 + x_2$

Subject to, $x_1 + 2x_2 \le 2000$

$x_1 + x_2 \le 1500$

$x_2 \le 600$

and $x_1, x_2 \ge 0$

b) Prove that the collection of all feasible solutions to linear programming problems constitutes a convex set whose extreme points correspond to the basic feasible solutions. **6**

OR

c) Express the following L.P.P. in matrix form **6**

Max. $z = 2x_1 + 3x_2 + 4x_3$

Subject to

$x_1 + x_2 + x_3 \ge 5$

$x_1 + 2x_2 = 7$

$5x_1 - 2x_2 + 3x_3 \le 9$

$x_1 \ge 0,\ x_2 \ge 0,\ x_3 \ge 0$

d) A company produces two types of hats. Each hat of the first type requires twice as much labour time as the second type. If all hats or of the second type only, the company can produce a total of 500 hats a day. The market limits daily sales of first and second type of 150 and 250 hats. Assuming that the profits per hat are Rs. 8 for type A and Rs. 5 for type B, formulate the problem as a linear programming model in order to determine the number of hats to be produced of each type. So as to maximize the profit. **6**

UNIT - II

2. a) Solve the following linear programming problem by using Simplex method. **6**

Min. $z = x_2 - 3x_3 + 2x_5$

Subject to

$3x_2 - x_3 + 2x_5 \le 7$

$-2x_2 + 4x_3 \le 12$

$-4x_2 + 3x_3 + 8x_5 \le 10$

$x_2, x_3, x_5 \ge 0$

b) Solve the following linear programming problem by using simplex method. **6**

Max $z = 3x_1 + 2x_2 + 5x_3$

Subject to: $x_1 + 2x_2 + x_3 \le 430$

$3x_1 + 2x_3 \le 460$

$x_1 + 4x_2 \le 420$

and $x_1, x_2, x_3 \ge 0$

OR

c) Solve the following problem by using Big-M method. **6**

Max $z = x_1 + 2x_2 + 3x_3 - x_4$

Subject to: $x_1 + 2x_2 + 3x_3 = 15$

$2x_1 + x_2 + 5x_3 = 20$

$x_1 + 2x_2 + x_3 + x_4 = 10$

and $x_1, x_2, x_3, x_4 \ge 0$

d) Explain the two phase method of solving a L.P. problem with artificial variables. **6**

UNIT - III

3. a) Explain Vogel's approximation method of solving a transportation problem. **6**

b) Determine an initial basic feasible solution to the following Transportation problem by using matrix minima method. **6**

Destination

		D_1	D_2	D_3	D_4	Supply
Origin	O_1	1	2	1	4	30
	O_2	3	3	2	1	50
	O_3	4	2	5	9	20
	Demand	20	40	30	10	100

OR

c) Determine an initial basic feasible solution to the following transportation problem by north-west corner rule. **6**

	D_1	D_2	D_3	D_4	Supply
O_1	6	4	1	5	14
O_2	8	9	2	7	16
O_3	4	3	6	2	5
Demand	6	10	15	4	35

d) Prove that number of basic variable in a transportation problem are at most m+n-1. **6**

UNIT - IV

4. a) Prove that in an assignment problem, if we add (or subtract) a constant to every element of any row (or column) of the cost matrix $\left[c_{ij}\right]$, then an assignment that minimizes the total cost on one matrix will also minimize the total cost on the other matrix. **6**

b) Solve the assignment problem. **6**

	1	2	3	4
I	2	3	4	5
II	4	5	6	7
III	7	8	9	8
IV	3	5	8	4

OR

c) Write a short note on Hungarian assignment method. **6**

d) Five men are available to do five different jobs from past records the time (in hours) that each man takes to do each job is known and given in the following table. **6**

		Job				
		I	II	III	IV	V
	A	2	9	2	7	1
Man	B	6	8	7	6	1
	C	4	6	5	3	1
	D	4	2	7	3	1
	E	5	3	9	5	1

Find the assignment of men to jobs that will minimize the total time taken.

5. Solve **any six** of the following.

a) Define Linear Programming Problem. **2**

b) Prove that a hyperplane in R^n is a convex set. **2**

c) Define entering variable and departing variable in L.P.P. **2**

d) Define artificial variable in L.P.P. **2**

e) Define optimal solution of Transportation problem. **2**

f) Define 'Loop' in a transportation table. **2**

g) Write mathematical formulation of Assignment Problem. **2**

h) Define unbalanced assignment Problem. **2**

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