

- N.B. :** 1. All questions should be compulsory.
2. Figures to the right indicates marks.

Q.1 a. Define feasible solⁿ of Lpp. (1)

OR

Define slack variable.

b. Attempt any Two.

i. Solve by Simplex Method. (7)

$$\begin{aligned} \text{Max. } z &= 2x_1 + 4x_2 \\ \text{Subject to } 2x_1 + 3x_2 &\leq 48 \\ x_1 + 3x_2 &\leq 42 \\ x_1 + x_2 &\leq 21 \\ x_1, x_2 &\geq 0 \end{aligned}$$

ii. Solve the following Lpp by graphical method. (7)

$$\begin{aligned} \text{Maximize } z &= 6x + 7y \\ \text{Subject to } 2x + 3y &\leq 12 \\ 2x + y &\leq 8 \\ x, y &\geq 0 \end{aligned}$$

iii. Prove that dual of dual is primal & write economic interpretation of duality. (7)

Q.2 a. Define balanced & unbalanced transportation problem. (1)

OR

Define optimal solⁿ of transportation problem.

b. Attempt any Two.

1. Find IBFS by North - West corner rule. (7)

Origine →	I	II	III	IV	ai
Source ↓					
1	8	10	7	6	50
2	12	9	4	7	40
3	9	11	10	8	30
bj	25	32	40	23	

2. Find IBFS by VAM.

(7)

Origine →	I	II	III	IV	ai
Source ↓					
1	8	10	7	6	50
2	12	9	4	7	40
3	9	11	10	8	30
bj	25	32	40	23	

3. Write the method of matrix - minima & solve the following problem by matrix - minima method.

		Plants				
		P ₁	P ₂	P ₃	P ₄	Requirement
Machines	M ₁	19	14	23	11	11
	M ₂	15	16	12	21	13
	M ₃	30	25	16	39	19
	Supply	6	10	11	15	

- Q.3 a. Define mathematical formulation of assignment problem.

(1)

OR

Define balanced - unbalanced assignment problem.

b. Attempt Any Two.

1. Write Hungarian method to solve an assignment problem.

(7)

2. Solve the following assignment problem.

(7)

		Jobs				
		I	II	III	IV	V
Machines	A	5	11	10	12	4
	B	2	4	6	3	5
	C	3	12	5	14	6
	D	6	14	4	11	7
	E	7	9	8	12	5

3. Four machines M₁, M₂, M₃, M₄ are to be installed in a machine shop. There are 5 recent places A, B, C, D, E. Because of limited space machine M₂ can not be placed at C & M₃ can not be placed at A. The assignment cost of machine i to place j is ₹100 as shown below

(7)

	A	B	C	D	E
M ₁	4	6	10	5	6
M ₂	7	4	-	5	4
M ₃	-	6	9	6	2
M ₄	9	3	7	2	3

Q.4 a. Define formulation of Lpp. (1)

OR

Define formulation of transportation problem.

b. Attempt Any Two. (7)

1. A toy manufactured has to manufacture scooters & bicycle. Each toy has to undergo processing through two machines, machine A & machine B. A bicycle requires 6 hr. in machine A & 3 hr. in machine B. A scooter requires 4 hr. in machine A & 10 hr. in machine B. Machine A & B are available for almost 120 hr. & 180 hr. respectively. The profit cost per bicycle is ₹ 100 & per scooter is ₹ 800. Formulate the above Lpp for maximization. (7)
2. Write a note on Vogel's approximation method to solve transportation problem & North - west corner rule. (7)
3. A market manager has 5 salesmen & 5 sales district considering the capacities of salesman & nature of district. The marketing manager existment that sales per month is 100 per each salesman in each district would be as follows. (7)

		District				
		A	B	C	D	E
Salesman	32	38	40	28	40	
	40	24	28	21	36	
	41	27	33	30	37	
	22	38	41	36	36	
	29	33	40	35	39	
