

- Note : 1) All questions are compulsory
 2) Attempt any two sub_questions from each question.
 3) Graph papers will be provided on request.
 4) Calculators are allowed .
 5) Figures to the right indicate marks.

Q.1

a) A toy manufacturing company has to manufacture scooter and bicycles. Each toy has to undergo processing through two machines, machine A and machine B. A bicycle requires 6 hours in machine A and 3 hours in machine B. A scooter requires 4 hours in machine A and 10 hours in machine B. Machine A and B are available for atmost 120 hours and 180 hours respectively. The profit per bicycles is Rs.100 and that per scooter is Rs.800. Formulate the above linear programming problem. (5)

b) Solve the following linear programming problem graphically :- (5)
 Minimize $Z = 9x + 5y$
 Subject to :- $2x + y \geq 6$
 $x + y \geq 5$
 $x \geq 0, y \geq 0$

c) Solve the following Linear programming problem using simplex method upto first iteration :- (5)
 Maximize $Z = x_1 + x_2$
 Subject to :-
 $3x_1 + 2x_2 \leq 6$
 $x_1 + 4x_2 \leq 4$
 $x_1 \geq 0, x_2 \geq 0$

Q.2

a) Determine the basic feasible solution to the following transportation problem using North-West corner rule :- (5)

Destination :-	P	Q	R	S	Supply
Source:- M	11	13	17	14	250
N	16	18	14	10	300
O	21	24	13	10	400
Demand :-	200	225	275	250	

b) Find initial basic feasible solution by Least Cost Entry method for the following transportation problem. (5)

To.:-	W	X	Y	Supply
From :- A	16	24	24	152
B	48	72	48	164
C	24	48	72	154
Demand :-	144	204	82	

- c) Find initial basic feasible solution by Vogel's approximation method for the following transportation problem :-

(5)

Warehouse:-	W ₁	W ₂	W ₃	W ₄	Capacity
Plant :- O ₁	21	16	25	13	11
O ₂	17	18	14	23	13
O ₃	32	27	18	41	19
Requirement :-	6	10	12	15	

Q.3

- a) 5 men are available to do five different jobs. From the past record the time (in hours) that each man takes to perform each job is known and is given in the following table :-

(5)

Job :-	J ₁	J ₂	J ₃	J ₄	J ₅
Man :-A	2	9	2	7	1
B	6	8	7	6	1
C	4	6	5	3	1
D	4	2	7	3	1
E	5	3	9	5	1

- b) Solve the following Assignment problem :-

(5)

A company has 4 machines on which to do 3 jobs. Each job can be assigned to one and only one machine. The cost of each job on each machine is given in the following table :-

Machine :-	M ₁	M ₂	M ₃	M ₄
Job :- J ₁	18	24	28	32
J ₂	8	13	17	19
J ₃	10	15	19	22

- C) Seven jobs each of which has to go through the machines P and machine Q in the order PQ have the following processing time in hours.:- (5)

Job:-	A	B	C	D	E	F	G
Machine P:-	3	12	15	6	10	11	9
Machine Q:-	8	10	10	6	12	1	3

Q.4

- a) Two different kinds of food A and B are being considered to form a weekly diet. The minimum weekly requirement of fats , carbohydrates and proteins are 16 , 25 and 15 units respectively. One kg of food A has 50 units of fats , 15 units of carbohydrates and 8 units of proteins . The corresponding figures for one kg of food B are 7 , 10 and 9 units respectively . The price of food A is Rs. 4/- per kg and that of B is Rs.3/- per Kg. Formulate the linear programming problem. (5)
- b) An iron and steel company has 3 open heat furnaces and 5 rolling mills. Transportation cost (Rs. per quintal) for transporting steel from furnaces to rolling mills is shown in the table below :- (5)

Rolling Mills :-	1	2	3	4	5	Capacity
Furnaces I :-	4	2	3	2	6	8
II :-	5	4	5	2	1	12
III :-	6	5	4	7	3	14
Requirement :-	4	4	6	8	8	

Solve the above transportation problem to minimize the transportation cost.

- c) A departmental has five operators A,B,C,D and E to be assigned to five machines M_1 , M_2 , M_3 , M_4 and M_5 with the condition that operator A cannot be assigned to machine M_3 and operator C cannot be assigned to machine M_4 . The assignment costs are given in the table below :- (5)

	M_1	M_2	M_3	M_4	M_5
A	7	7	--	4	8
B	9	6	4	5	6
C	11	5	7	--	5
D	9	4	8	9	4
E	8	7	9	11	3

Determine the optimum assignment so as to minimize the total cost.