Answer All Five Questions   **Time: 03 Hours**

Q1.

A company has four production centers A, B, C and D producing a certain product at a level of capacity of 140, 260, 360 and 220 units respectively. The products produced are distributed among four sales centers W, X, Y and Z demanding the product of 200, 320, 250 and 210 units respectively. The following table shows the per unit transportation cost from production centers to sales centers.

	W 200	X 320	Y 250	Z 210
A 140	48	60	56	58
B 260	45	55	53	60
C 360	50	65	60	62
D 220	52	64	55	61

1. What is the total minimum transportation cost for initial allocation? (Use the least cost method to find an initial feasible solution).

2. What is the total optimum transportation cost? (Use the MODI method to find optimum solution).

(Total 20 Marks)

Q2.

(1) A manufacture of complex electronic equipment has just received a sizable contract and plans to subcontract part of the job. He has requested bids for 6 subcontracts from 3 firms. Each job is sufficiently large and any firm can take only one job. The following table shows the bids as well as the cost estimates (in lakhs of rupees) for doing the job internally. **Not more than three job can be assigned/performed internally**.

Firm \ Job	1	2	3	4	5	6
1	44	67	41	53	48	64
2	46	69	40	45	45	68
3	43	73	37	51	44	62
Internal	50	65	35	50	46	63

Find the optimal assignment that will result in minimum total cost.

(2) A company is faced with the problem of assigning 4 machines to 6 different jobs machine to one job only). The profits are estimated as follows:

Job	Machine			
	A	B	C	D
1	3	6	2	6
2	7	1	4	4
3	3	8	5	8
4	6	4	3	7
5	5	2	4	3
6	5	7	6	4

Required: Solve the problem to maximize the total profits.

(Total 20 M:

Q3.

Management Ltd. has planned to operate a project in the urban area of Batticaloa noted that following activities are needed to conduct for the success of the project activities and other related information are given below:

Activity	Preceding Activity	Normal		Crashed	
		Weeks	Cost (Rs.)	Weeks	Cost (R
A	-	3	6,000	1	8,
B	-	5	8,000	2	14,
C	-	2	2,000	1	4,
D	A, B	4	4,000	1	5
E	A, B, C	6	10,000	4	13
F	D	9	8,000	6	14,
G	D, E	4	6,000	2	12,
H	E	2	2,000	1	4
I	G, H	1	1,000	1	1,
J	I, F	5	3,000	2	3,
K	J	7	7,000	3	11,
L	K	8	8,000	5	14,

You are required to draw the network diagram for the above project and fin answers for the following questions:

1. Find the normal duration of this project.

2. Find the critical path of the project under the normal circumstance.

3. Which activity is allowed to save/reduce maximum weeks?

4. Which activity has lowest cost slop?

5. Is there a possibility to reduce the duration of this project by 50% with extra cost the normal duration?

6. Find the minimum duration of this project.

7. Find the cost of this project at the minimum duration.

8. If this project has to be completed in 20 weeks, find the minimum cost of the project.

9. If this project has to be completed in 22 weeks, find the minimum cost of the project.

10. Find the cost of this project under the normal circumstance.

(Total 20 Marks)

Q4.

(1) Suppose Q stands for ordering quantity and the annual demand for the product is 20,000 units. Assume that ordering cost is Rs.75/=. The cost of holding per unit is 60% of the unit cost of Rs.20/=. Use this information to answer the following questions:

(a) Show that total annual cost of maintaining the inventory is,

$$Y(Q) = 6Q + 1,500,000/Q$$

(b) Find the Economic order quantity Q*, and the total cost corresponding to that value of Q*.

(c) Find the total cost if orders are placed for 1000 units.

(d) Find the total cost if orders are placed for 1500 units.

(10 Marks)

(2) A firm uses a material in the production process of its products which it orders from a local supplier. The following information are given below:

C_H = Rs. 12/=

Daily Usage (d) = 4 units

Working days per year is 300 days

Ordering cost per order (Co) = 200/N + 40

N = Number of Orders

Find the 'N' that minimize the Total Inventory Cost and EOQ of the Material.

(05 Marks)

(3) ABC sells a particular brand of personal computer. It costs the store Rs. 450/= each time it places an order with the manufacturer for the personal computers. The annual cost of carrying the PCs in inventory is Rs.170/=. The store manager estimates the annual demand for the PCs will be 1,200 units.

(a) Determine the optimal order quantity and the total minimum inventory cost.

(b) Assume that shortages are allowed and that the shortage cost is Rs. 600 per unit per year. Compute the optimal order quantity and the total minimum inventory cost.

(05 Marks)

(Total 20 Marks)

Q5.

(1) Solve the following Linear Programming problem through simplex method:

Objective Function: Maximize $Z = 3x_1 + 5x_2 + 7x_3$

subject to the constraints:

$$2X_1 + 4X_2 + 5X_3 \leq 12$$

$$X_1 + 6X_2 + 3X_3 \geq 16$$

$$5X_1 + 2X_2 + X_3 = 7$$

where $x_1 \geq 0, x_2 \geq 0,$ and $x_3 \geq 0$

(10 M

(2) Given the following Linear Programming Problem setup/develop the initial sir table only (**the first table only**):

Objective Function: Minimize $Z = 4x_1 + 12x_2 + 5x_3$

subject to the constraints:

$$X_1 + 3X_2 + 8X_3 = 5$$

$$2X_1 + 9X_2 + 4X_3 \leq 14$$

$$3X_1 + 5X_2 + X_3 \geq 7$$

$$X_2 = 5$$

where $x_1 \geq 0, x_2 \geq 0,$ and $x_3 \geq 0$

(02 M

(3) Given the following Graphical LP Problem

$$\text{Mini } Z = 2x_1 + 8x_2$$

subject to the constraints:

$$X_1 + 2X_2 \geq 6$$

$$10X_1 + 2X_2 \geq 20$$

$$4X_1 + 2X_2 = 16$$

where $x_1 \geq 0,$ and $x_2 \geq 0$

(a) Plot the constraints and identify the feasible region.
(b) Solve graphically for Z minimization.
(c) What happens to the feasible region if the first constraint becomes an e
   constraint?

(08 N

(Total 20 N