[Time: 3:00 Hours] [Marks:80]

Please check whether you have got the right question paper.

N.B: 1. Question No.1 is compulsory.

2. Attempt any 3 questions from question 2 to 6.

3. Figure to the right indicates marks.

4. Use of scientific calculator is allowed.

5. mixing of sub-questions not allowed

Q.1) a) Five jobs are to be processed at three machines A, B and C in the order ABC. The time taken by each job on the three machines is given below. Each machine can process one job at a time. Determine the optimum sequence for the jobs and total elapse time. Also find the idle time for each machine. **[10]**

Task	Jobs				
	1	2	3	4	5
A	7	12	11	9	8
B	8	9	5	6	7
C	11	13	9	10	14

b) A house wife makes sauce and chutney which she sells to the local store each week. She obtains a profit of Rs 4 and Rs 5 for a kg of chutney and sauce respectively. One kg of chutney requires 3 Kg of tomatoes and 4 cups of vinegar and one kg of sauce requires 5 kg of tomatoes and 2 cups of vinegar. She can buy 24 kg tomatoes and 3 bottles of vinegar at discounted price each week. The 3 bottles provide 16 cups of vinegar. In order to make it worthwhile the store insists on buying at least 3 kg of goods each week. What combination should be made in order to maximize profit. Form a Mathematical model and use graphical method to get solution **[10]**

Q.2 a) Solve the following using Simplex Method **[10]**
Maximize $Z = 12X1 + 3X2 + X3$
Subject to
$10X1 + 2X2 + X3 <= 100$
$7X1 + 3X2 + 2X3 <= 77$
$2X1 + 4X2 + X3 <= 80$
$X1, X2, X3 >= 0$

b) Find an initial basic feasible solution to the following transportation problem by VAM Method **[10]**

Plant	Distribution centre				Supply
1	2	3	11	7	6
2	1	0	6	1	1
3	5	8	15	9	10
Requirement	7	5	3	2	

Page **1** of **3**

Q.3) a) Solve the following assignment problem and find the optimum assignment that will result in the minimum man hours needed.

				Jobs		
		A	B	C	D	E
Workers	P	10	12	15	12	8
	Q	7	16	14	14	11
	R	13	14	7	9	9
	S	12	10	11	13	10
	T	8	13	15	11	15

b) Find the optimal strategies and value of the game for the following problem: **[10]**

	Player B		
Player A	1	-1	-1
	-1	-1	3
	-1	2	-1

Q.4) a) The data collected in running a machine, the cost of which is Rs 60,000 are given

Year	1	2	3	4	5
Resale Value (Rs.)	42000	30000	20400	14400	9650
Cost of spare (Rs.)	4000	4270	4880	5700	6800
Cost of Labour	14000	16000	18000	21000	25000

Determine the optimum of replacement of the Machine?   **[10]**

b) The following are set of activities and different time estimates for a project in days

Activity	1-2	1-3	1-4	2-5	3-5	4-6	5-6
Optimistic(to)	1	1	2	1	2	2	3
Most likely™	1	4	2	1	5	5	6
Pessimistic(tp)	7	7	8	1	14	8	15

i) Draw the network.
ii) Determine the expected duration and variance of each activity.
iii) Find the expected project length.
iv) Calculate the variance and standard deviation of project length. If the project due date is 18 weeks, what is the probability of not meeting the due date [P(z=0.33)= 0.623]   **[10]**

Q.5)a) A salesman has to visit five cities A, B., C, D, E. The distance between 5 cities are as below. If the salesman starts from city A and has to come back to city A which route will he select so that the total time to visit all cities will be minimum? **[10]**

From		TO CITY				
		A	**B**	**C**	**D**	**E**
city	**A**	0	7	6	8	4
	B	7	0	8	5	6
	C	6	8	0	9	7
	D	8	5	9	0	8
	E	4	6	7	8	0

b) Solve the following problem using Dual Simplex method: **[10]**

Minimize $Z = 2x_1 + 2x_2 + 4x_3$
Subject to $2x_1 + 3x_2 + 5x_3 \geq 2$
$3x_1 + x_2 + 7x_3 \leq 3$
$x_1 + 4x_2 + 6x_3 \leq 5$
$x_1, x_2, x_3 \geq 0$

Q.6) a) Solve the following LPP by Big-M method:
Maximize $Z = 3x_1 - x_2$

Subject to $2x_1 + x_2 \leq 2$
$x_1 + 3x_2 \geq 3$
$x_2 \leq 4$
$x_1, x_2 \geq 0$

b) Consider the data shown below for a project **[10]**

i) Draw the network diagram and determine the project duration and the critical path

ii) Determine total float, free float and independent float for each activity

Activity	1-2	1-3	1-4	2-5	3-5	4-6	5-6
Duration(weeks)	2	4	3	1	6	5	7

Page **3** of **3**