

**Duration: 3 Hours**

**Total Marks: 80**

**N. B.**

1. Question Number **ONE** is compulsory.
2. Attempt any **THREE** questions from remaining **FIVE** questions.
3. Assume suitable data if necessary.

- Q.1.** Attempt any four questions from the followings **20**
- a Briefly explains the reasons for replacement of equipment? **5**
  - b Explain dynamic programming and state its applications? **5**
  - c How assignment models are different from transportation models? **5**
  - d Generate a sequence of five two digit random numbers using mixed congruential generator with  $a=25$ ,  $c=55$ , seed =48 and  $m=100$  **5**
  - e Write short note on Bellman’s principle of optimality **5**

- Q.2.** a Five jobs are performed, first on machine X and then on Y. Time in hours taken by each job on each machine is given below: **10**

Machines	Jobs				
	A	B	C	D	E
X	12	4	20	14	22
Y	6	14	16	18	10

Determine the optimum sequence of job that minimizes the total elapsed time to complete the jobs.

- b. A company has three plants A, b and C and three ware houses P, Q and R. **10**  
 the transportation cost per unit, demand of each ware house and capacity of each plant are as given in the table below. Find the optimum transportation plan:

Plant	Warehouse			Capacity
	P	Q	R	
	Transportation cost(Rs.)			
A	50	80	100	400
B	22	90	40	500
C	70	100	55	300
Demand	400	400	400	

- Q.3.** a. A manufacturing company is engaged in producing three types of products: A, Band C. The production department produces each day components sufficient to make 50units of A, 25units of B and 30units of C. The management is confronted with the problem of optimizing the daily production of the products in the assembly department, where only 100 man-hours are available daily for assembling the products. The following additional information is available: **10**

Type of product	Profit per unit of the product(Rs.)	Assembly time per product (hrs.)
A	12	0.8
B	20	1.7
C	45	2.5

The company has a daily order commitment for 20units of A, total of 15units of B and C. formulate the problem as an LPP model and solve.

- b. For the given game below determine the optimal strategies for A by graphical method: **10**

		<b>B</b>	
		I	II
<b>A</b>	I	4	2
	II	3	8
	III	2	12

- Q.4.** a. Solve the following LPP by using Two Phase method: **10**

$$\text{Minimize: } z = 12x_1 + 20x_2$$

Subjected to:

$$6x_1 + 8x_2 \geq 100$$

$$7x_1 + 12x_2 \geq 120$$

$$x_1, x_2 \geq 0$$

- b. A firm is using a machine whose purchase price is Rs. 13000/-. The installation charges is Rs. 3600/- and the machine has a scrap value of only Rs. 1600/- because the firm has a monopoly of this type of work. The maintenance cost in various years is given in following table; **10**

Year	1	2	3	4	5	6	7	8	9
Cost (Rs.)	250	750	1000	1500	2100	2900	4000	4800	6000

The firm wants to determine after how many years should the machine be replaced on economic consideration, assuming that the machine replacement can be done only at the year ends.

- Q.5.** a. A captain of a cricket team has to allot five middle order batting positions to five batsmen. The average runs scored by each batsman at these positions are given in the table: **10**

		Batting position				
		III	IV	V	VI	VII
Batsman	A	40	40	35	25	50
	B	42	30	16	25	27
	C	50	48	40	60	50
	D	20	19	20	18	25
	E	58	60	59	55	53

Make the assignment so that the expected total average runs scored by these batsmen are maximum.

- b A super market has two sales girls at the sales counters. If the service time for each customer is exponential with a mean of 4 minutes and if the people arrive in a Poisson fashion at the rate of 10 an hour. Calculate: **10**
1. Probability that there is no customer in the system,
  2. Average no. of customers in the queue,
  3. Average no. of customers in the system,
  4. Average waiting time in the queue,
  5. Utilization factor

- Q.6** a Observations of past data show the following patterns in respect of inter-arrival durations and service durations in a single channel queuing system. Using the random numbers simulate the queue behavior for a period of 60minutes and estimate the probability of the service being idle and mean time spent by a customer waiting to be served: **10**

Inter Arrival time		Service time	
Minutes	Probability	Minutes	Probability
2	0.15	1	0.1
4	0.23	3	0.22
6	0.35	5	0.35
8	0.17	7	0.23
10	0.10	9	0.1

Use the following random numbers:

93,81,29,51,14,87,17,40,72,90,11,30,10,38,68,52,21,10,99,71

- Q.6** b The profit for three markets as a function of sales effort expended is given in the table below. How will you distribute a given number of salesmen so as to maximize the profit: **10**

No. of salesman	Markets		
	I	II	III
0	40	50	50
1	42	60	60
2	50	65	70
3	60	75	80
4	66	85	88
5	75	95	105
6	82	110	115
7	90	120	130