

OPERATIONS RESEARCH

Time : Three Hours

Maximum : 75 Marks

SECTION-A (20 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(10 x 2 = 20)

- 1 What do you mean by a general LPP?
- 2 Define optimal solution.
- 3 What do you mean by an unbalanced T.P?
- 4 Define Holding cost.
- 5 Define Group Replacement.
- 6 What is present worth factor?
- 7 What are the basic characteristics of a queuing system?
- 8 Define Processing time.
- 9 What is a dummy activity and when is it needed?
- 10 What are the three main phases of a project?

SECTION - B (25 Marks)

Answer ALL Questions

ALL Questions Carry EQUAL Marks

(5 x 5 = 25)

- 11 a A firm manufacturer two types of products A and B and sells them at a profit of Rs. 2 on type A and Rs. 3 on type B. Each product is processed on two machines M_1 and M_2 . Type A requires 1 minute of processing time on M_1 and 2 minutes on M_2 . Type B required 1 minute on M_1 and 1 minute on M_2 . Machine M_1 is available for not more that 6 hours 40 minutes while machine M_2 is available for 10 hours during any working day. Formulate the problem as a LPP so as to maximize the profit.

OR

- b Explain the formulation of a dual problem.
- 12 a Obtain an Initial basic feasible solution to the following transportation problem using North West Corner Rule :

	D	E	F	G	Available
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400

Requirement 200 225 275 250

OR

- b A manufacturer has to supply his customer with 600 units of his product per year. Shortages are not allowed and the storage cost amounts to Re.0.60 per unit per year. The set-up cost per run is Rs. 80.000. Find the optimum run-size and the minimum average yearly cost.
- 13 a A firm is considering replacement of a machine, whose cost rice is Rs. . 12,200 and the scrap value, Rs. 200. The running (maintenance and operating) cost in rupees are found from experience to be as follows :

Year	1	2	3	4	5	6	7	8
Running cost (Rs.) :	200	500	800	1200	1800	2500	3200	4000

When should the machine be replaced?

OR

- b Let $v = 0.9$ and Initial price is Rs. 5,000. Running cost varies as follows :

Year	1	2	3	4	5	6	7
Running cost (Rs.) :	400	500	700	1000	1300	1700	2100

What would be the optimum replacement interval?

- 14 a In a public telephone booth the arrivals are on the average 15 per hour. A call of the average takes 3 minutes. If there is just one phone, find (i) expected number of callers in the booth at any time (ii) the proportion of the time the booth is expected to be Idle?

OR

- b In a factory, there are six jobs to perform, each of which should go through two machines A and B, in the order A, B. The processing times for the jobs are given below. You are required to determine the sequence for performing the jobs that would minimize the total elapsed time, J. What is the value of Time?

Jobs	:	J_1	J_2	J_3	J_4	J_5	J_6
Machine A	:	1	3	8	5	6	3
Machine B	:	5	6	3	2	2	10

- 15 a Draw a network for the following project :

Activity	:	A	B	C	D	E	F	G	H	I	J	K
Predecessor	:	-	-	-	A	B	B	C	D	E	H, I	F, G

OR

- b Distinguish between PERT and CPM.

SECTION - C (30 Marks)

Answer any **THREE** Questions

ALL Questions Carry **EQUAL** Marks (3 x 10 = 30)

- 16 Solve the following LPP graphically :

$$\text{Maximize } Z = 100x_1 + 40x_2$$

$$\text{Subject to } 5x_1 + 2x_2 \leq 1000$$

$$3x_1 + 2x_2 \leq 900$$

$$x_1 + 2x_2 \leq 500 \text{ and } x_1, x_2 \geq 0$$

- 17 Solve the following Transportation problem :

	D_1	D_2	D_3	D_4	Available
O_1	5	3	6	2	19
O_2	4	7	9	9	37
O_3	3	4	7	5	34

Requirement 16 18 31 25

- 18 Fleet cars have increased their costs as they continue in service due to increased direct operating cost (gas and oil) and increased maintenance (repairs, tyres, batteries, etc.). The initial cost is Rs. 3500 and the trade-in-value drops as time passes until it reaches a constant value of Rs. 500. Given the cost of operating, maintaining and the trade-in-value, determine the proper length of service before cars should be replaced.

Year of service	:	1	2	3	4	5
Year end trade in value	:	1900	1050	600	500	500
Annual operating cost	:	1500	1800	2100	2400	2700
Annual maintaining cost	:	300	400	600	800	1000

- 19 In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average 36 minutes. Calculate the following : (i) the mean queue size (line length), and (ii) the probability that the queue size exceeds 10. If the input of trains increases to an average 33 per day. What will be the change in (i) and (ii)?

- 20 The following table shows the jobs of a network long with their time estimates :

Activity	:	1-2	1-6	2-3	2-4	3-5	4-5	6-7	5-8	7-8
a	:	1	2	2	2	7	5	5	3	8
m	:	7	5	14	5	10	5	8	3	17
b	:	13	14	26	8	19	17	29	9	32

Draw the project network and the probability that the project is completed in 40 days.