Roll No. ..... Total Pages : 07

BT-8/D-13 **8850**

OPERATION RESEARCH

ME-416-E

Time : Three Hours] [Maximum Marks : 100

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. All questions carry equal marks.

Unit I

1. (a) Two products A and B are to be manufactured one single unit of product A requires 2.4 minutes of punch press time and 5 minutes of assembly time. The profit for product A is Re. 0.60 per unit. One single unit of product B requires 3 minutes of punch press time and 2.5 minutes of welding time. The profit for product B is Re. 0.70 per unit. The capacity of the punch press department available for these products is 1,200 minutes/week. The welding

department has an idle capacity of 600 minutes/week and assembly department has 1,500 minutes/week.

(i) Formulate the problem as linear programming problem.

(ii) Determine the quantities of products A and B so that total profit is maximized.

(b) Write short notes on the following :

(i) Sequencing models in OR

(ii) Inventory models in OR. **2×10=20**

2. (a) A company is manufacturing product Y and Z. One unit of product Y requires 4.8 minutes of machining and 10 minutes of assembly time. The profit for product Y is Re. 0.70 per unit. Product Z requires 6 minutes of machining time and 5 minutes of welding time for manufacturing one unit. Profit for Z is Re. 0.90 per unit. The capacity of the machining department available for these products is 1,400 minutes per week. The welding department has an idle capacity of 800 minutes/week and assembly department has 1,800 minutes/week.

Determine the quantities of Y and Z so that total profit is maximized.

(b) Dual of dual is primal. Discuss. **2×10=20**

Unit II

3. The following table gives data on normal time and cost and crashed time and cost for a project :

Activity	Time		Cost (Rs.)	
	Normal	Crash	Normal	Crash
1-2	9	4	1300	2400
1-3	15	13	1000	1380
2-3	7	4	7000	1540
2-4	7	3	1200	1920
2-5	12	6	1700	2240
3-6	12	11	600	700
4-5	6	2	1000	1600
5-6	9	6	900	1200

Find the optimum project time and corresponding minimum total project cost by crashing appropriate activities in proper order. Show the network on time-scale at each step.

The indirect cost per day is Rs. 400.

4. A steel company has three furnaces and five rolling mills. Transportation cost (rupees per quintal) for sending steel from furnaces to rolling mills are given in the following table :

Furnaces	M1	M2	M3	M4	M5	Availability
A	4	2	3	2	6	8
B	5	4	5	2	1	12
C	6	5	4	7	3	14
Requirement	4	4	10	8	8	

(Quintal)

How should they meet the requirement ? **20**

Unit III

5. Write notes on the following :

(i) Minimization of maximum loss

(ii) Maximization of minimum gain

(iii) Rational Decision Making

(iv) Criterion of optimality. **20**

6. Five jobs 1, 2, 3, 4 and 5 are to be assigned to five persons A, B, C, D and E. The time taken in minutes by each person given in the following matrix :

	1	2	3	4	5
A	16	13	17	19	20
B	14	12	13	16	17
C	14	11	12	17	18
D	5	5	8	8	11
E	5	3	8	8	10

Determine Optimal Schedule with time. **20**

Unit IV

7. (a) In relation to Game Theory, explain the following terms :

(i) Pay off matrix

(ii) Saddle point

(iii) Competitive games

(iv) Pure and Mixed Strategies.

(b) In a service department manned by one server, on an average 8 customers arrive every 5 minutes while the service can server to customer in the same time. Assuming Poisson distribution for arrival and exponential distribution for service rate determine :

(i) Average no. of customer in systems

(ii) Average no. of customer in queue

(iii) Average time a customer spent in system

(iv) Average time a customer waits before being served. **2×10=20**

8. (a) The milk plant at a city distributes its products by trucks, loaded at the loading dock. It has its own fleet of trucks plus trucks of a private transport company. This transport company has complained that sometimes its trucks have to wait in line and thus the co. loses money paid for a truck and driver that is only waiting. The company has asked the milk plant

management either to go in for a second loading dock or discount prices equivalent to the waiting time.

The following data is available.

Average Arrival Rate (all trucks) = 3 per hour

Average Service Rate = 4 per hour.

The transport co. has provided 40% of the total number of trucks. Determine :

(i) The probability that a truck has to wait.

(ii) The waiting time of a truck that waits.

(iii) The expected waiting time of co's trucks per day.

(b) What are the assumptions underlying common queuing models ?

(c) Why must the service rate be greater than the arrival rate in a single channel queuing system ? **10+5+5=20**