

OPERATIONS RESEARCH

Time: 3 Hours

Max. Marks: 75

*Answer Any FIVE Questions, one from each unit
Question No. 11 is Compulsory*

UNIT-I

1. a) Discuss the various phases in solving an OR problem. 6M
 b) Use simplex method to minimize 6M
 $Z = x_1 - 3x_2 + 2x_3$
 Subject to $3x_1 - x_2 + 2x_3 \leq 7$
 $-2x_1 + 4x_2 \leq 12$
 $-4x_1 + 3x_2 + 8x_3 \leq 10$
 $x_1 \geq 0, x_2 \geq 0, x_3 \geq 0$

(OR)

2. a) How the degeneracy is resolved in LPP? 6M
 b) Use graphical method to solve the following 6M
 Maximize $z = x_1 + x_2/2$
 Subject to $3x_1 + 2x_2 \leq 12$
 $5x_1 \leq 10, x_1 + x_2 \leq 18$
 $-x_1 + x_2 \geq 4, x_1, x_2 \geq 0$

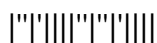
UNIT-II

3. a) Solve the following cost minimizing transportation problem. 6M

	D1	D2	D3	D4	D5	D6	Available
O1	2	1	3	3	2	5	50
O2	3	2	2	4	3	4	40
O3	3	5	4	2	4	1	60
O4	4	2	2	1	2	2	30
Req	30	50	20	40	30	10	180

- b) Find the sequence that minimizes the total time required in performing the following jobs on three machines in order A-B-C as shown in the below table. Also find the total elapsed time. 6M

		Jobs					
		1	2	3	4	5	6
Machines	A	8	3	7	2	5	1
	B	3	4	5	2	1	6
	C	8	7	6	9	10	9



(OR)

4. a) 5 machines are to be assigned for 5 jobs. The cost of assigning each job to each machine is given in the following matrix. Which machine to be assigned to which job to minimize. The total cost of assignment. 6M

Jobs/ Machines	J ₁	J ₂	J ₃	J ₄	J ₅
M ₁	11	17	8	16	20
M ₂	9	7	12	6	15
M ₃	13	16	15	12	16
M ₄	21	24	17	28	26
M ₅	14	10	12	11	15

- b) When do you say a solution to a transportation problem is degenerate? Explain with example? 6M

UNIT-III

5. a) What are the essential characteristics of dynamic programming problem? 6M
 b) Define simulation. Explain utility of simulation to solve inventory problems. 6M

(OR)

6. a) Solve the following LP problem by dynamic programming approach 6M

$$\begin{aligned} &\text{Maximize } Z = 3x_1 + 5x_2 \\ &\text{Subject to the constraints} \\ &\quad x_1 \leq 4 \\ &\quad x_2 \leq 6 \\ &\quad 3x_1 + 2x_2 \leq 18 \\ &\quad x_1, x_2 \geq 0 \end{aligned}$$

- b) Discuss the relation between linear and dynamic programming. 6M

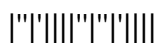
UNIT-IV

7. a) Explain the characteristics of waiting lines. 6M
 b) Briefly explain 6M
 i. pure strategy
 ii. mixed strategy
 iii. optimal strategy

(OR)

8. a) Explain the following: 6M
 i. Competitive games
 ii. Two person zero sum game
 b) Solve the following game using dominance principle 6M

		Player B			
		1	2	3	4
Player A	I	19	6	7	5
	II	7	3	14	6
	III	12	8	18	4
	IV	8	7	13	-1



UNIT-V

9. Compare and contrast CPM and PERT. Under what conditions would you recommend the scheduling by PERT? Justify your answer with reasons. 12M

(OR)

10. a) State some of the important distributions of arrival intervals and service time. 6M

b) In a store with one server, 10 customers arrive on an average of 6 minutes. Service is done for 12 customers in 7 minutes, find 6M

- i. The average number of customers in the system
- ii. The average queue length
- iii. The average time a customer spends in the store.
- iv. The average time a customer waits before being served.

11. **CASE STUDY** 15M

A harbor has a single dock to unload the containers from the incoming ships. The arrival rate of ships at the harbor follows Poisson distribution and the unloading time for the ships follow exponential distribution and hence, the service rate also follows Poisson distribution. The arrival rate and service rate are 8 ships per week and 14 ships per week, respectively. Find the following

- i. Utilization factor of the dock
- ii. Average number of waiting ships in the queue
- iii. Average number of waiting ships in the system
- iv. Average waiting time per ship in the queue
- v. Average waiting time per ship in the system

