

Total No. of Questions : 12]

SEAT No. :

P780

[Total No. of Pages : 5

[4659]-132

**B.E. (Production Engg.) (Semester - I)**

**OPERATIONS RESEARCH**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Attempt questions 1 or 2, 3 or 4, and 5 or 6 from section I.*
- 2) *Attempt questions 7 or 8, 9 or 10, and 11 or 12 from section II.*
- 3) *Draw neat flowcharts or state algorithms, if needed.*

**SECTION - I**

**UNIT - I**

**Q1) a)** Solve by Simplex method : **[10]**

$$\text{Maximize } Z = 4x_1 + 10x_2$$

$$\text{Subject to } 2x_1 + x_2 \leq 50$$

$$2x_1 + 5x_2 \leq 100$$

$$2x_1 + 3x_2 \leq 90$$

$$x_1, x_2 \geq 0$$

- b) A person requires 10, 12 and 12 units of chemicals A, B and C respectively for his garden. A liquid product contains 5, 2 and 1 units of A, B and C respectively per jar. A dry product contains 1, 2 and 4 units of A, B and C per carton. If the liquid product sells for ₹ 3 per jar and the dry product sells for ₹ 2 per carton. How many of each should he purchase in order to minimize the cost and meet the requirement? (Only formulate LPP. Do not solve it) **[7]**

**P.T.O.**

**Q2) a)** Solve by Dual Simplex method : **[10]**

$$\begin{aligned}
 \text{Minimize : } Z = & \quad 20x_1 \quad + \quad 16x_2 \\
 & \quad x_1 \quad + \quad x_2 \quad \geq 12 \\
 & \quad 2x_1 \quad + \quad x_2 \quad \geq 17 \\
 & \quad x_1 \quad \geq 2.5 \\
 & \quad \quad \quad x_2 \quad \geq 6 \\
 & \quad x_1 \quad , \quad x_2 \quad \geq 0
 \end{aligned}$$

**b)** Discuss ANY ONE : **[7]**

- i) Zero - One Programming
- ii) Sensitivity Analysis

### UNIT - II

**Q3) a)** Discuss Reduced Matrix method of assignment model. **[6]**

**b)** A company has three factories F1, F2, and F3 and goods are supplied to 4 different cities D1, D2, D3 and D4. The table shows per unit cost of transportation. The Supply capacities and demand are as shown in the table. Find the optimal solution.

Factories	Consumption centers				Capacity
	D1	D2	D3	D4	
F1	13	25	12	21	18
F2	18	23	14	9	27
F3	23	15	12	16	21
Demand	14	12	23	17	

**[10]**

**Q4) a)** Four operators are to be assigned one job each. The matrix represents the cost for assignments for five jobs. Find the optimal assignments. Which job is unassigned? **[10]**

Operators	Jobs				
	I	II	III	IV	V
A	4	6	10	5	6
B	7	4	-	5	4
C	-	6	9	6	2
D	9	3	7	2	3

**b)** Discuss : u-v method. **[6]**

**UNIT - III**

- Q5)** a) What is Goal programming? Distinguish it from linear programming. [6]  
 b) A distance network consists of 11 nodes which are distributed as shown in following table. A person wants to go from city 1 to city 11. Find the shortest path by DYNAMIC Programming. [11]

Arc	Distance	Arc	Distance	Arc	Distance	Arc	Distance
1-2	8	3-6	8	6-9	3	9-11	5
1-3	7	3-7	4	6-10	5	10-11	8
1-4	4	4-7	6	7-9	5		
1-5	2	5-7	8	7-10	1		
2-6	4	5-8	1	8-10	5		

- Q6)** a) Discuss Geometric programming and its applications. [6]  
 b) Discuss branch and bound technique of Integer programming. [6]  
 c) Discuss state and stage as used in dynamic programming. What is recursive function. [5]

**SECTION - II**

**UNIT - IV**

- Q7)** a) The fleet owner finds from his past record, that the maintenance cost per year of an auto whose purchase price is ₹ 60,000 is given below :  
 Consider cost of money as 10% per year. [10]

Year	1	2	3	4	5	6	7	8
Maintenance	1000	1200	1400	1800	2300	2800	3400	4000

What is the optimum replacement plan?

- b) Discuss Minimax and Maximin rule with saddle point. [6]

- Q8)** a) Discuss individual and group replacement policies. [6]  
 b) Solve the game : [10]

		Player B		
		Strategies	b1	b2
Player A	a1	-6	10	11
	a2	-1	-2	-3
	a3	-1	-2	-4

## UNIT - V

**Q9)** a) Arrival rate of the customers at the banking counter follows Poisson distribution with mean 15 per hour. The service rate of the counter also follows Poisson distribution with mean of 25 per hour. Find : **[10]**

- i) Probability of having zero customers in the system.
- ii) Probability of having 3 customers in the system.
- iii) Probability that customer have to spend 30 minutes in bank.
- iv) Mean customers in queue.
- v) Average waiting time in queue.

b) Discuss : Inventory costs. **[6]**

**Q10)** a) An automobile factory manufactures a particular type of gear within the factory. This gear is used in the final assembly. The particulars of the gear are : **[10]**

Demand rate	12000	units/day
Production rate	20000	units/day
Set up cost	1000	₹/set-up
Carrying cost	10	₹ per unit per year
Working days	300	per year

Find Economic Production Quantity, time between two setups, production period, annual holding cost, annual set up cost and annual total cost.

b) Discuss minimum cost service rate. **[6]**

**UNIT - VI**

**Q11) a)** Network IP table is given below : **[14]**

Act	A	B	C	D	E	F	G	H	I	J	K	L	M	N
IP	-	-	-	B	A	A	B	C,D	C,D	E	F,GH	F,GH	I	J,K
Days	2	6	4	3	6	8	3	7	2	5	4	3	13	7

- i) Draw a network and find critical activities and critical path.
  - ii) How long is the project duration?
  - iii) Tabulate Early Start Schedule (ESS) and Late Start Schedule times (LSS).
  - iv) Tabulate all the floats for all the activities.
- b) Discuss resource leveling. **[4]**

**Q12) a)** Network is given below with three times estimates in weeks. **[14]**

Act	A	B	C	D	E	F	G	H
IP	-	-	A	B	A	C,D	C,D,E	F
a*	1	2	6	1	1	1	1	1
b**	3	8	8	3	7	9	3	9
m***	2	2	7	2	4	5	5	2

a\* – Optimistic time estimate, b\*\* – Pessimistic time estimate,  
m\*\*\* – most likely time estimate.

- i) Construct the project network.
  - ii) Find the expected duration and variance of each activity?
  - iii) Find the critical path and the expected project completion time?
  - iv) Find the probability of completing the project on or before 20 weeks?
  - v) If the probability of completing the project is 0.8, find the expected project completion time?
- b) State different types of floats and discuss any three. **[4]**

