

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE- SEMESTER-V (NEW) EXAMINATION – WINTER 2020****Subject Code:3151910****Date:05/02/2021****Subject Name:Operation Research****Time:10:30 AM TO 12:30 PM****Total Marks: 56****Instructions:**

1. Attempt any FOUR questions out of EIGHT questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) State various phases of Operations Research problem. **03**  
 (b) Briefly explain the characteristics of Operations Research. **04**  
 (c) A paper mill produces paper for books as well as for magazines. Each kg of paper for books requires 2 kg of material A and 3 kg of material B. for magazines, the proportion is 2 kg of A and 2 kg of B for each kg of paper. The mill need 15000 kg paper for books and 6000 kg for magazines. Materials A and B are available as 3 and 5 lakhs kg respectively. Requirements of books is twice that for magazines. Selling price per book paper is Rs. 14 per kg and for magazines it is Rs. 10 per kg. cost of material A is Rs. 2 per kg and that for material B is Rs. 2.5 per kg. Formulate LP model for paper mill to maximize the total profit. **07**

- Q.2** (a) Write at least five application areas of Linear Programming. **03**  
 (b) Discuss basic assumptions in Linear Programming. **04**  
 (c) Solve the following LP problems using Simplex Method. **07**

Maximise $Z = 10x + 15y + 20z$ S.T. $10x + 5y + 2z \leq 2,700$ $5x + 10y + 4z \leq 2,200$ $x + y + 2z \leq 500$ and All $x, y$ and $z$ are $\geq 0$
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- Q.3** (a) Explain the following terms: **03**  
 a. Shadow price  
 b. Opportunity cost  
 (b) Briefly explain unbalanced assignment problem. **04**  
 (c) A company manufacturing air coolers has two plants located at Mumbai and Kolkata with a capacity of 200 units and 100 units per week respectively. The company supplies the air cooler to its four show rooms located at Ranchi, Delhi, Lucknow and Kanpur which have a maximum demand of 75, 100, 100, and 30 units respectively. Due to the differences in raw material cost and transportation cost, the profit per unit in rupees differs which is given below. **07**

	Ranchi	Delhi	Lucknow	Kanpur
Mumbai	90	90	100	110
Kolkata	50	70	130	85

Solve the transportation problem to maximize the profit.

- Q.4** (a) Give mathematical model for transportation problem. **03**  
 (b) Define the term Decision theory. Describe decision models based on the criterion of degree of certainty. **04**

- (c) Five wagons are available at stations 1, 2, 3, 4, and 5. These are required at five stations I, II, III, IV and V. The mileage between various stations are given by the table below. How should the wagons be transported so as to minimize total mileage covered? **07**

	I	II	III	IV	V
1	10	5	9	18	11
2	13	9	6	12	14
3	3	2	4	4	5
4	18	9	12	17	15
5	11	6	14	19	10

- Q.5 (a)** Explain the queuing model as indicated by the following notations. **03**

M/D/1 : FCFS/ $\infty/\infty$

- (b) The following matrix gives the payoff of different strategies (alternatives) A, B, and C against conditions (events) W, X, Y and Z. Identify the decision taken under the following approaches: **04**
- Regret,
  - Hurwicz criterion. The decision maker's degree of optimism ( $\alpha$ ) being 0.7.

	Events			
	W	X	Y	Z
	Rs.	Rs.	Rs.	Rs.
A	4000	-100	6000	18000
B	20000	5000	400	0
C	20000	15000	-2000	1000

- (c) A mechanic is to be recruited to repair scooters that breakdown at an average rate of 6 per hour. The breakdowns follow a Poisson distribution. Non-productive time of a scooter costs Rs. 40 per hour. Mechanics A and B have been interviewed for the purpose. Mechanic A charges Rs. 20 per hour, and services scooters at the rate of 8 per hour. Mechanic B charges Rs. 28 per hour, and services 12 scooters per hour, on an average. Which one of the two should be recruited and why? Assume an 8 hours of work each day. **07**

- Q.6 (a)** What is replacement? Explain by means real world examples. **03**
- (b) Differentiate between PERT and CPM. **04**
- (c) The maintenance cost and resale value per year of a machine whose purchase price is Rs. 7000/- is given below: **07**

Year	1	2	3	4	5	6	7	8
Maintenance cost in Rs.	900	1200	1600	2100	2800	3700	4700	5900
Resale value in Rs.	4000	2000	1200	600	500	400	400	400

When should the machine be replaced?

- Q.7 (a)** Define following: **03**
- Saddle Point
  - Pure Strategy
  - Mixed Strategy
- (b) Discuss the rules of network construction **04**
- (c) A and B play a game in which each has three coins: 5 paise, 10 paise, and 20 paise coin. Each player selects a coin without the knowledge of the other's choice. If the sum of the coins is an odd amount, A wins B's coin, and if the sum is even, B wins A's coin. Find the best strategy for each player and the value of the game. **07**

- Q.8 (a)** Briefly explain Decision Tree **03**

(b) Discuss all four types of Floats.

(c) There are seven activities in a project and the time estimates are as follows:

Activity	Immediate Predecessor	Optimistic Time	Most Likely Time	Pessimistic Time
A	–	2	6	10
B	–	4	6	12
C	A	2	3	4
D	A	2	4	6
E	B, D	3	6	9
F	B, C, D	6	10	14
G	F	1	3	5

Draw activity on node network for the project. Calculate expected project duration and variance for each activity.

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