

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-VII EXAMINATION – WINTER 2025****Subject Code:2171901****Date:28-11-2025****Subject Name:Operation Research****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

- Marks
- Q.1** (a) Briefly explain: Phases of Operation Research. **03**
- (b) Discuss scope of Operation Research with example. **04**
- (c) Consider the following linear programming problem: **07**
 Maximize $Z = X_1 + X_2$
 Subject to
 $X_1 + X_2 \geq 2$
 $X_1 + 2X_2 \leq 8$
 $X_1, X_2 \geq 0$
 Identify the feasible region on a graphical representation of the problem and calculate optimal solution.
- Q.2** (a) Explain the set of assumptions for Linear Programming in details. **03**
- (b) The postal department is considering the purchase of vehicles to pick up and deliver mail from various offices. They are considering three types of vehicles. The cost of each of these are Rs. 5 lakhs, Rs. 10 lakhs and Rs. 8 lakhs per vehicle, respectively. These require a crew of 2, 4 and 4 persons per day considering multiple shifts. They expect these to run for 60, 100 and 80 km per day. They expect that the total distance to be covered by the vehicles per day would be 2000 km. Based on the fuel economy, the operating cost per day for these vehicles are Rs. 200, Rs. 350 and Rs. 300 per day. They have a budget restriction of Rs. 1.6 crore and have 80 people available as crew. Formulate a Linear Programming Problem to minimize the operating costs. **04**
- (c) Solve the following linear programming problem using simplex method. **07**
 Maximize $Z = 6X_1 + 3X_2$
 Subject to,
 $X_1 + X_2 \leq 4$
 $2X_1 + X_2 \leq 4$
 $X_1, X_2 \geq 0$
- OR**
- (c) Explain step by step procedure of solving Linear Programming Problem by simplex method with example. **07**
- Q.3** (a) What is unbalanced assignment problem? How it should be solved? **03**
- (b) Discuss various types of solutions in transportation model. **04**
- (c) A company has three production facilities S_1 , S_2 and S_3 and to be shipped to four warehouses D_1 , D_2 , D_3 and D_4 as mentioned in below table. **07**

	D_1	D_2	D_3	D_4	Supply
S_1	19	30	50	10	7
S_2	70	30	40	60	9
S_3	40	8	70	20	18
Demand	5	8	7	14	34

Use North-West Corner Method to find an initial basic feasible solution to the transportation problem.

OR

- Q.3** (a) Explain various applications of Assignment problem. **03**
 (b) Discuss steps of Vogel's approximation method to solve transportation problem. **04**
 (c) Solve the assignment problem of five different jobs to five different operations as shown in below table using Hungarian method. Processing time is in hours. **07**

		Operator				
		1	2	3	4	5
Job	1	20	15	18	20	25
	2	18	20	12	14	15
	3	21	23	25	27	25
	4	17	18	21	23	20
	5	18	18	16	19	20

- Q.4** (a) Discuss elements of queuing system with example. **03**
 (b) What is selective inventory control? Explain any one selective inventory control technique. **04**
 (c) Calculate EQO for the annual bearing requirement of PQR industries. They consume 450 bearings every month, which are procured from LMN firm for bearing assembly. The ordering cost is Rs. 250 per order and inventory carrying cost per bearing per month is Rs. 2.5. **07**

OR

- Q.4** (a) Define inventory. Why is it necessary to control? **03**
 (b) Discuss costs associated with inventory control. **04**
 (c) The arrival rate of customers at a banking counter follows Poisson distribution with a mean of 360 per day. The service rate of the counter clerk also follows Poisson distribution with a mean of 1 per minute. Bank is open for 8 hours a day for the customers. **07**
 1. Find the probability of having 0, 5 and 10 customers in the system?
 2. Find average number of customers waiting in the queue and in the queuing system.
 3. Find average waiting time of the customer waiting in the queue and in the queuing system. (in minutes)

- Q.5** (a) Explain PERT method of project management. **03**
 (b) What do you understand by decision-making? Differentiate decision making under the conditions of certainty and uncertainty. **04**
 (c) A firm is considering replacement of a machine; whose cost price is Rs. 71,000 and the scrap value is Rs. 1000. The maintenance cost found from experience are as follow. Find when machine should be replaced? **07**

Year	Maintenance cost (Rs.)
1.	2000
2.	3500
3.	5000
4.	7000
5.	10000
6.	13000
7.	17000
8.	21000

OR

- Q.5** (a) What is Game theory? List various applications of Game theory **03**
 (b) Discuss matrix reduction by Dominance in Game theory. **04**

- (c) The utility data for the network diagram is given below. Draw the project network diagram, find the critical path and calculate project completion time.

07

Activity	Duration (Days)
0-1	2
1-2	8
1-3	10
2-4	6
2-5	3
3-4	3
3-6	7
4-7	5
5-7	2
6-7	8
