

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VII (OLD) EXAMINATION – WINTER 2023****Subject Code:2171901****Date:16-12-2023****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) Discuss scope of Operations Research.	03
	(b) Define the following terms for Linear Programming Problem.	04
	(a) Unbounded solution	
	(b) Artificial variable	
	(c) Briefly explain formulation of dual problem with example.	07
Q.2	(a) ABC company manufactures two types of products, P and Q. Each product uses Printing and Binding machine. The processing time per unit of product P on the Printing machine is 250 hours and on the Binding machine is 200 hours. The processing time per unit of product Q on the Printing machine is 500 hours and on the Binding machine is 200 hours. The maximum number of hours available per month on the Printing and Binding machine are 6000 hours and 4000 hours, respectively. Also the profit per unit of selling product P and Q are Rs. 30.00 and Rs. 40.00, respectively. Formulate a linear programming problem to determine the production volume of each of the products such that the total profit is maximized.	03
	(b) Find the dual of the following LP problem.	04
	Maximize $Z=2X_1-4X_2+6X_3$	
	Subject to,	
	$X_1+X_2+X_3\leq 1$	
	$2X_1-2X_3\leq 2$	
	$3X_1-2X_2+3X_3\leq 3$	
	$X_1, X_2, X_3\geq 0$	
	(c) Using graphical method find the minimum value of Z	07
	$Z= -X_1+2X_2$	
	Subject to	
	$-X_1 + 3X_2\leq 10$	
	$X_1 + X_2\leq 6$	
	$X_1 - X_2\leq 2$	
	$X_1, X_2\geq 0$	
	OR	
	(c) Discuss steps of simplex method for solving Linear Programming Problem.	07
Q.3	(a) What is degeneracy in transportation problem?	03
	(b) How profit maximization problem can be solved by assignment Problem?	04

- (c) XYZ Company has 3 production plants and 3 warehouses. The supply are transported from manufacturing units to storage unit, which are located remotely from the manufacturing unit. The transportation cost per product in (Rs.) between manufacturing units to storage unit is mentioned in the below table. Find out allocation for the minimum transportation cost. **07**

		Warehouse			Supply
		W1	W2	W3	
Prod. Plant	P1	16	20	12	200
	P2	14	8	18	160
	P3	26	24	16	90
Demand		180	120	150	450

OR

- Q.3 (a)** Explain the steps for Vogel's Approximation Method of Transportation method. **03**
- (b)** How to tackle the non-square matrix in the assignment problem? **04**
- (c)** Solve the following assignment problem using Hungarian method. The matrix entries are processing time of each man in hours. **07**

J/M	I	II	III	IV	V
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)** Define the following term. **03**
- Jockeying
 - Balking
 - Reneging
- (b)** What is inventory? Discuss benefits and limitations of inventory. **04**
- (c)** A rolling mill buys raw material from a vendor. The annual demand of the raw material is 9000 units. The ordering cost is Rs. 100 per order and the carrying cost is 20% of the purchase price per unit per month, where the purchase price per unit is Rs. 1. Find the following **07**
- Economic order quantity
 - Total cost of inventory at EOQ
 - Number of orders per year
 - Time between consecutive two orders in days.

OR

- Q.4 (a)** Briefly discuss different types of Queuing models. **03**
- (b)** Discuss different costs associated with inventory system. **04**
- (c)** The arrival rate of customers at a banking counter follows Poisson distribution with a mean of 45 per hour. The service rate of the counter clerk also follows Poisson distribution with a mean of 60 per hour. **07**
- What is probability of having 0 customer, 5 customers and 10 customers in the system?
 - Find average number of customers waiting in the queue and in the queuing system.
 - Find average waiting time of the customer waiting in the queue and in the queuing system.

- Q.5 (a)** What are the different time estimates used in PERT method of project management? **03**
- (b)** Explain the different methods useful for decision making under certainty **04**

- (c) A firm is considering replacement of an equipment whose first cost is Rs. 4000 and the scrap value is negligible at the end of any year. Based on experience, it has been found that the maintenance cost is zero during the first year and it is Rs. 1000 for the second year. It increases by Rs. 300 every year thereafter. When should the equipment be replaced if interest rate is 0%. **07**

OR

- Q.5** (a) Explain the concept of decision tree. Explain each term used in decision tree. **03**
(b) Explain various terms used in game theory. **04**
(c) In a flyover construction project, activity durations and its relationships are mentioned in the below table. Draw the project network diagram, find the critical path and calculate project completion time. **07**

Activity	Duration (Days)
1-2	3
1-3	4
2-4	5
2-5	6
4-6	7
5-6	8
3-6	9
6-7	3
