

GUJARAT TECHNOLOGICAL UNIVERSITY**BE – SEMESTER- VII EXAMINATION-SUMMER 2023****Subject Code: 2171901****Date: 30/06/2023****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) Define Operations research. Discuss applications of Operations Research.	03
(b) Explain the assumptions for Linear Programming Problem.	04
(c) Illustrate graphically Feasible solution, No-feasible solution and Unbounded solution for Linear Programming Problem.	07
Q.2 (a) ABC company manufactures two types of products, A and B. Each product uses grinding and drilling machine. The processing time per unit of product A on the grinding machine is 5 hours and on the drilling machine is 4 hours. The processing time per unit of product B on the grinding machine is 10 hours and on the drilling machine is 4 hours. The maximum number of hours available per week on the grinding and drilling machine are 60 hours and 40 hours, respectively. Also the profit per unit of selling product A and B are Rs. 6.00 and Rs. 8.00, 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. Maximize $Z=2X_1-7X_2+3X_3$ Subject to, $2X_1+X_2+X_3 \leq 14$ $5X_1-X_3 \leq 12$ $X_1-2X_2+3X_3 \leq 9$ $X_1, X_2, X_3 \geq 0$	04
(c) Solve the following linear programming problem using simplex method. Maximize $Z=10X_1+15X_2+20X_3$ Subject to, $2X_1+4X_2+6X_3 \leq 24$ $3X_1+9X_2+6X_3 \leq 30$ $X_1, X_2, X_3 \geq 0$	07
OR	
(c) Explain step by step procedure of solving Linear Programming Problem by simplex method.	07
Q.3 (a) Describe the various steps in Hungarian method used for solving the assignment problem.	03
(b) Differentiate between Transportation problem and Assignment problem	04
(c) ABC Company has three manufacturing units and three storage unit. The supply are transported from manufacturing units to storage unit,	07

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.

		Storage unit			Supply
		S1	S2	S3	
Mfg. unit	M1	16	20	12	200
	M2	14	8	18	160
	M3	26	24	16	90
Demand		180	120	150	450

OR

- Q.3** (a) Explain the steps for N-W Corner Transportation method. **03**
 (b) What do you mean by unbalanced assignment problem? How it should be tackled? **04**
 (c) Five different jobs are to be assigned to five different operations as shown in below table. Develop the assignment such that the total processing time is minimized. **07**

		Operator				
		1	2	3	4	5
Job	1	10	12	15	12	8
	2	7	16	14	14	11
	3	13	14	7	9	9
	4	12	10	11	13	10
	5	8	13	15	11	15

- Q.4** (a) Explain the various elements of queuing system. **03**
 (b) Derive the equation for Economic Order Quantity (EOQ) for constant demand with the condition of no shortage. **04**
 (c) ABC industries needs 5400 bearings every year, which are procured from XYZ firm for bearing assembly. The procurement cost is Rs. 250 per order and inventory carrying cost per bearing per year is Rs. 30. Calculate the Economic Order Quantity and total number of orders in a year. **07**

OR

- Q.4** (a) Why inventory is known as necessary evil? **03**
 (b) Explain Kendall's Notation in terms of Queuing Theory **04**
 (c) The arrival rate and service rate at a courier booking counter follows poisson distribution and negative exponential distribution respectively. The arrival rate and service rate for courier booking are 25 and 35 customers per hour respectively. Calculate **07**
 1. Courier booking clerk utilization
 2. Average number of customers waiting in the queue
 3. Average number of customers waiting in the system
 4. Average waiting time per customer in the queue
 5. Average waiting time per customer in the system

- Q.5** (a) Differentiate CPM and PERT method of project management. **03**
 (b) Explain the different methods useful for decision making under certainty **04**
 (c) The operation cost, maintenance cost and salvage value at the end of every year of a machine whose purchase value is Rs. 12,000 is mentioned in below table. Find the economic life of the machine assuming the interest rate as 0%. **07**

End of year (n)	Operation cost at the end of year (Rs.)	Maintenance cost at the end of year (Rs.)	Salvage value at the end of year (Rs.)
1	2000	2500	8000
2	3000	3000	7000
3	4000	3500	6000
4	5000	4000	5000
5	6000	4500	4000
6	7000	5000	3000
7	8000	5500	2000
8	9000	6000	1000

OR

- Q.5 (a)** Explain the concept of decision tree. Explain each term used in decision tree. **03**
- (b)** What do you understand by 'zero-sum' in the context of game theory? Explain the meaning of various terms used in game theory. **04**
- (c)** ABC company is producing automotive assembly line for automobile industries. ABC company is in the process of filling tender for a big automotive manufacturer. 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	Predecessor Activity	Duration (Days)
A	-	3
B	-	4
C	A	5
D	A	6
E	C	7
F	D	8
G	B	9
H	E,F,G	3
