Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V EXAMINATION – SUMMER 2025

Subject Code:3151910 Date:26-05-2025

Subject Name: Operation Research

Time:02:30 PM TO 05:00 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 various applications of operation research.	**03**
	(b)	Illustrate graphically for Linear Programming Problem; (a) No-feasible solution (b) Unbounded solution.	**04**
	(c)	ABC Printing Company is facing a tight financial squeeze and is attempting to cut costs wherever possible. At present it has only one printing contract, and luckily, the book is selling well in both the hardcover and the paperback editions. It has just received a request to print more copies of this book in either the hardcover or the paperback form. The printing cost for the hardcover books is Rs 600 per 100 books while that for paperback is only Rs 500 per 100. Although the company is attempting to economize, it does not wish to lay off any employee. Therefore, it feels obliged to run its two printing presses - I and II, at least 80 and 60 hours per week, respectively. Press I can produce 100 hardcover books in 2 hours or 100 paperback books in 1 hour. Press II can produce 100 hardcover books in 1 hour or 100 paperbacks books in 2 hours. Determine how many books of each type should be printed in order to minimize costs.	**07**
Q.2	**(a)**	What are the assumptions in LPP?	**03**
	(b)	What is degeneracy in transportation problem?	**04**
	(c)	Solve the following problem using Big-M method.	**07**

Minimize $Z=2X1+5X2$

Subject to constraints $X_1+X_2 = 100$

$X_1 \leq 40$

$X_2 \geq 30$

Non-negative condition $X_1, X_2 \geq 0$

OR

(c) Solve the following LP problem graphically: **07**

Maximize $Z = -X_1+2X_2$

Subject to constraints $X_1-X_2 \leq -1$

$-0.5X_1+X_2 \leq 2$

$X_1, X_2 \geq 0$

Q.3 **(a)** What is 'dominance rule' in game theory? **03**

(b) Is it possible to solve assignment problem using transportation technique? Explain with reason **04**

(c) The following table provides all the necessary information on the availability of supply to each warehouse, the requirements of each market and the unit transportation cost (in Rs) from each warehouse to each market. **07**

Warehouse	Market				
	P	Q	R	S	Supply
A	6	3	5	4	22
B	5	9	2	7	15
C	5	7	8	6	8
Demand	7	12	17	9	45

The shipping clerk of the shipping agency has worked out the following schedule, based on his own experience: 12 units from A to Q, 1 unit from A to R, 9 units from A to S, 15 units from B to R, 7 units from C to P and 1 unit from C to R.

(a) Check and see if the clerk has the optimal schedule.

(b) Find the optimal schedule and minimum total transport cost.

(c) If clerk is approached by a carrier of route C to Q, Who offers to reduce his rate in the hope of getting some business, by how much should the rate be reduced before the clerk would offer him the business.

OR

Q.3 **(a)** Explain: Procedure for Group Replacement Theory **03**

(b) Briefly explain Decision Tree **04**

(c) Explain the steps of a Travelling Salesman Problem. **07**

Q.4 **(a)** Define the following terms relating the customer's behavior in Queue. **03**
(A)Balking (B) Jockeying (C) Reneging

(b) What is float? Discuss in brief (i) Total float (ii) Free Float. **04**

(c) Two breakfast food manufacturers KFG and MCZ are competing for an increased market share. The playoff matrix, shown in the following table, describes the increase in market share for KFG and decrease in market share of MCZ. **07**

KFG	MCZ			
	Give Coupons	Decrease Price	Maintain Present Strategy	Increase advertising
Give Coupons	2	-2	4	1
Decrease Price	6	1	12	3
Maintain Present Strategy	-3	2	0	6
Increase advertising	2	-3	7	1

Determine the optimal strategies for both the manufacturers and the value of game.

OR

Q.4 **(a)** Define following: **03**

a. Saddle Point

b. Pure Strategy

c. Mixed Strategy

(b) How profit maximization problem can be solved by assignment Problem? **04**

(c) An engineering company is offered a material handling equipment A. It is priced at Rs 60,000 including cost of installation. The cost for operation and maintenance are estimated to be Rs 10,000 for each of the fiveyear, increasing every year by Rs 3,000 in the sixth and subsequent years.The company expects a return of 10 per cent on all its investment. What is the optimal replacement period? **07**

Q.5 **(a)** Explain the following terms used in decision theory. **03**

EMV, EOL, EVPI.

(b) A warehouse has only one loading dock manned by a three person crew. Trucks arrive at the loading dock at an average rate 4 trucks per hour and the arrival rate is Poisson distributed. The loading of truck takes 10 minutes on an average and can be assumed to be exponentially distributed. The operating cost of a truck is Rs 20 per hour and the members of the loading crew are paid Rs. 6 each per hour. Would you advise the truck owner to add another crew of three persons? **04**

(c) The following table gives the activities in a construction project and also gives other relevant information **07**

Activity	Immediate Predecessor	Time		Direct Cost (Rs 'ooo))	
		Normal	Crash	Normal	Crash
A	-	4	3	60	90
B	-	6	4	150	250
C	-	2	1	38	60
D	A	5	3	150	250
E	C	2	2	100	100
F	A	7	5	115	175
G	D, B, E	4	2	100	240
				713	

Indirect costs vary as follows

Months :	15	14	13	12	11	10	9	8	7	6
Cost (Rs) :	600	500	400	250	175	100	75	50	35	25

(a) Draw the arrow diagram for the project.

(b) Determine the project duration that will result in minimum total project cost.

OR

Q.5 **(a)** What is replacement? Explain by real examples. **03**

(b) Discuss the rules network construction. **04**

(c) Explain steps for decision theory approach. **07**

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