

GUJARAT TECHNOLOGICAL UNIVERSITY
MCA– SEMESTER III- EXAMINATION –SUMMER-2024

Subject Code: 639406**Date: 21/05/2024****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. Use of simple calculators and non-programmable scientific calculators are permitted.

- Q.1 (a) Define Operations Research. State applications of Operation Research. 07
 (b) Solve the following LPP using simplex method. 07

$$\begin{aligned} \text{Max } Z &= 15x_1 + 6x_2 + 9x_3 + 2x_4 \\ \text{Subject to, } &2x_1 + x_2 + 5x_3 + 6x_4 \leq 20 \\ &3x_1 + x_2 + 3x_3 + 25x_4 \leq 24 \\ &7x_1 + x_4 \leq 70 \\ &x_1, x_2, x_3, x_4 \geq 0 \end{aligned}$$

- Q.2 (a) Obtain the dual of the following primal LP problem. 07

1. Maximize $Z_x = x_1 - 2x_2 + 3x_3$
 subject to the constraints
 (i) $-2x_1 + x_2 + 3x_3 = 2$,
 (ii) $2x_1 + 3x_2 + 4x_3 = 1$
 and $x_1, x_2, x_3 \geq 0$

2. Minimize $Z_x = 3x_1 - 2x_2 + 4x_3$
 subject to the constraints
 (i) $3x_1 + 5x_2 + 4x_3 \geq 7$,
 (ii) $6x_1 + x_2 + 3x_3 \geq 4$,
 (iii) $7x_1 - 2x_2 - x_3 \leq 10$
 (iv) $x_1 - 2x_2 + 5x_3 \geq 3$,
 (v) $4x_1 + 7x_2 - 2x_3 \geq 2$
 and $x_1, x_2, x_3 \geq 0$

- (b) Explain components and assumptions of Linear Programming Model in detail. 07

OR

- (b) State and discuss similarities and differences between Transportation problem and Assignment Problem. 07

- Q.3 (a) Explain in detail the Hungarian method to solve an assignment problem with 07

suitable example.

- (b) Find the initial feasible solution of the transportation problem by Vogel's Approximation Method. 07

ORIGIN	DESTINATION				SUPPLY
	1	2	3	4	
1	20	22	17	4	120
2	24	37	9	7	70
3	32	37	20	15	50
DEMAND	60	40	30	110	240

OR

- Q.3 (a) Discuss the fields of application for queuing theory. Explain queue discipline and its various forms. 07
- (b) Solve the following assignment problem and find the minimum cost. 07

		JOBS			
		I	II	III	IV
workers	A	10	12	19	11
	B	5	10	7	8
	C	12	14	13	11
	D	8	15	11	9

- Q.4 (a) Explain with suitable examples the different costs that are involved in the inventory problems. 07
- (b) Customers arrive at a window in a bank, according to a Poisson distribution with mean 10 per hour. Service time per customer is exponential with mean 5 minutes. The space in front of the window including that for the serviced customers can accommodate a maximum of three customers. Other customers can wait outside this space. 07
- What is the probability that an arriving customer can go directly to the space in front of the window?
 - What is the probability that an arriving customer will have to wait outside the indicated space?
 - How long is an arriving customer expected to wait before being served?

OR

- Q.4 (a) What is Replacement? Explain the types of failures with example. 07
- (b) A manufacturer uses Rs. 10,000 worth of an item during the year. He has estimated the ordering cost is Rs. 25 per order and carrying costs as 12.5% of average inventory value. Find the optimal order size, number of orders per year, time period per order and total cost. 07

- Q.5 (a) Explain Johnson's procedure (steps) for processing n jobs through two machines. 07
- (b) Six jobs go first over machine I and then over machine II. The order of the completion of jobs has no significance. The following table shows the machine times in hours for six jobs and the two machines. 07

Job	J ₁	J ₂	J ₃	J ₄	J ₅	J ₆
Machine I	2	4	9	6	7	4
Machine II	6	7	4	3	3	11

OR

- Q.5 (a) Describe the PERT/CPM network components and rules for network construction. 07
(b) Draw a network arrow diagram for the following information concerning some 07 project:

Activity	Predecessor activities
A	None
B	A
C	A
D	B,C
E	C
F	D
G	E
H	F,G
